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University of Delhi I NAAC accredited: A Grade
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Supporting document for 3.3.2

3.3.2: Number of books and chapters in edited volumes/books published and papers published in national/ international conference proceedings per teacher during last five years.

S.No.	Year	Number of books and chapters in edited volumes/books published and papers published in national/ international conference proceedings during last five years.	Page No.
1.	2017-18	18	1-56
2.	2018-19	22	57-93
3.	2019-20	41	98-157
4.	2020-21	30	158-212
5.	2021-22	31	213-274
	TOTAL	**142**	

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Convenor, NAAC
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Prof. Ravi Toteja
Officiating Principal
Acharya Narendra Dev College

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Supporting document for 3.3.2

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Sl. No.	Name of the teacher	Title of the book/chapters published	Title of the paper	Page Nos.
		2017-18		
1	Dr Gagan Dhawan	-	Influenza pandemics and the associated bacterial infections; Basic and Clinical Virology	1
2	Dr. Sunita Hooda	-	Magnetic graphene oxide for adsorption of organic dyes from aqueous solution.	6
3	Dr. Geetu Gambhir & Sunita Hooda	-	Remediation of heavy metal ion toxicity from waste water using functionalized chitin.	7
4	Dr. Sunita Hooda & Vikrant Kumar	-	Fast and selective detection of Cu2+ and Fe3+ ions by 4-substituted 2-Aminothiazole in aqueous medium.	8
5	Dr. Sharanjeet Kaur	-	Leveraging Hierarchy and Community Structure for Determining Influencers in Networks.	9
6	Mr Manoj Kumar Garg	Basic Business Communication Legal English Language and Communication Skills.	-	17
7	Dr Laxmi Narain	Mathematica Programming on Numerical Methods Differential Equations Modeling using Mathematica Modeling of calculus problems using Mathematica	-	18
8	Dr Sarita Kumar	Exploring Biology for Class VI	-	21
9	Dr Sarita Kumar	Exploring Biology for Class VII	-	22
10	Dr Sarita Kumar	Exploring Biology for Class VIII	-	23

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11	Dr Seema Makhija and Dr Ravi Toteja	Protozoa: Ciliophora (Ciliates). In K. Chandra, K.C. Gopi, D.V. Rao, K. Valarmathi and J.R.B. Alfred (Eds.), Current Status of Freshwater Faunal Diversity in India	-	24
12	Dr Seema Makhija and Dr Ravi Toteja	Cell Biology: Practical Manual	-	47
13	Dr. Sarita Kumar	-	Characterization and comparative bio-efficacy assessment of silver nanocomposites synthesized from leaf and stem extracts of Achyranthes aspera against early fourth instars of dengue vector, Aedes aegypti L. (Diptera: Culicidae). Biochemistry and Molecular Biology: From Niche to Nation.	51
14	Dr. Sarita Kumar	-	Investigations on the impact of five essential oils on the oviposition and hatchability of eggs of female adults of dengue vector, Aedes aegypti L. Biochemistry and Molecular Biology: From Niche to Nation.	52
15	Dr. Sarita Kumar	-	Impact of acetamiprid on the survival, morphology and development of Aedes aegypti L. (Diptera: Culicidae). Biochemistry and Molecular Biology: from Niche to Nation.	53
16	Dr. Sarita Kumar	-	Evaluation of emamectin benzoate as a potential larvicide and antifeedant agent against cotton bollworm Helicoverpa armigera (Lepidoptera: Noctuidae). "Biochemistry and Molecular Biology: From Niche to Nation";	54
17	Dr. Monisha Khanna Kapur	-	Taxonomic study of extracellular enzyme producing actinomycetes from varied ecological habitats	55
18	Dr. Monisha Khanna Kapur	-	Phylogenetic characterization of antibiotic producing actinomycete strains from diverse ecological habitats.	56

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2018-19				
19	Dr Rashmi Sharma (Botany)	Neurotransmitters in Plants: Perspectives and Applications	Role of Acetylcholine System in Allelopathy of Plants	57
20	Dr Geetika Kalra (Botany)	Plant Physiology, Development and Metabolism	Cytokinins	58
21	Dr Geetika Kalra (Botany)	Plant Physiology, Development and Metabolism	Gibberelins	59
22	Dr Geetika Kalra (Botany)	Plant Physiology, Development and Metabolism	Abscisic Acid	60
23	Dr Geetika Kalra (Botany)	Plant Physiology, Development and Metabolism	Physiology of Flowering	61
24	Dr Geetika Kalra (Botany)	Plant Physiology, Development and Metabolism	Senescence and Program cell Death	62
25	Dr. Sharanjit Kaur (Computer Science)	Class XI Computer Science	Textbook	63
26	Dr. Harita Ahuja (Computer Science)	Class XI Computer Science	Textbook	63
27	Dr. Amit Garg (Electronics), Dr. Arijit Chowdhuri(Physics)	Conference Proceedings	Effect of concentration variation in Graphene Oxide (GO) membranes for water flux optimization	64
28	Dr. Monika Bhattacharya (Electronics)	Conference Proceedings	Impact of donor-layer doping & thickness, gate-length and temperature on potential and electron concentration in AlGaN/GaN Double-Heterostructure and Single-Heterostructure HEMT	65
29	Mr. Manoj Kumar Garg (English)	Business Communication for undergraduate students	Reference Book	66
30	Mr. Manoj Kumar Garg (English)	General English	Reference Book	67
31	Dr. Sarita Kumar (Zoology)	Hindi Vishwakosh (MHRD, GoI)		68

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32	Dr. Sarita Kumar (Zoology)	Conference Paper	Variation in the Insecticide-Resistance Spectrum of Aedes aegypti L. after Selection with Acetamiprid.	72
33	Dr. Sarita Kumar (Zoology)	Conference Paper	Growth Inhibition and Growth Regulatory effects of Lufenuron on Aedes aegypti L.: A potential Mosquito Control Agent.	73
34	Dr. Rakesh K. Sonker (Physics)	Energy Analysis and Optimization for Liquefied Natural Gas Process	Design and growth of metal oxide film as Liquefied Petroleum Gas Sensors	75
35	Prof. Arijit Chowdhuri (Physics), Dr. Amit Garg (Electronics)		Effect of Concentration Variation in Graphene Oxide (GO) Membranes For Water Flux Optimization	76
36	Prof. Arijit Chowdhuri (Physics), Dr. Charu Khosla Gupta (Botany)	4th National Symposium on Environment: Green Technology for Environmental Sustainability	Study of Particulate Matter Pollution in Different Modes of Public Trasport in New Delhi, India	79
37	Prof. Arijit Chowdhuri (Physics), Dr. Charu Khosla Gupta (Botany)	4th National Symposium on Environment: Green Technology for Environmental Sustainability	Gauging the Comprehension about Environmental Awareness, Conservation and Sustainability Amongst Primary, Secondary and Undergraduate Students for Precisely Defining Exposure–Response Relationships of Pollution on Health	80
38	Dr. Harita Ahuja (Computer Science)	Textbook for IX Information and Communication Technology (ICT), NCERT	Text Book	82-89
39	Prof. Gagan Dhawan (Biomedical Sciences)	Conference Paper	Synthesis of silver nanoparticles using Terminalia bellerica: Physicochemical characterization and their antibiofilm evaluation.	92
40	Prof. Sunita Hooda (Chemistry)	Conference Paper	Magnetic Graphene Oxide for Adsorption of Organic Dyes from Aqueous Solution.	93
		2019-20		
41	Dr. Sharanjit Kaur (Computer Science)	Textbook for XI Information Practices, NCERT	-	98-104
42	Dr. Harita Ahuja(Computer Science)	Textbook for XI Information Practices, NCERT	-	98-104

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43	Dr. Harita Ahuja (Computer Science)	Certificate in Computer Application, Vocational Course, NIOS	-	108
44	Dr.Udaibir Singh (Electronics)	-	Impact of fabrication of pyramidal structure on silicon wafer surface in ZnO/Si heterojunction	109
45	Dr.Udaibir Singh (Electronics)	-	Absorption enhancement by surface texturing in ZnO/Si heterojunction	111
46	Mr. Dinesh Kumar (Electronics)	-	Physico-Chemical Modification Induced by 70 MeV Carbon Ions in Alpha Phased Polyvinylidene Fluoride(Alpha PVDF)-Ag(NPs) Composites	114
47	Dr. Rakesh K. Sonker (Physics)	Energy Analysis and Optimization for Liquefied Natural Gas Process	Design and growth of metal oxide film as Liquefied Petroleum Gas Sensors	116
48	Dr. Siddhartha (Physics), Dr.Neelakshi N K Borah(Physics)	Advances in Electronics and Communcation Engineering (Vol-2)	Semiconductor materials in electronic devices	117
49	Dr. Sarita Kumar (Zoology)	Laboratory Manual of BZYCL-136	Physiology and Biochemistry: Laboratory	118
50	Dr. Sarita Kumar (Zoology)	Conference Proceedings	Biochemical characterization of acetamiprid resistance in laboratory-bred population of Aedes aegypti L. larvae.	119
51	Dr. Sarita Kumar (Zoology)	Conference Proceedings	Lufenuron: A potential chitin synthesis inhibitor against Aedes aegypti L.	120
52	Dr. Sarita Kumar (Zoology)	Conference Proceedings	Assessment of toxicity and growth regulatory effects of beta-cyfluthrin against Red Cotton Bug, Dysdercus koenigii (Fabr.) (Heteroptera: Pyrrhocoridae): An emerging cotton pest.	121
53	Dr. Sarita Kumar (Zoology)	Conference Proceedings	Development of acetamiprid resistance in Aedes aegypti L.: Correlation with growth and reproductive fitness.	123
54	Dr. Sarita Kumar (Zoology)	Conference Proceedings	Lufenuron: A potential agent to control insecticide resistant population of Aedes aegypti L.	124

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55	Dr. Sarita Kumar (Zoology)	Conference Proceedings	Bioefficacy of beta-cyfluthrin against red cotton bug, Dysdercus köenigii (Heteroptera: Pyrrhocoridae).	125
56	Dr. Sarita Kumar (Zoology)	Conference Proceedings	Effect of dietary stress of emamectin benzoate on the survival and feeding potency of Helicoverpa armigera (Lepidoptera: Noctuidae).	126
57	Dr. Sarita Kumar (Zoology)	Conference Proceedings	Phyto-mediated silver nanocomposites as a control agent of Aedes aegypti L.: Optimal formulation with Citrus limetta peel extract.	127
58	Dr. Sarita Kumar (Zoology)	Conference Proceedings	Enhanced larvicidal potential of α-cypermethrin against Aedes aegypti l. when synergized with citrus peel extract.	129
59	Dr. Sarita Kumar (Zoology)	Conference Proceedings	Characterization of acetamiprid resistance in the laboratory population of Aedes aegypti L.	130
60	Dr. Sarita Kumar (Zoology)	Conference Proceedings	Review the Ecology, behaviour, physiology & development of transmission of vector-borne diseases in urban areas in Jalgaon, Maharashtra.	131
61	Dr. Sarita Kumar (Zoology)	Conference Proceedings	Bio-efficacy of Achyranthes aspera-derived silver nanocomposites against early fourth instars of Aedes aegypti L.	133
62	Dr. Sarita Kumar (Zoology)	Conference Proceedings	Knockdown and Irritability Response to Deltamethrin in the Susceptible and Deltamethrin-resistant adults of Culex quinquefasciatus.	134
63	Dr. Sarita Kumar (Zoology)	Conference Proceedings	Effect of Emamectin Benzoate-induced dietary stress on the nutritional performance of American Bollworm, Helicoverpa armigera.	135
64	Dr. Monisha Khanna Kapur(Zoology)	A Closer Look at Actinomycetes	Metabolic Profiling of Streptomyces sp. Strain 51 for Detection of Bioactive Compounds	136

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69	Dr Yash Mangla (Botany)	Plant Reproductive Ecology: Patterns and Processes. Tandon et al.	Dynamics of Eco-evolutionary Forces in Shaping Dioecy	141
70	Dr Vineet Kumar Singh (Botany)	Plant Reproductive Ecology: Patterns and Processes. Tandon et al. I	Secondary Pollen Presentation in Flowering Plants	142
71	Mr. Manoj Kumar Garg (English)	Easy English Grammar	-	143
72	Mr. Manoj Kumar Garg (English)	English Fluency (Part 1)	-	144
73	Mr. Manoj Kumar Garg (English)	English Language	-	145
74	Mr. Manoj Kumar Garg (English)	Essential Business Communication	-	146
75	Dr. Deo Datta Arya (Mathematics)	-	A Fuzzy Economic Order Quantity Model for Growing Items with Imperfect Quality	147
76	Dr. Pankaj Khanna (Chemistry)	-	Hepatic lipoprotein receptor related protein modulators as potential therapeutics for Alzheimer's disease (Proc. of 'Alzheimer's Association International Conference')	148
77	Dr Gagan Dhawan (BMS)	Nanobiotechnology: Current and Future Perspectives in Combating Microbial Pathogenesis.	-	149

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78	Dr Urmi Bajpai (BMS)	Conference Proceedings	A new phage consortium hosts its first public lecture. Capsid & Tail	150
79	Dr. Sarita Kumar (Zoology)	Conference Proceedings	Phyto-mediated Silver Nano-composites: Eco-friendly nano-larvicide against early fourth instars of dengue vector Aedes aegypti L. (Diptera: Culicidae)	153
80	Dr. Sunita Hooda (Chemistry)	Conference Proceedings	Rhodamine 6G Adsorbed by Eco-friendly adsorbent Needle – Shaped Chitin Nanoparticle in Day light.	154
81	Dr. Sarita Kumar (Zoology)	Conference Proceedings	Acetamiprid resistance in Aedes aegypti: Evaluation of metabolic detoxification and target site mutations as defense mechanisms	157
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82	Dr. Sharanjit Kaur (Computer Science)	Class XII Computer Science	Textbook	158-160
83	Dr. Sharanjit Kaur (Computer Science)	Class XII IP	Textbook	161-163
84	Dr. Harita Ahuja (Computer Science)	Class XII Computer Science	Textbook	164-166
85	Dr. Harita Ahuja (Computer Science)	Class XII IP	Textbook	167-169
86	Dr. Chandra Kanta Samal (Computer Science)	The Internet of Drones: AI Applications for Smart Solutions	"Real Time Monitoring and Analysis of Troposphere Pollutants Using a Multipurpose Surveillance Drone"	172
87	Dr. Chandra Kanta Samal (Computer Science)	Advance Computing	"Programmable Joint Computing Filter For Low-Power and High-Performance Applications"	173
88	Dr. Joita Dhar Rakshit (English)	Travel Writing	Criticism of the British Raj in the Writings of Nineteenth Century British Women Travellers to India	174-176
89	Mr. Vishal Dhingra (Electronics), Dr. Amit Garg (Electronics) and Dr. Arijit Chowdhuri (Physics)	Conference Proceedings	Varying sonication conditions to tailor surface morphology of GO thin films for enhanced gas sensing performance	178
90	Dr. Sarita Kumar (Zoology)	Textbook for Class XII	Illustrated Biology	180

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91	Dr. Sarita Kumar (Zoology)	Pyrethroids: Exposure, Applications and Resistance	Status of pyrethroid resistance and mechanism in the dengue vector, Aedes aegypti L. (Diptera: Culicidae).	183
92	Dr. Sarita Kumar (Zoology)	Advances in Animal Science and Zoology, Volume 15	Multiple insecticide resistance in Culex quinquefasciatus: Impact and associated mechanisms.	186
93	Dr. Sarita Kumar (Zoology)	Advances in Animal Science and Zoology, Volume 16	Silver nanoparticles with mosquito control potential: Optimal synthesis and biophysical characterization.	189
94	Dr. Sarita Kumar (Zoology)	Polymer Nanocomposites Based on Silver Nanoparticles: Synthesis, Characterization and Applications	Synthesis and green synthesis of nanoparticles	192
95	Dr. Sarita Kumar (Zoology)	Insect and Vectors-borne Diseases	Unit 3: Basic Classification of Class Insecta.	193
96	Dr. Sarita Kumar (Zoology)	Insect and Vectors-borne Diseases	Unit 6: Medically Important Insect Orders.	193
97	Dr. Sarita Kumar (Zoology)	Conference Proceedings	Diversity of some pollinator bee fauna vis-à-vis crop from Delhi.	195
98	Dr. Monica Misra (Zoology)	Practical Manual of Developmental Biology	-	196
99	Prof. Ravi Toteja & Prof. Seema Makhija (Zoology)	Text Book of Immunology	-	199
100	Dr. Vikrant Kumar (Chemistry)	Herbs and Spices—New Processing Technologies. Syzygium aromaticum: Medicinal Properties and Phytochemical Screening	-	201
101	Prof. Urmi Bajpai (BMS)	Translational Bioinformatics Methods for Drug Repurposing.	-	202
102	Dr. Manoj Kumar Singh (Botany)	Waterborne Pathogens Detection and Treatment Edited by Majeti Narasimha Vara Prasad, Anna Grobelak	Bioaugmentation for the treatment of waterborne pathogen contamination water' in Waterborne Pathogens Detection and Treatment Edited by Majeti Narasimha Vara Prasad, Anna Grobelak	204

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103	Dr. Manoj Kumar Singh (Botany)	Waterborne Pathogens Detection and Treatment Edited by Majeti Narasimha Vara Prasad, Anna Grobelak	Biofiltration technique for removal of waterborne pathogens, in Waterborne Pathogens Detection and Treatment Edited by Majeti Narasimha Vara Prasad, Anna Grobelak	205
104	Dr. Manoj Kumar Singh (Botany)	Waterborne Pathogens Detection and Treatment Edited by Majeti Narasimha Vara Prasad, Anna Grobelak	Chemical treatment for removal of waterborne pathogens	206
105	Dr. Manoj Kumar Singh, Dr. Sumit Sahni, Dr. Anita Narang (Botany)	Energy: Crises, Challenges and Solutions Eds. Pardeep Singh, Suruchi Singh, Gaurav Kumar, Pooja Baweja	Sustainable Solution for Future Energy Challenges through Microbes'	207
106	Dr. Manoj Kumar Singh, Dr. Sumit Sahni, Dr. Anita Narang (Botany)	Energy: Crises, Challenges and Solutions Eds. Pardeep Singh, Suruchi Singh, Gaurav Kumar, Pooja Baweja	Production of Liquid Biofuels from Lignocellulosic Biomass	208
107	Dr. Manoj Kumar Singh, Dr. Sumit Sahni, Dr. Anita Narang (Botany)	Climate Change and the Microbiome Sustenance of the Ecosphere Eds. DK Choudhary, Arti Mishra, Ajit Verma	Impact of Climate Change on Functional AM Fungi in Rhizosphere	209
108	Dr. K R Meena (Mathematics)	Adjusted Bias and Risk for Estimating Treatment Effect after Selection with an Application in Idiopathic Osteoporosis	-	210
109	Gurudatt Rao Ambedkar (Mathematics)	Conference Paper	Optimizing EOQ Model for Expiring Items with Stock selling and Life time Dependent demand under inflation	211
110	Narayan Singh (Mathematics)	Conference Paper	Determination of the system cost with two level permissible delay and cash discount for retailer in a three echelon supply chain system	212
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111	Prof. Seema Gupta (Chemistry)	Nanomaterials: Evolution Advancement Towards Therapeutic Drug Delivery	Hydrogels for Drug Delivery	213
112	Prof. Urmi Bajpai (Biomedical Science)	Bacteriophages: Interaction, Diversity and Applications: Bacteriophages in the Treatment of Biofilms	-	217
113	Prof. Gagan Dhawan (Biomedical Science)	Nanotechnology for Infectious Diseases : Understanding the pharmacology and pharmacotherapeutics for infectious diseases	-	218

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115	Prof. Sarita Kumar (Zoology)	-	Growth regulatory and fitness cost studies in Aedes aegypti on exposure to diflubenzuron, an insect growth regulator	221
116	Prof. Sarita Kumar (Zoology)	Illustrated Biology – Textbook for Class XI	-	222
117	Prof. Sarita Kumar (Zoology), Prof. Sunita Hooda (Chemistry)	Characterization of mesoporous materials.	-	227
118	Prof. Sarita Kumar (Zoology)	Textbook for Undergraduate courses on Fundamentals of Environmental Studies – Reprint	-	230
119	Prof. Charu K Gupta (Botany)	Reproductive Biology of angiosperms	-	231
120	Dr Sandeep Kumar Goel (Commerce)	Unit-5: Capital Budgeting – An Introduction	-	233-234
121	Dr Sandeep Kumar Goel (Commerce)	Unit-6: Techniques of Capital Budgeting – I	-	233-234
122	Dr Sandeep Kumar Goel (Commerce)	Unit-7: Techniques of Capital Budgeting – II	-	233-234
123	Dr Sandeep Kumar Goel (Commerce)	Unit-8: Capital Budgeting under Risk and Uncertainty	-	233-234
124	Prof. Pankaj Khanna (Chemistry)	Graphene-Based Nanomaterial Catalysis: Graphene Based Nanomaterials as Catalyst in Reduction Reactions	-	237
125	Prof. Pankaj Khanna (Chemistry)	Advanced Nanocatalysis for Organic Synthesis and Electroanalysis : Nanocatalysis for Reduction/Hydrogenation Reactions	-	240
126	Prof. Dinesh Arya (Chemistry)	New Horizons in Life Science : The Impact of Climate Change on human health in India: An Overview	-	241

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Mini Review

Influenza Pandemics and the Associated Bacterial Infections

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Introduction

Influenza A virus is major respiratory pathogen responsible for causing highly contagious and acute respiratory disease. It belongs to the family of RNA viruses "Orthomyxoviridae" and has a 13.5kb genome with eight single-stranded (ss) RNA segments. These negative-sense ssRNA segments encode eleven proteins: HA, PB1, PB2, PA, NP, NEP, M1, NA, NS1, M2 and PB1-F2. HA protein facilitates entry of virus in the host cell, polymerase subunits PB1, PB2, PA and NP (nucleoprotein) assist in replication and transcription of viral RNAs. Nuclear export protein (NEP/NS2) and matrix protein (M1) plays a role in export of viral nucleoprotein from the nucleus to cytoplasm and their assembly into virion at plasma membrane. The NA protein assist in the release of virus from infected cells and NS1 protein acts as interferon antagonist inhibiting the host immune response. M2 protein is an integral part of viral envelope, forming pH regulated and highly sensitive proton conducting channels, essential for viral replication. PB1-F2 protein is an important determinant of virulence of influenza virus, increases the severity of secondary bacterial infections and also induces apoptosis [1].

In Influenza A virus, aquatic birds act as natural reservoir but it has the ability to infect variety of hosts like birds, human beings and swine [3]. Due to segmented nature of the genome, influenza A virus has high variability thereby undergoing re-assortment when a cell is infected with more than one virus [4]. This process of genetic reassortment results in generation of novel strains of influenza virus thus preventing the acquired immune response from previous infections, leading to recurrent epidemics and global pandemics.

Influenza virus pandemics have been defined as global outbreaks of the disease due to emergence of viruses with new antigenic subtypes. There have been four pandemics: the 1918 Spanish influenza, the 1957 Asian influenza, the 1968 Hong Kong influenza and the 2009 Swine influenza, resulting in more than a million deaths [5]. Between these episodes of pandemics, there have been various epidemics of grave severity. Influenza pandemics and epidemics are initiated by the introduction and successful adaptation of antigenic variation in the surface glycoproteins, Hemagglutinin (HA) and Neuraminidase (NA) assisting the virus in evading the host immune response [6,7]. On the basis of sequence analysis, a total of sixteen HA (H1-H16) and eleven NA (N1-N11) have been identified, combination of which results in major outbreaks [3]. The variation in viral genome occurs either as a result of minor antigenic changes over a period of time, facilitating escape from the existing immune response, known as "antigenic drift", producing outbreaks of seasonal flu or by sudden major change in the genome as a result of genetic re-assortment where the genomes of two different strains of viruses are re-assorted creating a novel viral strain, process known as "genetic shift" [8]. The outbreaks of seasonal influenza are the result of frequent anti¬-genic drift, however in case of genetic shift, if the novel strain has virulence for human; it may give rise to pandemic situation, since humans are unlikely to generate appreciable immune response against the new virus.

Earlier FDA had approved the drugs Amantidine and Rimantidine (M2 proton-selective ion channel protein inhibitors), but these drugs are abandoned for treatment owing to the high resistance (>99%) of Influenza A (H3N2, H1N1'09) virus for these drugs (CDC) Existing influenza treatment is limited to neuraminidase inhibitors and increasing number of drug resistance cases against these inhibitors has been reported which is serious matter of concern [9]. The most efficient treatment for influenza virus infection is through vaccination, thereby reducing the impact of pandemic influenza [10]. The currently approved vaccine provides an effective counter-measure against influenza virus, but they provide humoral immunity against the surface antigen, which often undergoes antigenic drift. Hence, these vaccines need to be reformulated annually in order to generate immune response against the specific strain of virus that is predicted to circulate in the next season, which is a major limitation [11].

Bacterial Infections

Influenza usually does not advance to death in healthy children and adults, however serious sequelae can occur with secondary or co-infection with bacterial pathogens, especially in immune-compromised individuals with chronic health conditions like respiratory ailment, cardiac disease etc. Bacterial associated pneumonia is the most common source of increased mortality during the pandemic season. Bacterial pathogens may infect concurrently with the viral infection, the co-infection results in pneumonia thereby

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increasing the severity of disease. Bacterial infection may also occur after the influenza virus has been cleared from lungs, and the host is more susceptible to secondary infections [12]. Secondary infections are facilitated by influenza-associated impairment of immune system, caused by enhanced release of inflammatory cytokines or by decreasing the ability to clear bacterial infections.

Clinicians now have several ways to alleviate pneumonia through vaccines, antibiotics and antiviral therapies, thereby contributing to decreasing the burden of disease globally. It has been observed that influenza and pneumococcal vaccine in synergy, reduced hospitalization due to influenza and pneumonia significantly [13]. In the cases of suspected invasive bacterial infection, early initiation of antiviral therapy and appropriate antibiotics should be administered to increase the efficiency of the treatment.

These measures however have limitations, which restrain their effectiveness. The over usage of antibiotics to combat bacterial infections, has contributed severely to the antibiotic resistance with evidence that MRSA (Methicillin-resistant *Staphylococcus aureus*) infections is responsible for increase in morbidity and mortality, especially among the children diagnosed with influenza [14]. Limitations include the delay in production of vaccines and stockpiling of antiviral and antibacterial drugs [15].

Pandemics

1918 H1N1 Pandemic

The 1918 Pandemic "Spanish flu" remains unprecedented in terms of severity, killing about 50-100 million people globally, hence often known as "mother of all pandemics" [16,17]. The causative organism was the H1N1 subtype of Influenza A virus with avian ancestral source. It was highly intriguing how the viruses of avian origin adapt to mammalian hosts and infect such different cell types. The examination of genome revealed the possibility of de novo adaptation of the avian virus by parallel evolution of genes in a novel (human) host [18]. The pandemic is believed to have originated from china and occurred in three waves, starting from a mild wave in spring season, followed by the most catastrophic and severe wave in fall and then the final mild wave in winter of 1918-1919 [19]. Pandemic reached Indian subcontinent through Bombay, thereby spreading North and south simultaneously, increasing the death toll to 10-20 million (38% of global mortality), making India the worst affected country in terms of mortality [16,19,20].

Although there were various theories regarding the severity of 1918 pandemic, the experts reached a consensus that the high mortality rate was due to secondary infections caused by bacterial pathogens (*pneumococci, streptococci*, *staphylococci*) colonizing the upper respiratory tract [21]. Experts believed that bacterial invaders infected in sequential manner, after the influenza virus cripple the pulmonary tissue [22]. Most commonly identified bacteria in the pandemic patients were *S. pneumoniae*, *S. pyogenes* and less commonly *S. aureus* and *H. influenzae* [23]. One of the most puzzling features of 1918 Pandemic was the W-shaped Influenza mortality curve with unusual burden among the young adults (healthy population between 20-40 years), instead of the usual U-shaped curve [6,18,24].Various reports have shown that the increased mortality in otherwise healthy young could be contributed by the excessive release of pro-inflammatory cytokines (IL-6, IL-8) and tumor necrosis factor (TNF-α) [25-27].

Another reason for the devastation by 1918 pandemic could be the rudimentary health practices with limited knowledge about disease prevention and control. The development of antivirals, vaccines and antibiotics to treat the secondary infections were still decades away, hence efforts to control the outbreaks were restricted to Non-Pharmaceutical Interventions (NPIs), which included quarantine, prohibition of public gatherings and use of facemasks [28].

Spanish flu is still believed to be the worst public disaster in the history, killing millions of people. However, it brought to light the urgency to improve the public health care conditions across the globe, which led to major advancements in medical sciences, awareness and better preparedness for such un-anticipated outbreaks.

1957 H2N2 Pandemic

After almost 40 years of Spanish flu, a novel strain of Influenza virus (H2N2) of avian origin, emerged in China in February 1957, and gave rise to a pandemic situation, killing around 500,000 to 2 million people worldwide [29]. After spreading across China, the Asian flu progressed to Singapore, Japan and Taiwan before traversing across the globe. The H2N2 strain was the product of re-assortment between the circulating human virus that introduced N2 and avian virus with H2 HA, as revealed from phylogenetic studies [1,30]. As with Spanish Flu, H2N2 virus would reappear in successive waves, second one being more severe than the previous one [31]. Asian flu reached India in May 1957 through the port of Madras, thereafter spreading throughout the country, leading to the death of about 1098 people from May 1957- February 1958 [32].

The Asian influenza had similar characteristics of increased deaths due to bacterial pneumonia with *S. aureus, H. influenza* and *S. pneumoniae* being the major pathogens that were isolated [21,22]. The Influenza mortality curve shifted towards younger age group, similar to 1918 Pandemic, suggesting the presence of pre-existing antibodies in elderly from the prior exposure [33]. By the time of Asian flu, global surveillance was used to determine the disease burden through a network of laboratories worldwide, linked to Influenza Research Center based in London [34]. After the catastrophic effect of Spanish flu, several measures were taken in the field of influenza research to be better prepared for such unforeseen situations, although the expertise was still inadequate. The 1957 pandemic was the first event to study the response of vaccination in large population that has not been exposed to the novel H_2N_2 strain of virus, but did not have a significant impact due to limited supply [35]. Antibiotics reduced the disease burden due to secondary bacterial infection; however they were not effective against viral infections [34]. The usage of non-pharmaceutical interventions was minimum and the antivirals were yet to be developed [36]. Asian flu, though mild pandemic, emerged as a reminder of persisting global threat of Influenza virus.

1968 H3N2 Pandemic

A decade after its emergence, Asian flu underwent genetic re-assortment between human and avian strain via antigenic shift, giving rise to a novel H3N2 strain and triggering a new pandemic situation known as Hong Kong flu. Even though this strain of virus was highly contagious leading to rapid dissemination globally, it was still milder

than Asian flu with the mortality estimates of 500,000 to 2 million deaths worldwide [29]. After being first reported in Hong Kong in July 1968, it spread throughout Asia before reaching west coast of United States in August, England and Australia by September, Canada in December and France by January 1969 [30,33]. The H3N2 virus reached Madras, India in September from Singapore followed by the reported decline in influenza activity during end of November and December in Madras. It gradually spread to entire Indian subcontinent with the appearance of most severe manifestation among children [37].

A characteristic shift in mortality curve was observed with highest fatality cases being reported among the children and elderly, forming a U-shaped mortality curve [38]. Similar to previous pandemics, it spread in two successive waves but the distinctive feature of this pandemic was that the number of associated deaths in the two waves varied with geographic location, with United states and Canada being more affected by the first wave, whereas Europe and Asia by the second wave, thereby following a smoldering pattern [33]. The relative amelioration of infection rates can be the consequence of the pre-existing antibodies to neuraminidase antigen (N2), similar to its antecedent Asian flu (H2N2) strain.

The foremost complication during the Hong Kong pandemic was pneumonia (associated with Influenza and *staphylococcus*), but due to advances in the field of antibacterial therapies, the mortality rate was higher from primary influenza associated pneumonia rather than in synergy with secondary bacterial infections [22,38]. Similar to the other infective parts of the world, in India the pandemic was relatively mild with few complications like pneumonia, bronchopneumonia, *streptococci* and *staphylococcus* isolation from sputum, gastrointestinal symptoms etc. [37]. Due to less severity and low mortality rates, the control measures ascertain the use of vaccines and antibiotics in the case of secondary bacterial infections (pneumonia), rather than more costly non-pharmaceutical interventions [39]. The vaccines were developed against the circulating virus but were made available only when the pandemic had peaked indicating towards the lack of progress in healthcare strategies from 1957 Asian flu pandemic [40].

2009 H1N1 Pandemic

The H1N1/09 virus commonly known as swine flu, emerged in April 2009 with Mexico being the epicenter and was declared as the first global pandemic of 21st century on 11 June 2009 by WHO [3,6,8]. Swine flu is believed to be the fourth generation descendant of Swine flu that was first described in 1918 and emerged from the triple re-assortment between human, swine and avian influenza A virus to form the H1N1/09 pandemic strain [3,6,31]. After the pandemic declaration, national pandemic preparedness plans were put in motion globally, which included the use of antiviral therapy, disease alleviation and treatment [41]. The virus spread at unprecedented speed across the world with the mortality estimates of 575,000. Similar to the previous pandemics of 20th century, the swine flu exhibited the wave pattern of dissemination, which varied geographically. For example in North America, the pandemic had a two-wave behavior with the peaks being observed during spring-summer and fall [42]. In India however three wave patterns was observed, with peaks during September 2009, December 2009 and August 2010 [43]. The index cases in India were identified from Pune, which soon spread to the entire nation [44].

The characteristics of Influenza H1N1/09 were similar to the seasonal influenza, infected individuals became more prone to underlying conditions, which further exacerbated the infection and increased the number of cases requiring hospitalization [45]. Complications seen in the patients included bacterial and viral pneumonia, asthma, lung and heart disease etc. Pneumonia caused by secondary bacterial infections and acute respiratory distress syndromes were the major cause of serious complications and mortality during 1918 Spanish flu [21,46]. Bacterial co-infections also played a major role in fatal cases of H1N1/09 pandemic with the S. pneumonia being most prevalent, followed by *S. pyogenes, S. aureus* (MRSA), *S. mitis*, *H. influenzae* being isolated from lung specimen of fatal cases [47]. Similarly in India, the severity of pandemic was associated mainly by secondary infections, like primary viral pneumonia and secondary bacterial pneumonia along with exacerbation of other chronic health conditions [48]. Apart from secondary bacterial infections, there were reports of viral co-infection leading to further exacerbation of the disease. The respiratory viruses like RSV, rhino virus, corona virus, metapneumovirus, parainfluenza co-infected the pandemic H1N1 cases, increasing the severity of the disease [22]. There was a shift in mortality curve, with the younger populations (children, young adults and pregnant women), being worst affected because the elderly are more likely to contain neutralizing antibodies from previous exposure to H1N1 virus [49,50].

Since its emergence, H1N1/09 virus was more susceptible to antivirals that were neuraminidase inhibitors (oseltamivir, zanamir) and resistant to adamantanes (amantadines, rimantadines). The antivirals were found to be most effective in patients with severe influenza illness and reducing secondary bacterial infections, when started within 48 hours of the onset of symptoms [22,50]. In the area of limited antiviral availability, the decision to start the antiviral therapy was based clinicians judgment, as the patients with mild symptoms did not require the antivirals unless they are at the risk of associated complications [46]. Clinician also prescribed antibacterial drugs in case bacterial co-infection was suspected, taking into account the data regarding the frequency of pathogen isolated during the cases of co-infection [3]. The alternative mode of treatment was vaccines, which were developed within 6 months and were the best tools to prevent the unforeseen spread of pandemic. Two types of vaccines were developed which were approved by FDA, adjuvant and non-adjuvant, both of which were safe and immunogenic, hence used widely during 2009 Pandemic situation.

The overall response to 2009 pandemic situation displayed a significant improvement in the preparedness plans by better surveillance schemes to ensure rapid detection and response to pandemics [50]. In comparison to previous pandemics, the pandemic of the 21st century was dealt with combined use of vaccines and antivirals, which undoubtedly reduced the morbidity and mortality. The non-pharmaceutical interventions like hand hygiene, isolation of symptomatic individuals, played an important role in containment of influenza pandemic [51].

Overall, the 2009 pandemic were mild but it caused a major socio-economic burden, which was more comprehensively documented than previous pandemics of last century. Though it reinforced

optimism about better preparedness, but the cost-effectiveness of the healthcare facilities were still a matter of concern.

Conclusion

Influenza pandemics are one of the major threats to the world because of their high morbidity and mortality. The influenza related mortalities are mostly not due to primary viral infection but due to secondary viral and bacterial pneumonia. Hence, strategy for prevention of future pandemics should give emphasis on the control of both bacterial and viral associated community acquired pneumonia. Another measure for better preparedness could be easy accessibility to antivirals, antibiotics and vaccines, hence priority should be given to better infrastructure facilities for rapid production of vaccines, stockpiling of antivirals and antibiotics. In addition to this, better sanitation and improved nutritional status of the society will go a long way in controlling the disease. The mortality surveillance plans would be helpful for better understanding of disease burden of influenza, the pathogens contributing to the mortality and the most vulnerable age group. It shall be helpful in designing more specific preventive strategies and thereby reducing the catastrophic effects of influenza.

References

1. Neumann G, Noda T, Kawaoka Y. Emergence and pandemic potential of swine-origin H1N1 influenza virus. Nature. 2009; 459: 931-939.
2. Chang LY, Shih SR, Shao PL, Huang DT, Huang LM. Novel swine-origin influenza virus A (H1N1): the first pandemic of the 21st century. J Formos Med Assoc. 2009; 108: 526-532.
3. Hajjar SA, McIntosh K. The first influenza pandemic of the 21st century. Ann Saudi Med. 2010; 30: 1-10.
4. Brockwell-Staats C, Webster RG, Webby RJ. Diversity of influenza viruses in swine and the emergence of a novel human pandemic influenza A (H1N1). Influenza Other Respir Viruses. 2009; 3: 207-213.
5. Saunders-Hastings PR, Krewski D. Reviewing the history of pandemic influenza: Understanding patterns of emergence and transmission. Pathogens. 2016; 5: 66.
6. Khanna M, Saxena L, Gupta A, Kumar B, Rajput R. Influenza pandemics of 1918 and 2009. Future Virology. 2013; 8: 335-342.
7. Khanna M, Kumar P, Choudhary K, Kumar B, Vijayan VK. Emerging influenza virus: a global threat. J Biosci. 2008; 33: 475-482.
8. Khanna M, Kumar B, Gupta A, Kumar P. Pandemic Influenza A H1N1 (2009) Virus: Lessons from the past and implications for the future. Indian J Virol. 2012; 23: 12-17.
9. Hurt AC, Holien JK, Parker MW, Barr IG. Oseltamivir resistance and the H274Y neuraminidase mutation in seasonal, pandemic and highly pathogenic influenza viruses. Drugs. 2009; 69: 2523-2531.
10. Khanna M, Sharma S, Kumar B, Rajput R. Protective immunity based on the conserved hemagglutinin stalk domain and its prospects for universal influenza vaccine development. BioMed Research International. 2014; 2014: Article ID 546274.
11. Pica N, Palese P. Toward a universal influenza virus vaccine: Prospects and challenges. Annu. Rev. Med. 2013; 64: 189-202.
12. Small CL, Shaler CR, McCormick S, Jeyanathan M, Damjanovic D, Brown EG, et al. Influenza infection leads to increased susceptibility to subsequent bacterial superinfection by impairing NK cell responses in the lung. J Immunol. 2010; 184: 2048-2056.
13. Hedlund J, Christenson B, Lundbergh P, Ortqvist A. Effects of a largescale intervention with influenza and 23-valent pneumococcal vaccines in elderly people: a 1-year follow-up. Vaccine. 2003; 21: 3906-3911.
14. Finelli L, Fiore A, Dhara R, Brammer L, Shay DK, Kamimoto L, et al. Influenza-associated pediatric mortality in the United States: increase of staphylococcus aureus coinfection. Pediatrics. 2008; 122: 805-811.
15. Cinti SK, Barnosky AR, Gay SE, Goold SD, Lozon MM, Kim K, et al. Bacterial pneumonias during an influenza pandemic: how will we allocate antibiotics? Biosecur Bioterror. 2009; 7: 311-316.
16. Johnson NP, Mueller J. Updating the accounts: global mortality of the 1918–1920 "Spanish" influenza pandemic. Bull Hist Med. 2002; 76: 105-115.
17. Khanna M, Saxena L, Gupta A, Kumar B, Rajput R. Influenza pandemics of 1918 and 2009. Future Virology. 2013; 8: 335-342.
18. Taubenberger JK, Morens DM. Influenza: the mother of all pandemics. Emerg Infect Dis. 2006; 12: 15-22.
19. Chandra S and Kassens-Noor E. The evolution of pandemic influenza: evidence from India, 1918-1919. BMC Infect Dis. 2014; 14: 510.
20. Chandra S, Kuljanin G, Wray J. Mortality from the influenza pandemic of 1918-1919: The case of India. Demography. 2012; 49: 857-865.
21. Morens DM, Taubenberger JK, Fauci AS. Predominant role of bacterial pneumonia as a cause of death in pandemic influenza: Implications for pandemic influenza preparedness. J Infect Dis. 2008; 198: 962-970.
22. Joseph C, Togawa Y, Shindo N. Bacterial and viral infections associated with influenza. Influenza and Other Respiratory Viruses. 2013; 7: 105-113.
23. Morens DM, Taubenberger JK, Harvey HA, Memoli MJ. The 1918 influenza pandemic: Lessons for 2009 and the future. Crit Care Med. 2010; 38: e10-e20.
24. Luk J, Gross P, Thompson WW. Observations on mortality during the 1918 influenza pandemic. Clin Infect Dis. 2001; 33: 1375-1378.
25. Osterholm MT. Preparing for the next pandemic. N Engl J Med. 2005; 352: 1839-1842.
26. Kash JC, Basler CF, García-Sastre A, Carter V, Billharz R, Swayne DE, et al. Global host immune response: pathogenesis and transcriptional profiling of type A influenza viruses expressing the hemagglutinin and neuraminidase genes from the 1918 pandemic virus. J Virol. 2004; 78: 9499-9511.
27. Kobasa D, Takada A, Shinya K, Hatta M, Halfmann P, Theriault S, et al. Enhanced virulence of influenza A viruses with the haemagglutinin of the 1918 pandemic virus. Nature. 2004; 431: 703-707.
28. Markel H, Stern AM, Navarro JA, Michalsen JR, Monto AS, DiGiovanni C. Nonpharmaceutical influenza mitigation strategies, US communities, 1918–1920 pandemic. Emerg. Infect. Dis. 2006; 12: 1961-1964.
29. Guan Y, Yikaykrishna D, Bahl J, Zhu H, Wang J, Smith GJ. The emergence of pandemic influenza viruses. Protein Cell. 2010; 1: 9-13.
30. Kilbourne ED. Influenza pandemics of the 20th century. Emerg Infect Dis. 2006; 12: 9-14.
31. Scalera NM, Mossad SB. The first pandemic of the 21st century: Review of the 2009 pandemic variant influenza A (H1N1) virus. Postgrad Med. 2009; 121: 43-47.
32. Menon IGK. The 1957 pandemic of influenza in India. Bull World Health Organ. 1959; 20: 199-224.
33. Viboud C, Grais R, Lafont B, Miller M, Simonsen L. Multinational impact of Hong Kong influenza pandemic: Evidence for a smoldering pandemic. J. Infect. Dis. 2005; 192: 233-249.
34. Jackson C. History lessons: The Asian flu pandemic. Br. J. Gen. Pract. 2009; 59: 622-623.
35. Henderson D, Courtney B, Inglesby T, Toner E, Nuzzo J. Public health and medical responses to the 1957-58 influenza pandemic. Biosecur. Bioterror. 2009; 7: 265-273.
36. Trotter Y, Dunn FL, Drachmann RH. Asian influenza in the United States. Am. J. Hyg. 1959; 70: 34-50.
37. Veeraraghavan N. Hong Kong Influenza in Madras State, India, 1968. Bull World Health Organ. 1969; 41: 399-400.
38. Hsieh YC, Wu TZ, Liu DP, Shao PL, Chang LY, Lu CY, et al. Influenza

pandemics: Past, present and future. J Formos Med Assoc. 2006; 105: 1-6.

39. Taubenberger JK, Morens DM. Influenza: The once and future pandemic. Public Health Rep. 2010; 125: 16-26.

40. Rogers K. Hong Kong Flu of 1968.

41. Berera D, Zambon M. Antivirals in the 2009 pandemic - lessons and implications for future strategies. Influenza Other Respir Viruses. 2013; 7: 72-79.

42. Cook S, Conrad C, Fowlkes AL, Mohebbi MH. Assessing google flu trends performance in the United States during the 2009 influenza virus a (H1N1) pandemic. PLoS ONE. 2011; 6: e23610.

43. Mishra B. 2015 resurgence of influenza A (H1N1) 09: Smoldering pandemic in India? J. Glob. Infect. Dis. 2015; 7: 56-59.

44. Mehta AA, Kumar VA, Nair SG, Joseph FK, Kumar G, Singh SK. Clinical profile of patients admitted with swine-origin influenza A (H1N1) virus infection: An experience from A tertiary care hospital. J Clin Diagn Res. 2013; 7: 2227-2230.

45. CDC. Swine-origin influenza A (H1N1) virus infection in a school-New York City, April 2009. MMWR. 2009(a); 58: 470-472.

46. Sinha M. Swine flu. Journal of Infection and Public Health. 2009; 2: 157-166.

47. CDC. Bacterial coinfections in lung tissue specimen from fatal cases of 2009 pandemic influenza A (H1N1)-United States. MMWR. 2009(b); 58: 1-4.

48. Dandagi GL, Byahatti SM. An insight into the swine-influenza A (H1N1) virus infection in humans. Lung India. 2011; 28: 34-38.

49. Girard MP, Tam JS, Assossou OM, Kieny MP. The 2009 A (H1N1) influenza virus pandmeic: A review. Vaccine. 2010; 31: 4895-4902.

50. del Rio C, Guarner J. The 2009 influenza A (H1N1) pandemic: what have we learned in the past 6 months. Trans Am ClinClimatol Assoc. 2010; 121: 128-137.

51. Cantey PT, Chuk MG, Kohl KS, Herrmann J, Weiss P, Graffunder CM, et al. Public health emergency preparedness: lessons learned about monitoring of interventions from the national association of county and city health official's survey of nonpharmaceutical interventions for pandemic H1N1. J Public Health Manag Pract. 2013; 19: 70-76.

52. CDC. Antiviral drug resistance.

53. Khanna M, Gupta N, Gupta A, Vijayan VK. Influenza A (H1N1) 2009: A pandemic alarm. Journal of Biosciences. 2009(a); 34: 481-489.

54. Khanna M, Kumar B, Gupta N, Kumar P, Gupta A, Vijayan VK, et al. Pandemic swine influenza virus (H1N1) A threatening evolution. Indian J Microbiol. 2009(b); 49: 365-369.

Magnetic Graphene Oxide for Adsorption of Organic Dyes from Aqueous Solution

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Abstract: Graphene oxide (GO), a 2-D carbon nanomaterial, large surface area, oxygen-containing groups (like: hydroxyl, epoxy and carboxyl) and excellent water dispersibility due to it is good adsorbent dye removal from pollutant water[1]. But it's difficult to separate GO from water after adsorption. Therefore, Iron oxide was introduced in Graphene oxide by decorating method to make separation more efficient[2]. We present herein a one step process to prepare Magnetic Graphene oxide (MGO). The Fourier transform infrared spectrometer (FT-IR), X-ray diffraction (XRD) and Raman Spectroscopy characterized the chemical structure of the MGO composite. The adsorption of dyes onto MGO was studied in relation to initial concentration of Dyes, contact time, adsorbent dose, temperature and pH value of solution. We have studied adsorption capacity of different dyes (Methylene blue and crystal violet) by MGO.

Keywords: Graphene oxide, Iron oxide, methylene blue, crystal violet and Adsorption.

INTRODUCTION

The contaminants (dyes, heavy metals etc.) in water are growing rapidly due to the lack of knowledge about their effect on living species these contaminate effecting our life slowly but regularly. Therefore, we need a technology that can reduce effect of these contaminants. So many technologies are being used, adsorption technology is one of the growing technologies because it can be used in large scale and it is cost effective. For maximum adsorption a material should contain maximum oxide group, there are so many adsorbent materials available in the market. The new era going to start in the field of electronics, bio-sensing, gas-sensing, optics, water purification, mechanical, catalyst, and drug delivery agent etc., [3]due to the world first 2-D material (Graphene) has arrived. Graphene is a one atom thick, single sheet of carbon atom arranged in honeycomb structure. Its sister materials are also gaining tremendous interest of researchers in the above applications. Graphene oxide, oxidized form of Graphene is a unique 2-D material which has different types of oxide groups (-OH,-C-O-C-, C=O and –COOH) available on its basal plane[4], therefore GO is very suitable for adsorption of contaminants. But for maximum use of adsorbent material recyclability should be high. The recyclability of GO is low to overcome this drawback in GO, magnetic nanoparticles comes in the role[1]. In this paper we have synthesized MGO by co-precipitations method [2]and two dyes (methylene blue and crystal violet) were used for adsorption for different temperature, pH, contact time and concentration of dosage.

EXPERIMENTAL SECTION

Materials: All the chemicals used e.g. Graphite, methylene blue Sulfuric acid, KMnO4, sodium nitrate, and hydrogen peroxide were all of analytical grade.

Graphene oxide preparation: Graphene oxide (GO) will be prepared from graphite powder by a Hummer's method. In this method Graphite (1 g), sodium nitrate (NaNO3, 0.50 g) and concentrated sulfuric acid (H2SO4, 23 ml) added into a 500 ml flask kept at 5°C in an ice bath under continuous stirring for 5 min. Then, potassium

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Leveraging Hierarchy and Community Structure for Determining Influencers in Networks

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Abstract. Predicting influencers is an important task in social network analysis. Prerequisite for understanding the spreading dynamics in online social networks, it finds applications in product marketing, promotions of innovative ideas, constraining negative information etc.

The proposed prediction method IPRI (Influence scoring using Position, Reachability and Interaction) leverages prevailing hierarchy, interaction patterns and community structure in the network for identifying influential actors. The proposal is based on the hypothesis that capacity to influence other social actors is an interplay of three facets of an actor viz. (i) position in social hierarchy (ii) reach to diverse homophilic groups in network, and (iii) intensity of interactions with neighbours. Preliminary comparative performance evaluation of IPRI method against classical and state-of-the-art methods finds it effective.

Keywords: k-truss · Hierarchy · Topology · Community · Interaction

1 Introduction

Predicting influential spreaders in Online Social Networks (OSNs) is an important task because of the critical role they play in dissemination of information. The task is also crucial for accelerating the spread of positive vibes and blocking cascade of negative vibes in highly linked contemporary society [1,11].

Early methods for finding influencers in networks were based on classical centrality measures and their variants [2,6,11]. Prediction quality of these methods leaves much to be desired due to limited view of node attributes they take into account and network topology they scrutinize. Taking cues from the real-world, researchers have considered intensity of interactions between individuals for identifying influential nodes [8,9]. Number of links of an actor in diverse communities provides a unique vantage point in aiding spread of information. Method proposed in [16] exploits this idea and uses community structure in addition to weight of links to identify influential nodes. Role of hierarchy in influence spread is admitted and shown to be effective in [6,12].

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These state-of-the-art methods for finding influencers consider only one facet of the network at a time, and hence overlook the advantage of interplay of three facets mentioned above. In this paper, we address the research gap by exploiting the synergy between community structure, network hierarchy and intensity of interactions with neighbours for spreading influence, and demonstrate improvement over existing methods for prediction of influencers in OSNs.

1.1 Contributions and Organization

In this paper, we introduce a novel scoring method IPRI (**I**nfluence scoring using **P**osition, **R**eachability and **I**nteraction) for identifying influencers by capitalizing on the underlying hierarchy and prevailing homophilic groups in the network. We highlight the contributions of our work below.

i We perform decomposition of the network using k-truss method to capture network hierarchy and to approximate homophilic groups instead of using computationally expensive community detection method (Sect. 3).
ii We capture complex interplay of network hierarchy, prevailing community structure and interaction patterns to differentiate between spreading ability of individuals in social networks (Sect. 4).
iii We evaluate the proposed method (IPRI) using three publicly available networks and compare results against classical and state-of-the art methods (Sect. 5).

2 Related Work

We briefly describe recent approaches that use network topology for identifying influential spreaders in OSNs.

Kitsak et al. have demonstrated that influential spreaders are located in the top hierarchical level of the network where levels are identified using k-core decomposition method [6]. Researchers have extended k-core method to identify better spreaders by incorporating neighbourhood coreness [3] and considering 2-step neighbourhood [10]. Approaches using k-core decomposition are inadequate for fine-grained differentiation since they assign same rank to multiple nodes.

Rossi et al. [12] further refine the set of influential nodes by using k-truss decomposition method to consider position in hierarchy for detecting influential spreaders. It is also shown in [6,13] that influential nodes are not always part of bigger neighbourhood. However, these works do not utilize diversity in neighbourhood contacts to capture node's influence.

Recently, researchers have shown that diverse groups in OSNs affect spreading capability of individuals. Extended Pagerank algorithm for finding influencers incorporates broadness of user's inter-community links to capture diversity of neighbours [16]. However, importance of each identified community is not used in capturing influential spreaders. Liu et al. [9] proposed Trust-Oriented Social Influencers method based on social relationships, trust and similarity preferences between individuals using meta-data.

The proposed method IPRI overcomes limitations of existing methods by incorporating network hierarchy, community structure, and intensity of interactions to discover influential spreaders.

3 Preliminaries

In this section we present the formal notation used in the paper, and briefly describe k-truss decomposition method.

We represent an online social network (OSN) as simple, undirected, unsigned, edge-weighted graph $G = (V, E, W)$ - a triplet formed by (i) finite set of vertices/nodes V, (ii) set of edges $E \in V \times V$, and (iii) an edge weight matrix $W : V \times V \rightarrow \mathbb{R}_{\geq 0}$. Here V models individuals, and $|V|$ $(= n)$ denotes number of individuals in network. Edge $e_{ij} \in E$ models link between individuals v_i and v_j $(v_i, v_j \in V)$, and $|E|$ $(= m)$ denotes number of edges. Weight w_{ij} (in W) of edge e_{ij} quantifies the extent of interaction between v_i and v_j. Degree d_i of v_i is the number of edges incident on it.

Concept of k-truss of graph G was proposed by Cohen [5] as a method to hierarchically decompose G into dense subgraphs with specific properties. We briefly explain k-truss decomposition method and related terminology here.

Definition 1. *A maximal subgraph, $G_k = (V_k, E_k, W_k)$ of $G = (V, E, W)$, induced by set $V_k \subseteq V$ and $E_k = \{e_{ij} | e_{ij} \in V_k \times V_k\}$ is a k-truss, iff each edge in G_k is reinforced by at least (k-2) pairs of edges making a triangle with that edge.*

Informally, a k-truss is a maximal subgraph, in which every edge participates in at least $(k-2)$ closed triads. The decomposition method produces a nested hierarchy of subgraphs where subgraphs at higher levels represent denser regions of G. Based on decomposition, definition of *trussness* of an edge, adapted from [14], is given below.

Definition 2. *Trussness t_{ij} of $e_{ij} \in E$ has value k, iff $e_{ij} \in G_k \wedge e_{ij} \notin G_{k+1}$.*

The naive k-truss algorithm iteratively removes those edges from G which are not part of $(k-2)$ triangles, until no more edges can be deleted. All the leftover edges in the reduced graph are part of minimum $(k-2)$ triangles and hence, form a k-truss. We use an elegant in-memory k-truss decomposition algorithm proposed by Wang et al. [15]. This algorithm has time complexity $O(m^{1.5})$ and space complexity $O(m+n)$, making the algorithm scalable.

4 Influence Scoring Using Position, Reachability and Interaction

The proposed influence scoring method (IPRI) hypothesises that a node at high position in hierarchy, with strong ties and connectivity to large number of communities has high spreading power. The proposed influence scoring method is detailed in following sections.

4.1 Trussness Based Hierarchical Decomposition

Use of k-truss decomposition method layers out G in hierarchy, thereby exhibiting demarcation among levels in network hierarchy. Trussness t_{ij} of edge e_{ij} indicates number of common neighbours of endpoints of the edge. We define below the trussness τ_i of a node $v_i \in V$.

Definition 3. *The trussness τ_i of node $v_i \in V$ is the maximum trussness of edges incident on it, i.e. $\tau_i = \max_j(t_{ij})$.*

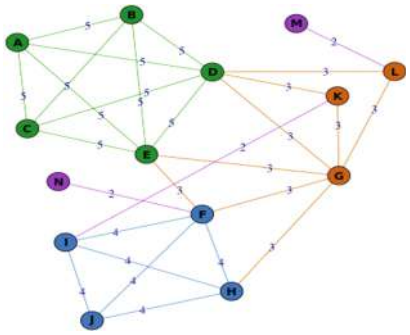


Fig. 1. k-truss decomposition of a toy network with 14 nodes and 28 edges. Vertices and edges with same trussness bear the same colour. Edges are labelled with their trussness. (Color figure online)

High value of trussness indicates occurrence of node in locally dense region of G. Nodes with same trussness actualize a tightly knit group and approximate a homophilic group binding individuals with similar connection patterns. As an example, we show hierarchical structure of homophilic groups obtained by k-truss decomposition of a toy network. Figure 1 shows nodes and edges with same trussness marked with same colour. All 5 nodes coloured green share similar characteristics of being a member of at least 3 triangular associations.

4.2 Positional Index

Network hierarchy reveals positional information of nodes in network. Trussness of a node obtained by hierarchical decomposition of the network proxies for its position. Higher level is indicative of larger neighbourhood span that aids wider spread of information.

Definition 4. *Positional Index of node v_i in G is equal to its trussness τ_i.*

4.3 Reachability Index

Each truss level in G represents a tightly-knit homophilic group and hence can be approximated as a community. A node having connections with more truss levels has higher reachability in terms of information propagation, compared to a node having connections with fewer truss levels [13,16].

We quantify a node's reach to diverse communities as the entropy of the trussness of its neighbours. Entropy is maximum when all neighbours have distinct trussness and minimum when all neighbours have same trussness. Let N_i be the neighbour set of node v_i. We define the probability of an arbitrary neighbour of v_i having trussness k as

$$p_i(k) = \frac{\sum\limits_{v_j \in N_i} I(\tau_j = k)}{|N_i|} \tag{1}$$

where I is an indicator function. The reachability index ρ_i of node v_i quantifies its accessibility to different communities and is formally defined below.

Definition 5. *The reachability index ρ_i of v_i is computed as*

$$\rho_i = \frac{-\sum\limits_{k=2}^{\mathcal{M}} p_i(k) \log_2 p_i(k)}{\log_2 \mathcal{M}} \tag{2}$$

where $\mathcal{M}$ indicates the number of hierarchical levels in G. We normalize the entropy to ensure $0 \leq \rho_i \leq 1$.

4.4 Interaction Index

It is accepted that a node with high degree centrality may not necessarily be efficient in spreading information/influence [6]. Interestingly, propagation of information is governed not only by the strength of interaction with neighbours $(w_{ij}, \forall v_j \in N_i)$, but also by the strength of interaction with 2-steps neighbours $(w_{jk}, \forall v_j \in N_i \wedge v_k \in N_j)$. This 2-steps neighbourhood of node v_i is sufficient for spreading its influence globally [10]. Based on this observation, we use local structure of a node's neighbourhood to determine its ability to spread its influence. The strength ω_j of node v_j is computed as $\omega_j = \sum\limits_{v_q \in N_j} w_{jq}$. The interaction index μ_i of node v_i is formally defined below.

Definition 6. *The interaction index μ_i of v_i is the sum of strength of neighbours scaled by their respective positional index and is computed as*

$$\mu_i = \sum_{v_j \in N_i} \omega_j * \tau_j \tag{3}$$

4.5 Influence Score

Influence score which indicates the ability of an individual to spread information is a real-valued function $\Psi : V \rightarrow \mathbb{R}^+$. It is the aggregation of positional index, reachability index and interaction index of a node using a multiplicative function.

$$\Psi = \tau * \rho * \mu \tag{4}$$

The score is indicative of the power to influence other users in the network. Higher the score, more is the influence it exerts on others.

5 Experimental Analysis

The proposed IPRI method is implemented[1] in *Python* (32 bits, v 2.7.3) and is executed on Intel Core i5-3201M CPU @2.50 GHz with 8 GB RAM, running UBUNTU 12.04. Preliminary experiment study is designed to answer the following questions:

- Do influential spreaders predicted by IPRI spread information more widely compared to other measures in simulation tests conducted using SIR epidemic model? (Sect. 5.1)
- Is ranking delivered by IPRI effective in terms of fine grained discrimination? (Sect. 5.2)

5.1 Investigation Using SIR Model

Following previous similar works [3,6,8,12], we perform comparative evaluation of IPRI using SIR epidemic model [4]. SIR model is an artificial stochastic epidemic model in which nodes can be in one of three states: Susceptible (S), Infected (I), or Recovered (R). A small number of nodes are infected initially. At each time step, infected nodes infect their neighbours with probability β (infection rate) and recover with probability γ (recovery rate). Spreading process ceases when no more nodes can be infected. Spreading ability (SA) of the initial set of infected nodes is quantified as the percentage of nodes infected during spreading process.

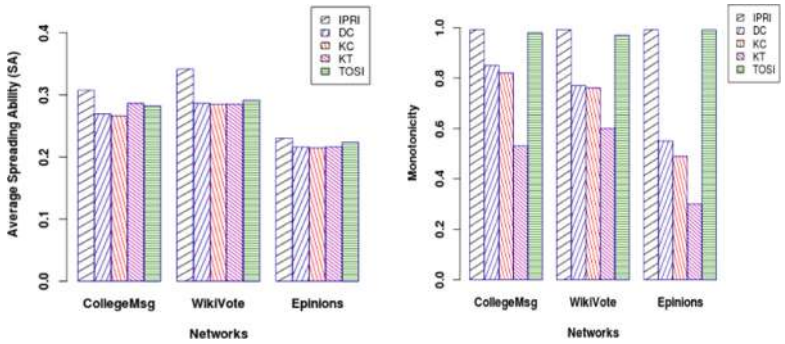
We report comparison results using three large real-worlds networks [7] shown in Table 1, along with network features. We compare IPRI with a classical measure - degree centrality (DC) and three recent influencer prediction measures - k-core (KC), k-truss (KT), Trust-Oriented Social Influencers (TOSI). Following [6], we set $\gamma = 0.8$ and β as $1/\lambda_1$, where λ_1 is the largest eigenvalue of the adjacency matrix of the network.

For each compared measure, top 20% nodes are taken as initial spreaders and 100 simulations of SIR model are run to capture the average spreading ability (SA) of top-rankers. Figure 2a shows average SA for each measure for three networks. It is clear from the figure that spreading ability of IPRI is higher than competing methods for CollegeMsg and WikiVote networks. For Epinions network it is marginally better.

[1] Python code for implemented measures is available on GitHub.

Table 1. Structural properties of networks. $\overline{k}$ - Average degree, k_{max}- Maximum degree, gcc - Global clustering coefficient, L - Number of truss levels, β - Infection rate (as in [6]).

Network	n	m	$\overline{k}$	k_{max}	gcc	L	β
CollegeMsg	1899	59835	63.02	1546	0.05	6	0.0026
WikiVote	7115	103689	29.15	1167	0.12	22	0.0067
Epinions	75879	508837	13.41	3079	0.06	32	0.004



(a) Spreading ability averaged over hundred runs

(b) Monotonicity of ranks

Fig. 2. Results of experimental evaluation of IPRI.

5.2 Monotonicity

In order to capture the uniqueness in ranks assigned by various measures, we quantify fraction of ties in ranks using monotonicity measure defined in [3]. Let R be the vector of ranks assigned to n vertices of G by a measure, then monotonicity $M(R)$ of ranks is defined as below:

$$M(R) = \left[1 - \frac{\sum_r n_r(n_r - 1)}{n(n-1)}\right]^2 \tag{5}$$

where n_r is the number of ties with rank r. If there are no ties in R, monotonicity is 1, and if all ranks are same, then monotonicity is 0. Figure 2b shows monotonicity of all predictive measures on three datasets. It is clearly visible that the proposed method IPRI and comparative measure TOSI are equally good for fine grained discrimination between spreading power of nodes. However, comparatively low spreading ability of TOSI top-rankers (Sect. 5.1) establishes IPRI as relatively better predictor of influencers.

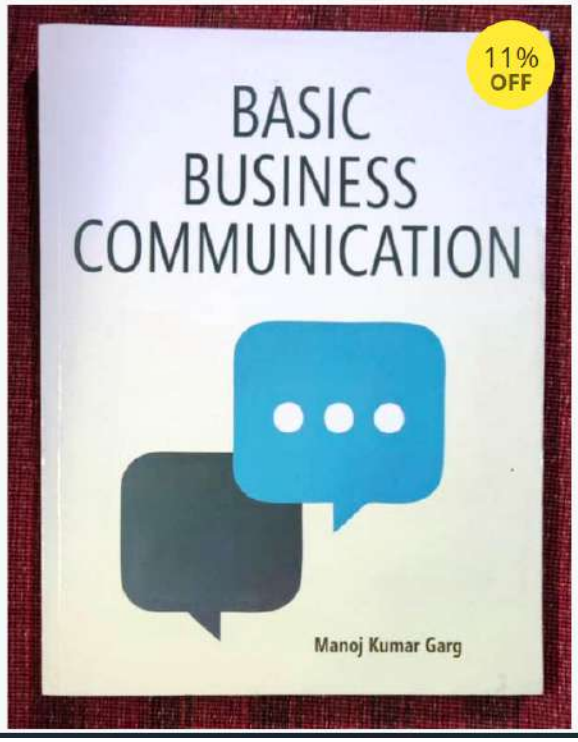
6 Conclusion

The proposed influence scoring method (IPRI) uses position of the actor in network hierarchy, intensity of his interactions with neighbours and extent of

his connectivity in different communities to predict influential spreaders. Use of k-truss method confers dual advantage of revealing hierarchy and homophilic groups (approximate communities) in the network, making computation efficient. Preliminary experimentation with publicly available real social networks establishes effectiveness of IPRI scores in terms of wider spread of information and fine grained discrimination as compared to classical and state-of-the-art influencer detection methods.

References

1. Al-Garadi, M.A., Varathan, K.D., Ravana, S.D.: Identification of influential spreaders in online social networks using interaction weighted k-core decomposition method. Phys. A **468**(C), 278–288 (2017)
2. de Arruda, G.F., Barbieri, A.L., Rodríguez, P.M., Rodrigues, F.A., Moreno, Y., da Fontoura Costa, L.: Role of centrality for the identification of influential spreaders in complex networks. Phys. Rev. E **90**(3), 032812 (2014)
3. Bae, J., Kim, S.: Identifying and ranking influential spreaders in complex networks by neighborhood coreness. Phys. A **404**, 549–559 (2014)
4. Barabási, A.L.: Network Science. Cambridge University Press, New York (2016)
5. Cohen, J.: Trusses: cohesive subgraphs for social network analysis (2008). http://www.cslu.ogi.edu/~zak/cs506-pslc/trusses.pdf
6. Kitsak, M., Gallos, L.K., Havlin, S., Liljeros, F., Muchnik, L., Stanley, H.E., Makse, H.A.: Identification of influential spreaders in complex networks. Nat. Phys. **6**(11), 888–893 (2010)
7. Leskovec, J., Krevl, A.: SNAP Datasets: Stanford large network dataset collection, June 2014. http://snap.stanford.edu/data
8. Li, Q., Zhou, T., Lv, L., Chen, D.: Identifying influential spreaders by weighted leaderrank. Phys. A **404**, 47–55 (2014)
9. Liu, G., Zhu, F., Zheng, K., Liu, A., Li, Z., Zhao, L., Zhou, X.: TOSI: a trust-oriented social influence evaluation method in contextual social networks. Neurocomputing **210**, 130–140 (2016)
10. Liu, Y., Tang, M., Zhou, T., Do, Y.: Identify influential spreaders in complex networks, the role of neighborhood. CoRR abs/1511.00441 (2015)
11. Pei, S., Muchnik, L., Andrade, J.S., Zheng, H., Makse, H.A.: Searching for super-spreaders of information in real-world social media. Sci. Rep. **4**, 5547 (2014)
12. Rossi, M.E.G., Malliaros, F.D., Vazirgiannis, M.: Spread it good, spread it fast: identification of influential nodes in social networks. In: Proceedings of the 24th International Conference on World Wide Web, pp. 101–102. ACM (2015)
13. Ugander, J., Backstrom, L., Marlow, C., Kleinberg, J.: Structural diversity in social contagion. PNAS **109**, 5962–5966 (2012)
14. Wang, J., Cheng, J.: Truss decomposition in massive networks. Proc. VLDB Endow. **5**(9), 812–823 (2012)
15. Wang, M., Wang, C., Yu, J.X., Zhang, J.: Community detection in social networks: an in-depth benchmarking study with a procedure-oriented framework. Proc. VLDB Endow. **8**(10), 998–1009 (2015)
16. Wang, S., Wang, F., Chen, Y., Liu, C., Li, Z., Zhang, X.: Exploiting social circle broadness for influential spreaders identification in social networks. World Wide Web **18**(3), 681–705 (2015)



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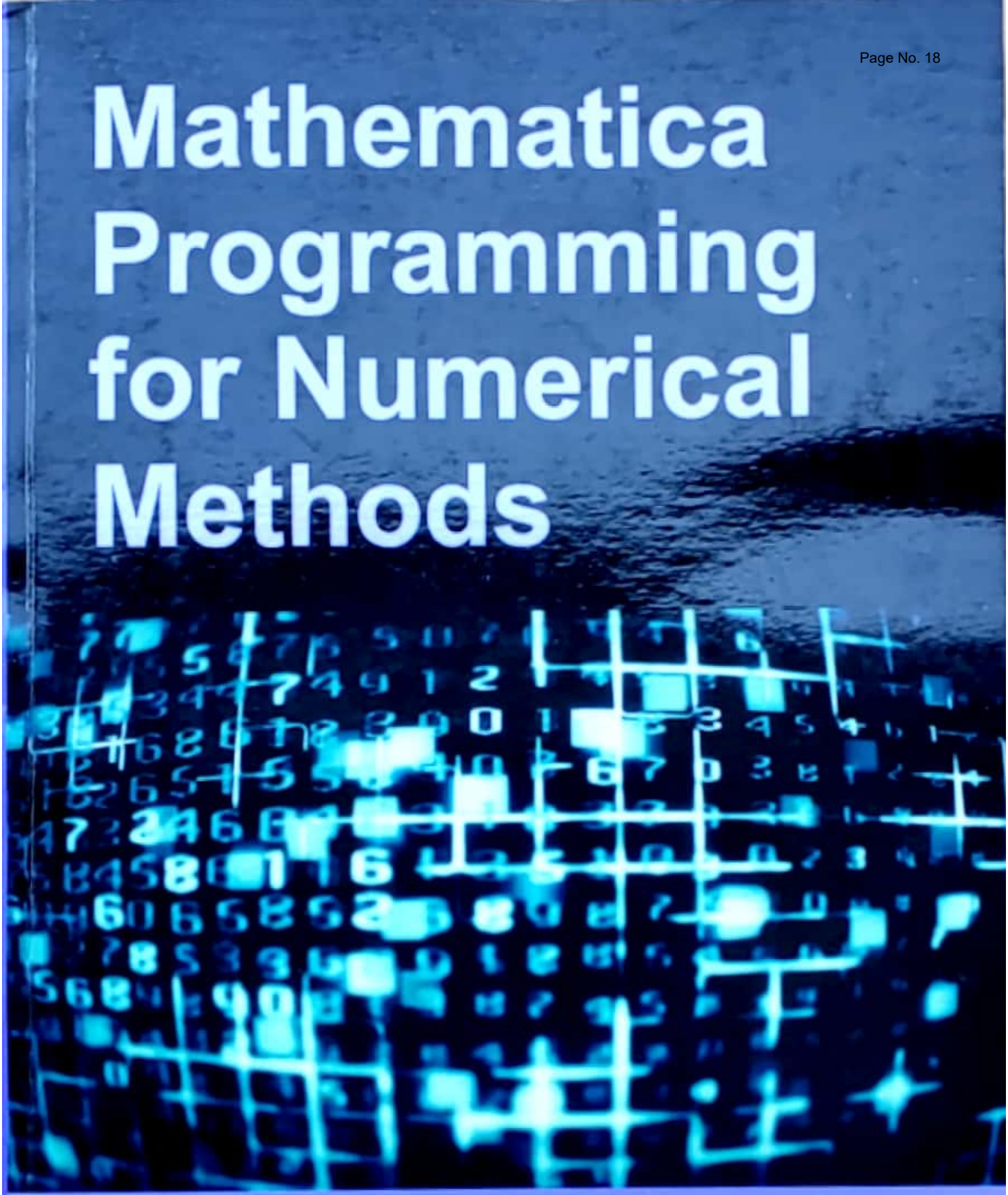

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PREFACE

This book entitled ***Mathematica Programming for Numerical Methods*** provides an introduction to the numerical methods that are typically encountered (and used) in science and engineering undergraduate courses. The material is developed in tandem with Mathematica which allows rapid prototyping and testing of the methods. The package Mathematica provides an environment in which students can learn to programme and explore the structure of the numerical methods. The methods included here are of a basic nature. This book is divided into seven chapters

Chapter 1: provides an introduction to basic concepts of Mathematica. It includes introduction to Mathematicabasics, functions, equations, lists, rules, graphics, animate and manipulate data and turning a notebook into a report.

Chapter 2 contains basic concepts of Mathematica programming. It includes looping constructs (iterations), Logical Expressions, conditionals (decision statements), user-defined functions, procedural programming and file I-O in Mathematica.

Chapter 3: in this chapter we consider one of the most basic problem of numerical approximation, the *root-finding problem*. We will consider the iterative methods: Bisection, Regula Falsi, Secant and Newton Raphson.

Chapter 4. in this chapter we describe iterative techniques used for solving linear systems of equations. We will consider the Jacobi and the Gauss-Seidel iterative methods.

Chapter 5: contains the problems of approximating a given function by polynomials i.e., interpolation. In this chapter we will study about two such methods - Lagrange interpolation and Newton divided difference interpolation polynomial.

Chapter 6: contains methods that deal with approximation of integration. In this chapter we will study Trapezoidal rule, composite Trapezoidal rule, Simpson's rule and composite Simpson's rule which are commonly introduced in calculus courses.

Chapter 7: consider *initial-value problem*, that is, the solution to a differential equation that satisfies a given initial condition. In this chapter, we will consider

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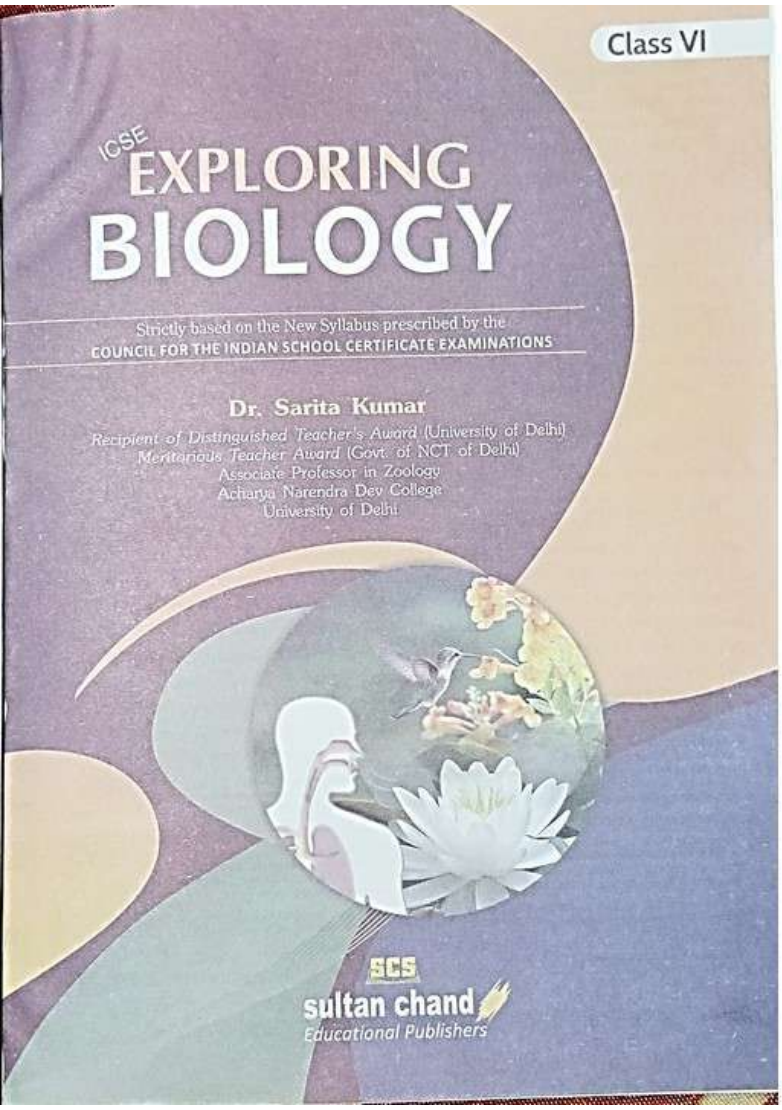

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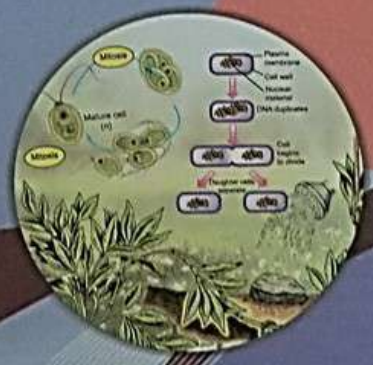

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Ministry of Environment, Forest and Climate Change

ZOOLOGICAL SURVEY OF INDIA 1916

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FRESHWATER FAUNAL DIVERSITY IN INDIA

KAILASH CHANDRA | K. C. GOPI | D. V. RAO
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CONTENTS

Chapter 3

PROTOZOA: CILIOPHORA (CILIATES)

JASMINE PURUSHOTHAMAN[1*], BINDU L[2], SEEMA MAKHIJA[3], RAVI TOTEJA[3], RENU GUPTA[4]

ABSTRACT

Ciliates are one of the important members in the eukaryotic microbial community. In order to better understand the distribution pattern of freshwater ciliates in India, a comprehensive literature review was done and compiled the current status of ciliates diversity in India. Altogether 106 species of ciliates belonging to 58 genera and 36 families are described from the fresh water ecosystems of India so far. Majority of the species reported from India belongs to family Oxytrichidae. It is concluded that extensive research should be made to assess the seamless diversity of this less studied microbes.

Key words: Protozoa, Ciliates, Freshwater

INTRODUCTION

Protozoans (ciliates and flagellates) are the main components of the "microbial loop", which is a distinct and important element of the trophic food web in aquatic ecosystems (Azam *et al.,* 1983). Free living ciliates are an important intermediate link between primary producers and higher trophic levels in every estuarine and marine ecosystem (Zingell *et al.*, 2007). They prey on autotrophic and heterotrophic pico and nano plankton and are preyed upon by larger zooplankton and contribute to the remineralization and cycling of nutrients (Blomqvist *et al.*, 2001; Ventela *et al.,* 2002).

The role of ciliates as an important component of the microbial loop in freshwaters is widely recognized (Wiackowsi *et al.*, 2001). Ciliates are a significant trophic link in energy transfer from heterotrophic (bacteria) and autotrophic picoplankton to the higher consumers (Zingell *et al.*, 2007) and play a significant role in energy transfer and nutrient remineralization in aquatic environments (Cleven & Weisse, 2001). Ciliates are an essential food source for rotifers, cladocerans and copepods (Jack and Gilbert, 1997) and some fish larvae, for example the guppy (*Poecilia reticulata*) larvae, can use ciliates as food in their early life stages (Lair *et al.*, 1994). The importance of the microbial loop is greater in oligotrophic than eutrophic lakes, although, Weisse *et al.*, (1998) demonstrated that almost 50% of carbon passed through the microbial loop in ameso-eutrophic lake.

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Many protozoan species can be considered as a highly valuable bioindicators in water quality analysis due to rapid growth, high turnover rates and short generation times which allow protozoan communities to respond quickly to changing environmental conditions (Berger *et al.*, 1997). Ciliates are important for the water industry because they can accelerate the process of water clarification by consuming bacteria, and their identification and quantification permit to rapidly assess the water quality (Curds & Cockburn, 1970; Al-Shahwani & Horan, 1991; Curds, 1992; Silva & Silva-Neto, 2001).

Ciliates are also used as bio indicators in rivers, lakes and waste waters. Foissner & Berger (1996) listed 300 ciliate species which can be used as bio indicators. Occurrence of the ciliate, *Metopus* sp. in any water body indicates the presence of hydrogen sulphide (Bick, 1972). Presence of this species and its associated ciliates belonging to the genera *Caenomorpha, Epalxella*, *Pelodinium* and *Sprodinium* in putrefying sludge are the indicators of the self purification process which has been stopped due to lack of oxygen and presence of high concentration of H_2S. Many species of ciliated protozoa are used as indicators for ecological monitoring of water quality and they can also be used in ecological studies of aquatic habitats in which mosquitos and other vectors and intermediate hosts of disease organisms are breeding (Bick, 1972).

The number of papers on freshwater ciliates has increased recently (Pace, 1982; Macek *et al.*, 1996; Weisse & Müller, 1998; Kalinowska, 2000, 2004; Mieczan, 2007). In both freshwater and marine ecosystems significant vertical gradients of protozoan diversity exist, these apparently being influenced by the distribution of their prey, and physical and chemical variables (Ventelä *et al.*, 1998, Thouvenot *et al.*, 1999, Jacquet *et al.*, 2005). Several investigators suggest that ciliate abundance and biomass reach maximum values in the epi- and metalimnion, with the lowest in the hypolimnion. In the epilimnion the oligotrich *Strombidium viride* frequently occurs, whereas in the meta- and hypolimnion the oligotrichs are gradually replaced by scuticociliates (Beaver & Crisman, 1990; Zingel, 2005). Zingel & Ott (2000) observed a positive significant correlation between ciliate numbers and chlorophyll *a* and bacterial densities in strongly stratified temperate lakes.

The importance of ciliate communities to the overall productivity of freshwater ecosystems has been well documented (Sorockin, 1972; Schonborn, 1977, 1982; Baldock *et al.*, 1983; Madoni, 1987a). Increasing attention is now being focused on planktonic and benthic microfauna of lakes (Madoni, 1989, 1990;Laybourn-Parry *et al.*, 1990a, b), reservoirs (Barbieri & Godinho Orlandi, 1989; Simek *et al.*, 1999), and rivers (Baldock & Sleigh, 1988; Blatterer & Foissner, 1990; Grolière *et al.*, 1990); however, studies on distribution and ecology of ciliates living in ponds covered by floating macrophytes are still few (Legner, 1964; Madoni & Viaroli, 1985).

Historical Resume

Ehrenberg (1838) and Dujardin (1841) initiated the work on ciliates. After them an exceptional contribution was made by Kent (1882) in his book named “Manual of Infusoria”.

Hundreds of species have since been discovered and described by experts from different parts of the world. Foissner (1977-2013) has made significant studies on the taxonomy and ecobiology of ciliates from different parts of the world. The pelagic ciliate communities from 58 north German lakes were described and compared at species level by Pfitser *et al.*, (2002), about 140 ciliate species were identified and quantified in all investigated lakes.

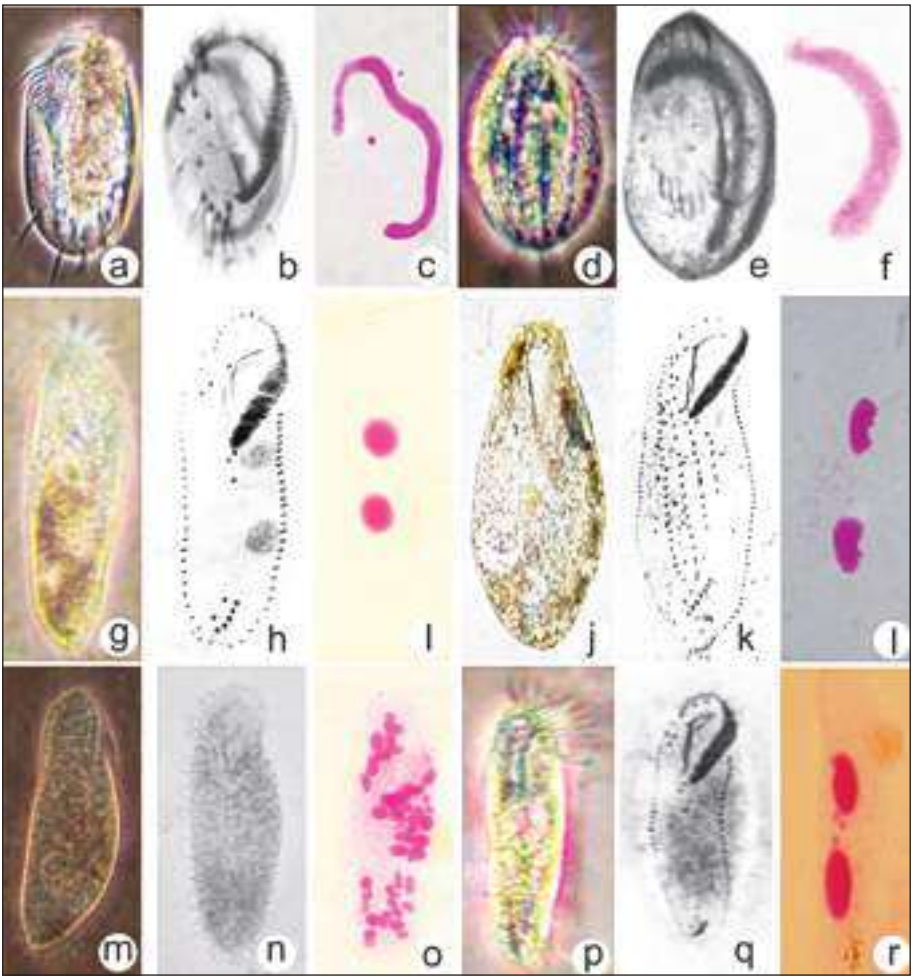
Freshwater protozoa in Thailand were investigated in different provinces of northern, eastern, northeastern and southern parts of Thailand from 1982 till 1999. The total of 166 genera and 259 species found were identified as 36 genera and 72 species of Phytomastigophora, 9 genera and 11 species of Zoomastigophora, 23 genera and 38 species of Sarcodina, 2 genera and 2 species of Labyrinthomorpha and 95 genera and 134 species of Ciliophora (Charubun & Charubun, 2000). Ciliate diversity was investigated in situ in freshwater ecosystems of Antarctic (Victoria Land, 751S), and the High Arctic (Svalbard, 791N). In total, 334 speciesfrom 117 genera were identified in both Polar Regions (Petz *et al.*, 1995). The most detailed studies of Turkish inland waters were performed by Şenler *et al.*, (1998), Şenler and Yıldız, (1998, 1999, 2004) who worked especially on rivers, small ponds and sewage treatment plants and by Çapar, (1997, 2005, 2007a, b) on free living pond and wetland ciliates.

India, with 2.4% of the world's area, has over 8% of the world's total biodiversity, making it one of the 12 mega diversity countries in the world. Despite this richness, the data concerning ciliate diversity from India is rather scarce. First report of protozoa from India is made from freshwater by Grant (1842) which is an unpublished work Cantor (1842). Since then, considerable work on protozoa from this environs has been done by Ghosh, (1818-1929), Nair and his co-workers (1960-1974) and Das, (1971) from West Bengal, Bhatia and Mallick, (1930) from Kashmir and Mahajan, (1969, 1971, 1977) from Rajasthan. Earlier works on freshwater inhabiting ciliates are available in the Ciliophora volume in the Fauna of British India series, written by Bhatia, (1936).

The record of Ciliophora known from India, Myanmar and Sri Lanka included 274 species belonging to101genera (Bhatia, 1936).Ghosh, (1918-1929) published a series of papers reporting 29 species of free-living ciliates and one species of testacid rhizopod from Kolkata and its nearby localities. Mahajan and Nair (1965) published the occurrence of 19 species of free-living ciliates from Kolkata and its vicinity. Mukherjee and Das (2000) recorded 5 species of ciliates from Renuka wetland which is a Ramsar site in Himachal Pradesh. Shaikh *et al.*, (2012) recorded 7 species of protozoan ciliates from Salim AliLake, Aurangabad, India. 61 species of ciliates under 37 genera belonging to 31 families and 12 orders were reported by Bindu L, (2010).

In West Bengal, in all 152 species of ciliates, belonging to 2 classes, 16 orders, 52 families and 75 genera have been recorded by several investigators since 1840s (Das *et al.*, 1993; Piyali and Das, 1997). Ghosh (1918-29) in a series of papers recorded 29 species of ciliates from Kolkata, while Mahajan and Nair (1965), Das (1971), Das *et al.*, (1993) and Piyali and Das (1997) reported a considerable number of species from different freshwater ecosystems of Kolkata. Although Kolkata

metropolis abounds with innumerable freshwater wetlands and even though several water bodies were surveyed from different parts of this mega city, the diversity and distribution of ciliates suggests that purposeful wetland specific surveys have not been conducted year round. Simmons (1889, 1891) recorded ciliates belonging to 12 genera from Calcutta, without giving any specific identification of the forms. Nair (1960) reported one new record of a ciliate from Sibpur (Howrah District). Mahajan & Nair (1971) reported 19 species of freshwater ciliates from Kolkata and its surrounding areas. Bindu L (2010) reported 23 species of free-living freshwater ciliates from Kolkata wetlands including Rabindra Sarovar, a National Lake, and an important freshwater wetland in Kolkata.



Photomicrographs of Spirotrich ciliates, a-c *Euplotes aediculatus*, d-f *Aspidisca* sp., g-i *Aponotohymena* sp., j-l *Paraurostyla coronate*, m-o *Pseudourostyla cristata*, p-r *Oxytricha granulifera*, showing live cell (a, d, g, h, m & p), after protargol impregnation (b, e, h, k, n & q) and after Feulgen staining (c, f, i, l, o & r).

The University of Delhi have been involved in the morphological and molecular taxonomy of ciliates from freshwater bodies namely, Okhla Bird Sanctuary, Sanjay Lake, Pond at Rajghat in Delhi region. Sripoorna *et al.,* 2015 studied the diversity of freshwater Spirotrich ciliate fauna from Okhla Bird Sanctuary, Delhi. They reported total of 12 species belonging to 10 different genera. From the Delhi region few Spirotrich freshwater ciliate species have been characterized and reported till date, namely, *Stylonychia ammermanni* (Gupta, R., *et al.,* 2001), *Pleurotricha curdsi* (Gupta, R., *et al.,* 2003), *Rubrioxytricha indica* (Naqvi, I., *et al.*, 2006), *Architricha indica* nov. gen., *Histriculus histrio* (Gupta *et al.*, 2006), *Coniculostomum bimarginata* (Kamra, K., 1994), *Notohymena limus,* (Naqvi, I., 2016), *Oxytricha granulifera, Aponotohymena* sp., *Paraurostyla coronata, Gastrostyla* sp., *Tetmemena* sp., *Laurentiella* sp., *Euplotes aediculatus, Aspidisca, Pseudourostyla cristata* and *Urostyla* sp. (Somasundaram *et al.*, 2015).

At molecular level, total 8 nucleotide sequences of the freshwater ciliates have been sequenced and submitted in Genbank database. 18S rRNA gene of *Tetmemena* sp. (Acc. No. KP336401), *Aponotohymena* sp. (Acc no. KP336402), *Gastrostyla* sp. (Acc. No. KT780432), *Pseudourostyla cristata* (Acc. No. KT731104), *Oxytricha granulifera* (Acc. No. KU715983), *Paraurostyla coronata* (Acc. No. KU715982), ITS (internal transcribed spacer) (Acc. No. KT731103) and histone (H_4) gene (Acc. No. KU761846) of *Tetmemena* sp. have been sequenced.

A new species of free living ciliated protozoa, *Oxytricha susheelum* was recorded from fresh water in Aurangabad by Deshmukh *et al.*, 2012. Ahamed & Sharma (2009) reported a total of seventeen species of ciliates from different pond localities of Lucknow city. A study on some free living protozoan from Salim Ali lake Aurangabad was done by Shaikh *et al.*, (2012), in which 7 species of ciliates have been recorded.

Methodology

Collection of ciliates is a two step process; collection from field site and transporting them to laboratory, examination and fixation. 2 litres of freshwater sample is filtered through 20 micron plankton net and the sample is collected in a plastic bottle. Sample should be collected from the bottom/surface/banks/submerged slops of water body. Samples should be fixed immediately to avoid loss of cell. The sample can be fixed in Lugol's iodine. After Lugol's fixation samples can be stored in cool dark place. Ciliate abundance can be obtained by settling the fixed samples in settling chamber and examining them under an inverted microscope (Hasle, 1978). Lugols is a relatively harmless and versatile fixation method, which is recommended for routine sampling of ciliates. Iodine not only enhances the sinking of cells but also stain them dark brown in colour. Lugol's fixed material can be processed in several ways: SEM (Montagnes & Taylor, 1994), DAPI, Protargol staining (Montagnes & Lynn 1993). Staining is an important process in ciliate study. Inverted microscopes are commonly used to quantify and identify ciliates and other microplankton in plankton samples. There are two types of staining; temporary and permanent staining. In temporary staining we can use Acetocarmine and 1% Methyl green in acetic acid as stain. Permanent staining method include three steps; adherence, fixation and staining. This will be done according to the standardised protocol (Foissner, 2007). Florescent dyes (DAPI)

can also be used as a diagnostic feature in ciliate study. SEM photograph of ciliates will be taken for further identification of species.

Diversity

It is estimated that 85% of the ciliate diversity is still to be described. A total of 8,000 ciliate morphospecies are described of which about 200 are fossil tintinnids and 2,600 are commensals and about 5,200 are true free-living species Corliss, (2000a). About 400 new species have been described till date by Song and Wang 1999; Foissner *et al.,* 2002; Foissner 2006. So in total there are about 5,600 described free-living ciliate species. Combining classical and modern methods, a few researchers have discovered hundreds of new ciliate morphospecies during the past 15 years, suggesting that most ciliate diversity is still unknown (Foissner 1993a, b; Petz *et al.*, 1995; Song and Wang, 1999; Foissner and Xu, 2006). The ciliates species which are distributed in the fresh water ecosystems of India is represented in the Table.1. A total of 106 species of ciliates belonging to 58 genera and 36 families are described from the fresh water ecosystems of India.

Table 1. List of ciliate species described from the fresh water ecosystems of India

Phylum CILIOPHORA				
Class	**Family**	**Genus**	**Species**	**Name of the species**
Armophorea	Metopidae	1	4	*Metopus es* Muller 1776 *Metopus minor* var. *Minor* Kahl 1927 *Metopus nasutus* Cunha 1915 *Metopus spiralis* Smith 1897
Colpodea	Colepidae	1	4	*Colpoda cucullus* Müller, 1786 *Colpoda aspera* Kahl *Colpoda maupasi* Enriques, 1908 *Colpoda steinii* Maupas 1883
	Cryptolophosididae	1	1	*Opisthostomatella bengalensis* Ghosh 1928
Heterotrichea	Blepahrismidae	1	1	*Blepharisma intermedium* Bhandary 1962
	Caenomorphidae	1	1	*Caenomorpha medusula* Perty 1852
	Stentoridae	1	1	*Stentor roeseli* Ehrenberg 1835
Karyolectiae	Loxodidae	1	3	*Loxodes magnus* Stokes 1887 *Loxodess triatus*(Engelmann 1862) *Loxodes vorax* Stokes 1885
Litostomatea	Tracheliidae	3	5	*Dileptus monilatus* (Stokes, 1886) Kahl, 1931 *Dileptus gigas* (Claparède & Lachmann, 1859) *Pseudomonili caryonanser*(Müller, 1773) Vďačný& Foissner, 2012 *Trachelius gutta* Cohn 1866 *Trachelius ovum* (Ehrenberg, 1831) Ehrenberg, 1838

Phylum CILIOPHORA				
Class	**Family**	**Genus**	**Species**	**Name of the species**
	Amphiletidae	4	10	*Litonotus fasciola* (Ehrenberg) *Litonotus infusionus* Ghosh, 1920 *Litonotus procera* Penard 1922 *Litonotus obtusa* *Acineria incurvata* Dujardin 1841 *Hemiophrys procera* Penard 1922 *Hemiophrys bivacuolata* Kahl 1931 *Loxophyllum nimeccense* (Stein, 1859) *Loxophyllum levigatum* Sauerbrey, 1928 *Loxophyllum undulatum* Sauerbrey, 1928
	Mesodiniidae	1	1	*Mesodinium pulex* (Claparède & Lachmann, 1859) Stein, 1867
	Actinobolinidae	1	1	*Actinobolina radians*(Stein, 1867) Strand, 1928
	Enchylidae	3	6	*Lacrymaria olor*Müller, 1776 *Lacrymaria lagenula* Claparede &Lachmann, 1858 *Lacrymaria vermicularis* (Müller, 1786) Bory, 1824 *Trachelophyllum vastitum* Stokes 1884 *Phialina minima* (Kahl, 1927) Foissner, Agatha & Berger, 2002 *Phialina pupula* Müller, 1773
	Spathidiidae	2	4	*Bryophyllum spathidiodes* Gelei, 1933 *Spathidium moniliforme* Bhatia, 1920 *Spathidium muscicola* Kahl 1930 Spathidiumspathula
Nassophorea	Nasulidae	3	3	*Nassula ornata* Ehrenberg 1833 *Orthodonella banerjeei* Ghosh, 1921 *Pseudomicrothoraxagilis* Mermod 1914
	Orthodoneliidae	1	1	*Chilodontopsis bengalensis* (Ghosh, 1921)
	Leptopharyngidae	2	3	*Leptopharynx chlorophagus* Das, 1971 *Leptopharynx torpens* (Kahl, 1931) *Pseudomicrothorax dubius* (Maupas, 1883) Penard, 1922
	Microthoracidae	2	4	*Drepanomonas dentate* Fressenius 1858 *Drepanomonas hooghlyensis* Nair &Das 1974 *Drepanomonas revolute* Penard, 1922 *Opisthostomum bengalensis* Ghosh 1928

Phylum CILIOPHORA				
Class	**Family**	**Genus**	**Species**	**Name of the species**
Oligohymenophora	Epistylidae	1	1	*Epistlylis niagaraKellicott* 1883
	Glaucomidae	1	1	*Glaucoma pyriformis* Ehrenberg 1838
	Neobursaridiidae	1	1	*Neobursaridium gigas* Balech 1941
	Paramecidae	1	2	*Paramecium bursaria* (Ehrenberg, 1831) Ehrenberg, 1836 *Paramecium caudatum* Ehrenberg, 1833
	Vaginicoloidae	3	3	*Platycola decumbens* (Ehrenberg, 1830) Kent, 1882 *Pyxicola affinis* Kent, 1881 *Vaginicola crystallina* Ehrenberg, 1830
	Pleuronematidae	1	1	*Pleuronema crassum*Dujardin, 1841
Phyllopharyngea	Chilodonellidae	1	3	*Chilodonella cucullus* (Muller, 1883) *Chilodonella uncinata* (Ehrenberg, 1838) *Chilodonella spiralidentis* (Bhatia & Mallik, 1930)
	Acinetidae	1	1	*Tokophrya lemnarum* Stein 1932
Plagiopylea	Plagiopylidae	1	1	*Plagiopyla nasuta* Stein, 1860
Prostomatea	Colepidae	1	5	*Coleps octospinus* Nolan, 1925 *Colep selongatus* (Ehrenberg, 1830) Diesing, 1866 *Coleps inermis* Perty 1852 *Coleps devdaniensis* Mahajan, 1971 *Coleps hirtus* (Muller 1786)
	Prorodontidae	1	4	*Prorodon edentates* Claparede &Lachmann 1858 *Prorodon discolor* (Ehrenberg, 1835) *Prorodon teres* Ehrenberg, 1838 *Prorodon stewarti* Ghosh, 1928
	Holophryidae	1	3	*Holophrya bengalensis* Ghosh, 1919 *Holophrya annandalei* Ghosh, 1919 *Holophrya simplex* Schewiakoff, 1889
	Urotrichidae	1	1	*Urotricha globosa* Schewiakoff, 1889
	Leptopharyngidae	1	1	*Pseudoprorodon lieberkuhni* Butschli, 1889
Spirotrichea	Euplotidae	1	2	*Euplotes patella* (0. F. Muller) Ehrenberg *Euplotes aediculatus* Pierson, 1943
	Aspidiscidae	1	1	*Aspidisca* sp. Ehrenberg, 1830

Phylum CILIOPHORA				
Class	**Family**	**Genus**	**Species**	**Name of the species**
	Halteriidae	1	1	*Halteriagrandinella* (Muller, 1773)
	Oxytrichidae	8	14	*Oxytricha susheelum* Deshmukh *et al.,* 2012 *Stylonchia mytilus* Müller, 1773 *Oxytricha granulifera* Foissner and Adam, 1983 *Aponotohymena* sp. Foissner, 2016 *Paraurostyla coronata* Arora *et al.*, 1999 *Gastrostyla* sp. Engelmann, 1862 *Tetmemena* sp. Eigner, 1999 *Laurentiella* sp. Dragesco and Njiné, 1971 *Stylonychia ammermanni*, Gupta *et al.,* 2001 *Pleurotricha curdsi* Shi *et al.*, 2002 *Rubrioxytricha indica* Naqvi *et al.*, 2006 *Architricha indica* Gupta *et al.*, 2006 *Histriculus histrio* Müller, 1773 *Coniculostomum bimarginata* Kamra *et al.*, 1994 *Notohymena limus* Naqvi *et al.*, 2016
	Pseudourostylidae	1	1	*Pseudourostyla cristata* Jerka-Dziadosz, 1964
	Urostylidae	1	1	*Urostyla* sp. Ehrenberg, 1830
	Total	58	106	

Classification

The phylum Ciliophora is composed of two sub phylum: Postciliodesmatophora and Intramacronucleata, with, 11 classes and 19 subclasses. Postciliodesmatophora consist of two classes; Karyorelictea and Heterotrichea. Intramacronucleata consists of 9 classes and 19 subclasses. The classes coming under Sub phylum Intramacronucleata are Spirotrichea, Armophorea, Litostomatea, Phyllopharyngea, Nassophorea, Colpodea, Prostomatea, Plagiopylea and Oligohymenophorea. Class Spirotrichea consists of 7 subclasses; Protocruziidia, Phacodiniidia, Hypotrichia, Oligotrichea, Choreotrichia, Stichotrichia, Licnophoria. Class Litostomatea consists of 2 sub classes; Haptoria and Trichostomatia. Class Phyllopharyngea has 4 sub classes; Crytophoria, Rhynchodia, Chonotrichia, Suctoria. Class Oligohymenophorea consists of 6 sub classes; Peniculia, Scuticociliata, Hymenostomatia, Apostomatia, Peritrichia and Astomatia.

The sub phylum Postciliodesmatophora represents 61 genera (+8 genus *incertae sedis*) belonging to 2 class, 4 order and 13 families. The sub phylum Intramacronucleata represents 1119 genera belonging to 9 class, 19 sub classes, 52 order and 264 families.

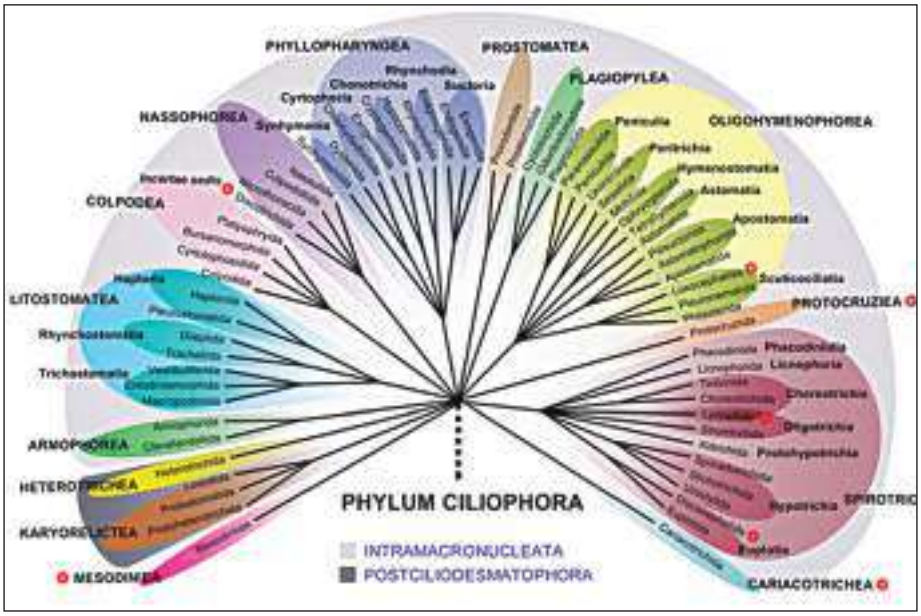


Fig : Systematic scheme for the phylum Ciliophora

Source: http://www.nature.com/articles/srep24874/figures/3

Distribution

The ciliophorans coming under the phylum Ciliophora are universally distributed in water bodies like freshwater ponds, streams and rivers and some species occur in wet soils and mosses. These free-living ciliates play an important role in the aquatic ecosystem and form an important component of the environment monitoring surveillance and these aquatic animalcules occupy an important position in the aquatic food chain. The role of ciliates as an important component of the microbial loop in freshwaters is widely recognized (Wiackowsi *et al.*, 2001).

Endemism

Ciliates are distributed globally in various habitats where they act as an important trophic link in variety of food webs (Adl, 2003). Ciliates exhibit lesser endemism and are considered ubiquitous and cosmopolitan in distribution. Some species show limited geographic distribution and low dispersal abilities. For example, the large tropical peniculine *Neobursaridium gigas*, a flagship tropical freshwater species, was described over 60 years ago in Africa and yet it has only been recorded from the Southern hemisphere (Foissner, 1999c).

Habitat

Many ciliates are associated with the surfaces of solid subjects, such as rocks, some species of algae, or some submerged substrates. Characteristic species, they are permanently attached forms are mainly peritrichs (eg. *Vorticella*,the colonial *Zoothamnium*, and the loricate *Cothurnia*). Folliculinid ciliates are

brightly coloured ciliates, which build an ampulla shaped loricae. The suctorians are carnivorous and feed on the motile ciliates of the habitat. In microaerophilic environments such as the layers of decaying leaf litter and detritus layers, harbours the species *Loxodes*, and also large heterotrich ciliates belonging to the genera *Spirostomum* and *Blepharisma*. A true anaerobic fauna of ciliates also occurs in freshwater sediments, mainly represented by the genera *Metopus, Caenomorpha, Plagiopyla* and also the representatives of odontostomatids.

Dysterid ciliates feeding on cyanobacteria and filamentous bacteria same as that found in hypotrich ciliates such as *Euplotes, Aspidisca, Holosticha*, etc. Amphileptids ciliates are dominant carnivores and some of them are specialised to prey on the zooids of peritrich ciliates.The naked oligotrichs include Halteria and species of *Strombidium* among which *S. viride* contains Zoochlorellae. Hecky and Kling, (1981) found that in Lake Tanganyika the biomass of *S. Viride* equalled the phytoplankton biomass and they may play a substantial role as a primary producer. Among the fresh water pelagic ciliates, species of *Frontonia* and *Euplotes* are common, but which are not typically pelagic forms. Ciliates also show high diversity on feeding large food particles. Species of *Nassula* specialise on feeding filamentous Cyanobaceteria, whereas species of *Frontonia* and various prostomatids specialise on feeding larger food particles such as dinoflagellates and diatoms. The bacteriovorous ciliates are mainly the scuticociliates (*Cyclidium, Uronema*) and also some stalked but unattached peritrichs. The ciliate predators consists of prostomatids, such as *Didinium, Coleps, Acaryophyra,* and *Actinobolina and pleurostomatids,* such as *Paradileptus and Trachelius.*

Gap in Research

The vast majority of microbial eukaryotic organisms are undescribed and unknown in India. In the current scenario, the diversity of these small organisms are much less well understood than that of larger organisms. There is a fundamental need to document the taxonomic composition of fresh water ciliate diversity through systematic biodiversity surveys of representative fresh water habitats, since these microbial eukaryotic communities very much influence the health of the freshwater ecosystem. This will give a comprehensive data to generate diversity estimates of different fresh water habitat types and biogeographic maps for relatively common species of freshwater. This information is critical to manage and conserve the functional properties of freshwater ecosystems for the long term, particularly in areas that are vulnerable to human activities.

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REFERENCES

Adl M. S. 2003. The Ecology of Soil Decomposition. CABI Publishing: Wallingford, UK.

Agatha S., Foissner W. 2009. Conjugation in the spirotrich ciliate Halteria grandinella (Müller, 1773) Dujardin, 1841 (Protozoa, Ciliophora) and its phylogenetic implications. Eur. J. Protistol. **45**: 51-63

Al-Shahwani, S.M. & Horan, N.J. 1991. The use of protozoa to indicate changes in the performance of activated sludge plants. Water Research, **6**: 633-638.

Azam, F., Fenchel, T., Field, J.G., Gray, J. S., Meyer-Reil, L.A,, Thingstad, F. 1983. The ecological role of watercolumnmicrobes in the sea. Mar. Ecol. Prog. Ser. **10**: 257-263.

Baldock B.M., Backer J.H., Sleigh M.A., 1983. Abundance and productivity of protozoa in chalk streams. Holoarct. Ecol., **6**: 238-246

Baldock B.M., Sleigh M.A., 1988. The ecology of benthic protozoa in rivers: seasonal variation in numerical abundance in fine sediments. Arch. Hydrobiol., **111**: 409-421.

Barbieri S.M., Godinho Orlandi M.J.L., 1989. Ecological studies on the planktonic protozoa of a eutrophic reservoir (Rio Grande Reservori, Brazil). Hydrobiologia, **183**: 1-10.

Berger H., Foissner W., Kohmann F. 1997 Bestimmung und Ökologie der Mikrosaprobien nach DIN 38 410. G. Fischer, Stuttgart, Jena, Lübeck, Ulm

Beaver J.R., Crisman L.T., 1990, Seasonality of planktonic ciliated protozoa in 20 subtropical Florida lakes of varying trophic state, Hydrobiologia, **190**: 127-135.

Bhatia B.L. 1936. The Fauna of British India, including Ceylon and Burma, Protozoa: Ciliophora, xxii+493 pp., London (Taylor & Francis, Ltd.).

Bick, H. 1972. Ciliated Protozoa. World Health Organization, Switzerland.

Bindu, L. 2010. On some testacids (Protozoa) of Melghat Wildlife Sanctuary, Maharashtra, India. J. Threatened Taxa., **2**(4): 827-830

Blatterer H., Foissner W., 1990 - Beitrage zur Ciliatenfauna (Protozoa: Ciliophora) der Amper (Bayern, Bundesrepublik Deutschland). Arch. Protistenkd., **138**: 93-115.

Blomqvist, P., Jansson M., Drakare A.K., Bergstrım M. and Brydsten A. 2001. Effects of additions of DOC on pelagic biota in Clearwater systems: Results from a whole lake experiment in northern Sweden. Microb. Ecol., **42**: 383-394.

Cantor T. 1842. General features of Chusan, with remarks on the Flora and fauna of that Island.-Ann. Mag. nat. Hist., London, 9, pp. 361-370.

Çapar S. 1997, Systematic studies on the free-living ciliophoran species living in Mogan Lake, Hacettepe University, Institute of Pure and Applied Sciences, Master Thesis, 96p. (in Turkish).

Çapar S. 2005, A systematic study on wetland ciliates (Ciliophora, Protista) of Göksu Delta, Hacettepe University, Institute of Pure and Applied Sciences, PhD Thesis, 246p. (in Turkish).

Çapar S., 2007a, Hypotrich Ciliates (Protozoa: Ciliophora) Of Gelingüllü Dam Lake, Yozgat-Turkey. Hacettepe J. Bio&Chem., **35**(1): 45-56.

Çapar S. 2007b, Morphology and morphometrics of two anaerobic ciliates *Metopus minor* (Kahl, 1927) and *Metopushasei* (Sondheim, 1929) from Göksu Delta with ecological notes. Hacettepe J. Bio. & Chem., **35**(1), 19-15.

Cleven, E.J. & Weisse, T. 2001. Seasonal succession and taxonspecific bacterial grazing rates of heterotrophic nanoflagellates in Lake Constance. Aquat Microb Ecol., **23**: 147-161.

Corliss J.O. 2000a. Biodiversity, classification, and numbers of species of protists. In: Nature and Human Society: The Quest for a Sustainable World, (Eds. P. H. Raven, T. Williams). National Academy Press, Washington, DC, 130-155

Curds, C.R. & Cockburn, A. 1970.Protozoa in biological sewage treatment process. II Protozoa as indicators in the activated sludge process.Water Research. **4**: 237-249.

Curds, C.R. 1992.Protozoa and the water industry.Cambridge University Press, Cambridge. 122p.

Dujardin F. 1841. Librairie Encyclopédique de Roret; Paris: Histoire naturelle des zoophytes.Infusoires, comprenant la physiologieet la classification de cesanimaux et la maniére de les étudier a l'aide du microscope.

Ehrenberg C.G. Voss; Leipzig: 1838. Die InfusionsthierchenalsvollkommeneOrganismen. EinBlick in das tiefereorganischeLeben der Natur.

Foissner W. 1993b. Corticocolpodakaneshiroae n. g., n. sp., a new colpodid ciliate (Protozoa, Ciliophora) from the bark of Ohia trees in Hawaii. J Eukaryot Microbiol, **40**: 764-775.

Foissner W. 2006. Biogeography and dispersal of micro-organisms: a review emphasizing protists. Acta Protozool, **45**: 111-136.

Foissner W & Berger H. 1996 A user-friendly guide to the ciliates (Protozoa, Ciliophora) commonly used by hydrobiologists as bioindicators in rivers, lakes, and waste waters, with notes on their ecology. Freshwater Biol., **35**: 375-481.

Foissner, W. 1977.Electronmicroscopical studies on the argyrophilic structures of Colpidiumcampylum (Ciliata, Tetrahymenidae). Acta BiolAcad Sci Hung, **28**: 59-72.

Foissner, W. 1979 Methylgru¨n-Pyronin: Seine EignungzursupravitalenUbersicht sfa¨rbung von Protozoen, besondersihrerProtrichocysten. Mikroskopie. **35**: 108-115 (in German).

Foissner, W. 1981. Das Silberliniensystem der Ciliaten: Tatsachen, Hypothesen, Probleme. Mikroskopie, 38: 16-26 (in German).

Foissner, W. 1991. Basic light and scanning electron microscopic methods for taxonomic studies of ciliated protozoa.Eur J Protistol, **27**: 313-330.

Foissner, W. 2005. Two new "flagship" ciliates (Protozoa, Ciliophora) from Venezuela: Sleighophryspustulata and Luporinophrysmicelae. Eur. J. Protistol, **41**: 99-117.

Foissner W. 2013. Description of Glaucomidesbromelicola n. gen., n. sp. (Ciliophora, Tetrahymenida), a macrostome forming inhabitant of bromeliads (Bromeliaceae), including redescriptions of Glaucoma scintillans and G. reniformis. J. Eukaryot Microbiol, **60**: 137-157.

Gause G.F. 1934. The struggle for existence. Williams and Wilkins, reprinted 1964 by Hafner, New York, Baltimore.

Ghosh E. 1918. Studies InInfusoria.-Rec. Indian Mus., Calcutta, **15**: 129-134.

Ghosh, E. 1919. Studies OnInfusoria. Ii.-On Two Species OfHolophrya, Ehrenb~Rg.-Rec. Indian Mus., Calcutta, **16**: 41-43.

Ghosh E. 1920.InfusoriaFrom Bengal.-Report Sci. Convention Indian Ass. Cult. Sci., For 1918, Calcutta, Pp. 144-149.

Ghosh E. 1921a.InfusoriaFrom The Environment of Calcutta. I. -Bull. C, Armichaellned. Coli., Calcutta, **2**: 6-17.

Ghosh E. 1922. New Species of Vorticella From Calcutta. Bull. Carmichael Med. Call., Calcutta, **3**: 8-18, 3 Pis.

Ghosh E. 1928. Two New Ciliates From Sewer Water. J.R. Micr. Soc., London, **1928**: 382-384.

Ghosh E. 1929. Two Ne\V Suctor~AFroln Sewer Water. J.R. Micr. Soc., London, **1929**: 222-223, Figs. 1-2.

Ghosh F. 1921b. New Hypotricholls Infusoria From Calcutta. J.R. Inicr. Soc., London, **1921**: 248-250.

Grolière C.A., Chakli R., Sparagano O., Pepin D., 1990. Application de la colonisation d'un substrat artificiel par les ciliés à l'étude de la qualité des eaux d'une rivière. Europ. J. Protistol., **25**: 381-390.

Hausmann K., Bradbury P.C. (Eds.) 1996 Ciliates: Cells As Organisms. G. Fischer, Stuttgart.

Hecky R.E. & Kling J. 1981. The phytoplankton and zooplankton of the euphotic zone of lake Tanganyika: species composition, biomass, chlorophyll content and spatio-temporal distribution. Limnology & Oceanography, **26**: 548-564.

Ilmas Naqvi, Renu Gupta, Seema Makhija, Ravi Toteja, Jeeva S. Abraham, S. Sripoorna and Hameed A.El-Serehy 2016. Morphology and morphogenesis of a new oxytrichid ciliate, *Notohymena limus* n. sp. (Ciliophora, Oxytrichidae) from Delhi, India. Saudi Journal of Biological Sciences, **23**(6): 789-794.

Jack, J.D. and y J.J Gilbert: 1997. Effects of metazoan predators on ciliates in freshwater plankton communities. J. Euk. Microbiol., **44**: 194-199

Jacquet V., Lair N., Hoffmann L., Cauchie H.M., 2005. Spatio-temporal patterns of protozoan communities in a meso-eutrophic reservoir (Esch-sur-Sure, Luxemburg), Hydrobiologia, **551**: 49-60.

Kalinowska K. 2000, Ciliates in small humic lakes (Masurian Lakeland, Poland): relationship to acidity and trophic parameters, Pol. J. Ecol., **48**: 169-183.

Kalinowska K.. 2004, Bacteria, nanoflagellates and ciliates as components of the microbial loop in three lakes of different trophic status, Pol. J. Ecol., **52**: 19-34.

Mahajan K.K. and Nair K.N. 1965. On some freshwater ciliates (Protozoa) from Calcutta and its environs, *Rec. zool. Surv. India*, **63**: 2-22.

Lair, N., Leveille J.C., Reyes-Merchant P. And Taleb H. 1994 The feeding of a larval fish, Lebistesreticulatus, on ciliates and rotifers. *Mar. Microb. Food Webs*, **8**: 337-345.

Laybourn-Parry J., Olver J., Rees S., 1990a. The hypolimnetic protozoan plankton of a eutrophic lake. Hydrobiologia, **203**: 111-119.

Laybourn-Parry J., Olver J., Rogerson A., Duverge P. L., 1990b. The temporal and spatial patterns of protozooplankton abundance in a eutrophic temperate lake. Hydrobiologia, **203**: 99-110.

Legner M., 1964. Annual observations on ciliates inhabiting the natant vegetation of two naturally polluted pools. Acta Soc. Zool. Bohemoslov., **33**: 193-213

Macek M., Simek K., Pernthaler J., Vyhnalek V., Psenner R., 1996. Growth rates of dominant planktonic ciliates in two freshwater bodies of different trophic degree, Journal of Plankton Research, **18**: 463-481.

Madoni P., 1987a. Estimation of production and respiration rates by the ciliated protozoa community in an experimental ricefield. Hydrobiologia, **144**: 113-120.

Madoni P., 1989. Community structure of the microzooberithos in Lake Suviana (Tusco-Emilian Apennines). Boll. Zool., **56**: 159-165.

Madoni P., 1990. The ciliated protozoa of the monomictic Lake Kinneret (Israel): species composition and distribution during stratification. Hydrobiologia, **190**: 111-120.

Madoni P., Viaroli P., 1985. Microfauna distribution in shallow macrophyte-covered basins. Verh. Internat. Verein. Limnol., **22**: 2353-2355.

Mieczan T., 2007. Size spectra and abundance of planktonic ciliates within various habitats in a macrophyte-dominated lake (Eastern Poland), Biologia Bratislava, **62/2**: 189-194.

Pace M.L., 1982. Planktonic ciliates: their distribution, abundance, and relationship to microbial resources in monomictic lake, Can. J. Fish. Aquat. Sci., **39**: 1106-1116.

Petz W, Song W, Wilbert N. 1995. Taxonomy and ecology of the ciliate fauna (Protozoa, Ciliophora) in the endopagial and pelagial of the Weddell Sea, Antarctica. Stapfia, **4**: 1-223.

Pfister, G., Auer, B. And Arndt, H., 2002. Pelagic Ciliates (Protozoa, Ciliophora) Of Different Brackish And Freshwater Lake: A Community Analysis At The Species Level. Limnologica, Vol. 32, No. **2**: 147-168.

R.N. Mukherjee and A.K. Das 2000 Fauna of Renuka wetland, wetland ecosystem series 2, Zoological Survey of India, pp. 7-9.

Raikov I.B. 1972. Nuclear phenomena during conjugation and autogamy in Ciliates. In: Research in Protozoology (Ed. Chen T.T.). Pergamon Press, Oxford, **4**: 147-291.

Renu Gupta, Komal Kamra and Gulshan Rai Sapra 2006. Morphology and Cell division of the oxytrichids *Architricha indica* nov. gen., nov. sp., and *Histriculus histrio* (Muller 1773), Corliss, 1960 (Ciliophora, Hypotrichida). European Journal of Protistology, **42**: 29-48.

Renu Gupta, Komal Kamra, Seema Arora and Gulshan Rai Sapra. 2003 *Pleurotricha curdsi* (Shi, Warren and Song 2002) nov. comb. (Ciliophora: Hypotrichida): morphology and ontogenesis of an Indian population; redefinition of the genus. European Journal of Protistology. **39**: 275-285 .

Renu Gupta, Komal Kamra, Seema Arora and Gulshan Rai Sapra 2001. *Stylonychia ammermanni* sp. n. a new oxytrichid (Ciliophora, Hypotrichida) ciliate from the river Yamuna, Delhi, India. Acta Protozoologica, **40**: 75-82 .

Schmidt A.R., Von Eynatten H., Wagreich M. 2001. The Mesozoicamber of Schliersee (Southern Germany) is Cretaceous in age. Cretaceous Res., **22**: 423–428.

Schönborn W, Dörfelt H, Foissner W, Krienitz L, Schäfer U. 1999. Afossilized microcenosis in Triassic amber. J Euk Microbiol, **46**: 571-584.

Schonborn W., 1977 - Production studies on Protozoa. Oecologia, **27**: 171-184.

Schonborn w., 1982 - Die Ziliatenproduktion in der mittleren Saale. Limnologica, **14**: 329-346.

Seema Arora, Renu Gupta, Komal Kamra and Gulshan Rai Sapra 1999. Characterization of *Paraurostyla coronata* sp. n. including a comparative account of other members of the genus. Acta Protozoologica, **38**: 133-144.

Şenler, N.G., İ. Yıldız, 1998, An investigation ciliate species on five rivers flowing into Van Lake. YY, Fen Bilimleri Enstitüsü Dergisi, **5**: 1-19.

Şenler, N.G., H. Bıyık, E. Öğün, İ. Yıldız, 1998, The pollution parameters and protozoological investigations on three rivers flowing into Van Lake. Bulletin of Pure and Applied Science, **17**: 35-50.

Şenler, N.G., İ. Yıldız, 2004, Faunistic and morphological studies on ciliates (Protozoa, Ciliophora) from a small pond, with response of ciliate populations to changing environmental conditions, Turk. J., Zool., **28**: 245-265.

Şenler, N.G., İ. Yıldız, An investigation on the ciliated protozoan biological sewage treatment plant of YüzüncüYıl University. Y.Y.U Fen Bilimleri Enstitü Dergisi, **6**: 1-10, 1999.

Shaikh, J.D, Shaikh, T.T, Kamble, U.P, Jadhav, T.J. and Kazum, M. 2012. Studies on some free living protozoan from Salim Ali Lake, Aurangabad. Int. Multidiscip. Res. J. **2**(6): 27-29.

Silva, S.B.A. & Silva-Neto, I.D. 2001. Morfologia dos protozoários ciliados presentes em um reator experimental de tratamento de esgotopeloprocesso de lodosativados. Revista Brasileira de Zoociências **3**: 203-230.

Simek K., Macek M., Vyhnalek V.1999. Uptake of bacteria-sized fluorescent particles by natural protozan assemblage in a reservoir. Arch. Hydrobiol. Beih. Ergebn. Limnol., **34**: 275-281.

Somasundaram, S., Abraham, J.S., Gupta, R., Makhija, S. and Toteja, R. 2015. *Tetmemena* sp. Y1 18S rRNA gene, partial sequence. Acc no. KP336401

Somasundaram, S., Abraham, J.S., Gupta, R., Toteja, R. and Makhija, S. 2015. *Tetmemena* sp. Y1 18S ribosomal RNA gene, partial sequence; internal transcribed spacer 1, 5.8S ribosomal RNA gene, internal transcribed spacer 2, complete sequence; 28S ribosomal gene, partial sequence. Acc. No. KT731103.

Somasundaram, S., Abraham, J.S., Toteja, R., Makhija, S. and Gupta, R. 2016 *Tetmemena* sp. Y1 histone H4 gene, partial cds. Acc. No. KU761846.

Somasundaram, S., Abraham, J.S., Gupta, R., Makhija, S. and Toteja, R. 2015. Diverse Freshwater Ciliate Fauna from Okhla Bird Sanctuary, Delhi, India. Global Journal for Research Analysis; **4**(9): 37-41.

Song W, Wang M. 1999 New name list of marine ciliates in China. In: Song W (ed) Progress in protozoology. Qingdao Ocean University Press, Qingdao, China, pp 65-76

Song W, Wilbert N. 2002. Faunistic studies on marine ciliates from the Antarctic benthic area, including descriptions of one epizoic form, 6 new species and 2 new genera (Protozoa: Ciliophora). Acta Protozool, **41**: 23-61

Song W., Zhao Y., Xu K. 2003. Pathogenic protozoa in mariculture. Science Press, Beijing (in Chinese).

Sonneborn T.M. 1937. Sex, Sex Inheritance And Sex Determination In Paramecium Aurelia. — *Proc. Natl. Acad. Sci. Usa*, **23**: 378-383.

Sonneborn T.M. 1957. Breeding Systems, Reproductive Methods, And Species Problems In Protozoa. — In: Mayr E. (Ed.): The Species Problem. American Association For The Advancement Of Science, Washington D.C.: 155-324

Sorokin Y.I., 1972 - Biological productivity of the Rybinsk reservoir. In: Z. Kayak & A. Hillbricht-Ilkowska (eds), Productivity problems of freshwaters. - Polish Sci. Publ., Warsaw, pp. 493-503.

Thouvenot A., Richardot M., Debroas D., Devaux J., 1999. Bacterivory of metazooplankton, ciliates and flagellates in a newly flooded reservoir, Journal of Plankton Research, **21**: 1659-1679.

Ventelä A.M., Saarikari V., Vuorio K., 1998. Vertical and seasonal distribution of microorganisms, zooplankton and phytoplankton in a eutrophic lake, Hydrobiologia, **363**: 229-240.

Ventela, M.A., K. Wiščkowski, M. Moilanen, V. Saarikari and K. Vuorio 2002.The effect of small zooplankton on the microbial loop and edible algae during a cyanobacterial bloom. Freshwater Biol., **47**: 1807-1819.

Wiackowski, K., A.M. Ventela, M. Moilanen, V. Saarikari, K. Vuorio and J. Sarvala 2001. What factors control planktonic ciliates during summer in a highly eutrophic lake? Hydrobiol., **443**: 43-57 .

Weisse T., Múller H. 1998. Planktonic protozoa and the microbial food web in Lake Constance, Archiv fűr Hydrobiol., **53**: 223-254.

Zingel P., 2005, Vertical and seasonal dynamics of planktonic ciliates in a strongly stratified hypertrophic lake, Hydrobiologia, **574**: 163-174.

Zingel P., Ott I., 2000, Vertical distribution of planktonic ciliates in strongly stratified temperate lakes, Hydrobiologia, **435**: 19-26.

Zingel, P., H. Agasild, T. Noges and V. Kisand: 2007. Ciliates are the dominant grazers on pico- and nanoplankton in a shallow, naturally highly eutrophic lake. Microb. Ecol., **53**: 134-142.

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Cell Biology

Practical Manual

Dr. Renu Gupta | Dr. Seema Makhija | Dr. Ravi Toteja

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About the Book

The present practical manual has been written with reference to the syllabi in Indian Universities for Cell Biology as there has been a total lacuna in the availability of any Indian Cell Biology Practical Manual. The manual incorporates practical exercises widely covering the contents of undergraduate courses including the essential background information and protocols for observing and understanding cell morphology, structure and its components, for example, investigations of nucleic acids, carbohydrates etc. The chapters will enable the students to understand basic and advanced experimental procedures in the field concerned and provide a better understanding of specialized practical work. The manual covers: a substantial range of methods for working on cytochemical staining, biological methods to culture and maintain model organism, details of cell division, barr body, comprehensive coverage of microscopy etc.

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*during the 44th Annual Convention of the Philippine Society of Biochemistry and Molecular Biology, with the theme **"Biochemistry and Molecular Biology: From Niche to the Nation"**, held on 27 - 30 November 2017 at the Taal Vista Hotel, Tagaytay City.*

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with the paper entitled

"Investigations on the impact of five essential oils on the oviposition and hatchability of eggs of female adults of dengue vector, Aedes aegypti L."

*during the 44th Annual Convention of the Philippine Society of Biochemistry and Molecular Biology, with the theme **"Biochemistry and Molecular Biology: From Niche to the Nation"**, held on 27 - 30 November 2017 at the Taal Vista Hotel, Tagaytay City.*

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to

ROOPA RANI SAMAL
and SARITA KUMAR

as

POSTER PRESENTER

with the paper entitled

"Impact of acetamiprid on the survival, morphology and development of Aedes aegypti L. (Diptera: Culicidae)"

*during the 44th Annual Convention of the Philippine Society of Biochemistry and Molecular Biology, with the theme **"Biochemistry and Molecular Biology: From Niche to the Nation"**, held on 27 - 30 November 2017 at the Taal Vista Hotel, Tagaytay City.*

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VINAY SINGH DAGAR
And SARITA KUMAR

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POSTER PRESENTER

with the paper entitled

"Evaluation of emamectin benzoate as a potential larvicide and antifeedant agent against cotton bollworm Helicoverpa armigera (Lepidoptera: Noctuidae)"

*during the 44th Annual Convention of the Philippine Society of Biochemistry and Molecular Biology, with the theme **"Biochemistry and Molecular Biology: From Niche to the Nation"**, held on 27 - 30 November 2017 at the Taal Vista Hotel, Tagaytay City.*

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Page No. 54

INSCR International Conference (IIC-2017)

Taxonomic study of extracellular enzyme producing actinomycetes from varied ecological habitats

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Abstract

Actinomycetes secrete various types of extracellular enzymes which have numerous applications in industry and agriculture. Traditional industrial microbiology has merged with molecular biology to yield improved recombinant processes for the industrial production of proteins, biopharmaceuticals and industrial enzymes. In a previous study, actinomycetes were isolated from diverse ecological habitats and screened for their ability to produce extracellular enzymes. Based on the results of primary and secondary screening, colonies 194 (Dumping site soil, Sarai Kale Khan Delhi), 51 (Agricultural soil, Dhanaura, U.P) and 157 (Agricultural soil, Dhanaura, U.P.) showed maximum cellulase activity; colonies 169 (Sugar plant soil, Dhanaura, U.P.), 126 (Lake soil, Purana Quila, Delhi) and 202 (Chemical plant soil, Faridabad, Haryana) showed maximum xylanase activity; colonies 130 (Chemical plant soil, Faridabad, Haryana), 194 (Dumping site soil, Sarai Kale Khan, Delhi) and 184 (Sugar plant soil, Dhanaura, U.P.) showed maximum chitinase activity and colonies 165 (Agricultural soil, Kashipur, Uttarakhand), 122 (Agricultural soil, Nainital, Uttarakhand) and 242 (Great Himalayan National park soil, Teerthan Valley) showed maximum phosphatase activity. The highest xylanase and chitinase producers, colonies 169 and 130 were further analysed to determine the type of protein and its 3D structure. In the present study, two tests (Biochemical and Morphological) of polyphasic characterization of above strains was done. Spore chains of colonies 51, 157, 122 and 126 were of Retinaculiaperti type, colonies 130, 184, 202 and 242 possessed Spirales type of spore chains and in colonies 165, 169 and 194 Rectiflexibles type of spore chain was observed. Biochemical studies were performed to check the metabolic status of strains. Colony 169 was found efficient in utilizing L-arabinose, D-fructose, L-arabinose and degrading urea, casein, tween, hypoxanthine. Similarly, colony 130 was found efficient in utilizing D-mannitol, meso-inositol, D-fructose and degrading urea and hypoxanthine. From the results of biochemical and morphological tests it was concluded that the strains from different ecological habitats belongs to genus *Streptomyces*.

Keywords: Actinomycetes, Extracellular enzymes, Primary and secondary screening, Protein type and structures, Spore chain morphology, Biochemical studies

(Page 59)

Monisha Khanna

INSCR International Conference (IIC-2017)

Phylogenetic characterization of antibiotic producing actinomycete strains from diverse ecological habitats

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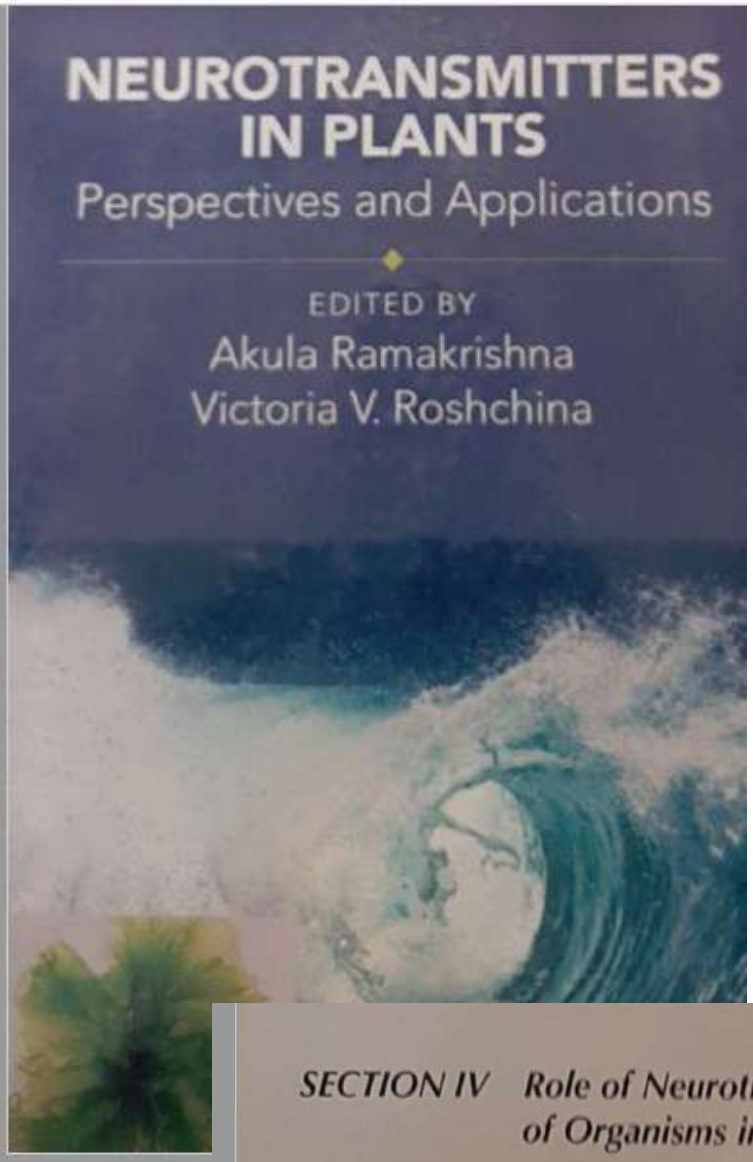
Abstract

Actinobacteria are major producers of important biomolecules, accounting for 70-80% of secondary metabolites available commercially. Its various genera are known for production of different classes of antibiotics. Microbial pathogens however, are developing resistance to existing antibiotics. There is an urgent inevitability to discover and develop new therapeutic compounds with unique modes of action. Polyketides and non-ribosomal peptides produced by this group of bacteria represent a large group of antibiotics. Biosynthesis of non-ribosomal peptides and polyketides takes place from acyl-coenzymeA monomers and amino acid building blocks. Biosynthesis of NRPs takes place by large multimodular proteins, in which each enzymatic module catalyse one step of elongation and modification of the growing polypeptide chain. In the current study, actinomycetes strains representing various ecological habitats were selected and revived. These strains have been screened in a previous study for production of antibiotics. The morphological, biochemical and 16S rRNA gene studies of these strains is done in this study. In the morphological studies, spore chain observations showed presence of hooks, loops, spirales with one and two turns (Retinaculiaperti) in strains RI.24, S.4A, S.43, SL.4 and 51. In case of strains B.69 and RI.30 straight to flexous (Rectiflexibles) spore chains were observed. The strains L3.41, L3.46 and strain 196 showed spiral type spore chains. Biochemical studies were performed to check the metabolic status of the strains, the results of which depicts the activity shown by strains in utilizing different sugars and organic compounds by the production of different metabolic enzymes. Comparison of 16S rRNA gene sequences of strains with sequences of close *Streptomyces sp.* deposited in EzTaxon database indicated that these isolates belong to genus *Streptomyces*. Rooted phylogenetic tress based on neighbor joining method, prepared separately for strains indicated that these were included in distinct clades in their respective trees.

Key words: Actinomycetes, PKS and NRPS, rRNA, Biochemical studies

Monisha Khanna



15 Role of Acetylcholine System in Allelopathy of Plants

Rashmi Sharma and Rajendra Gupta

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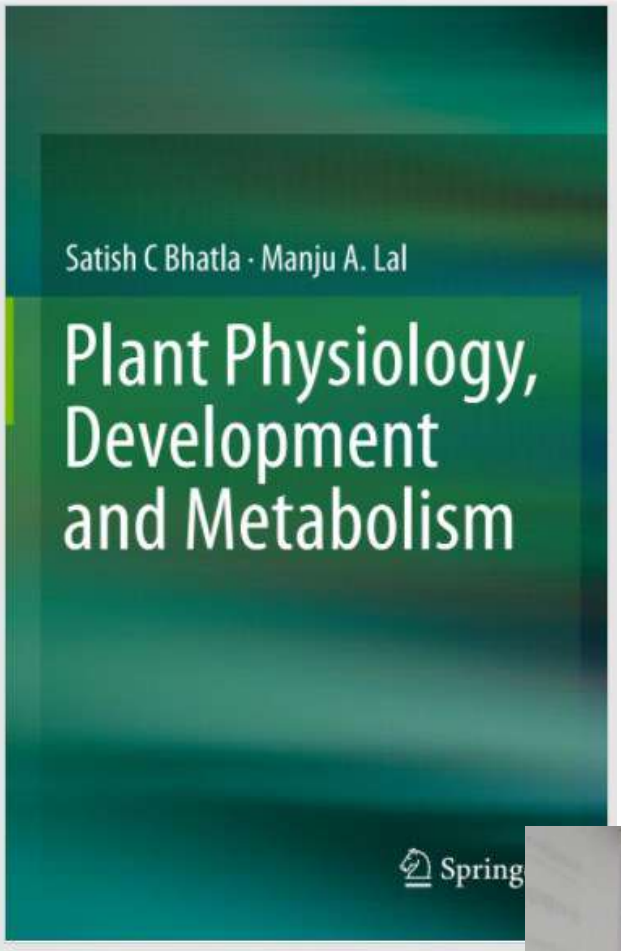

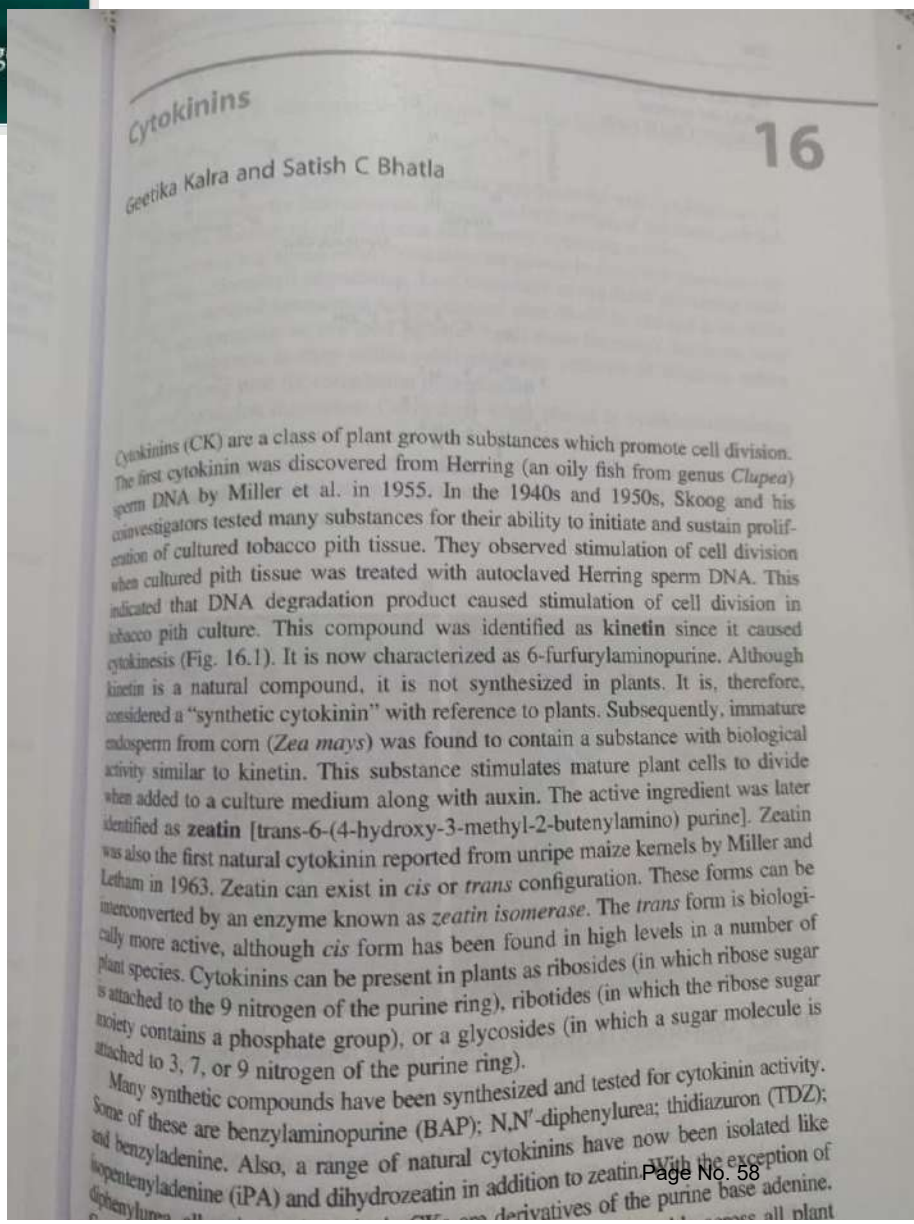

Cytokinins

Geetika Kalra and Satish C Bhatla

16

Cytokinins (CK) are a class of plant growth substances which promote cell division. The first cytokinin was discovered from Herring (an oily fish from genus *Clupea*) sperm DNA by Miller et al. in 1955. In the 1940s and 1950s, Skoog and his coinvestigators tested many substances for their ability to initiate and sustain proliferation of cultured tobacco pith tissue. They observed stimulation of cell division when cultured pith tissue was treated with autoclaved Herring sperm DNA. This indicated that DNA degradation product caused stimulation of cell division in tobacco pith culture. This compound was identified as **kinetin** since it caused cytokinesis (Fig. 16.1). It is now characterized as 6-furfurylaminopurine. Although kinetin is a natural compound, it is not synthesized in plants. It is, therefore, considered a "synthetic cytokinin" with reference to plants. Subsequently, immature endosperm from corn (*Zea mays*) was found to contain a substance with biological activity similar to kinetin. This substance stimulates mature plant cells to divide when added to a culture medium along with auxin. The active ingredient was later identified as **zeatin** [trans-6-(4-hydroxy-3-methyl-2-butenylamino) purine]. Zeatin was also the first natural cytokinin reported from unripe maize kernels by Miller and Letham in 1963. Zeatin can exist in *cis* or *trans* configuration. These forms can be interconverted by an enzyme known as *zeatin isomerase*. The *trans* form is biologically more active, although *cis* form has been found in high levels in a number of plant species. Cytokinins can be present in plants as ribosides (in which ribose sugar is attached to the 9 nitrogen of the purine ring), ribotides (in which the ribose sugar moiety contains a phosphate group), or a glycosides (in which a sugar molecule is attached to 3, 7, or 9 nitrogen of the purine ring).

Many synthetic compounds have been synthesized and tested for cytokinin activity. Some of these are benzylaminopurine (BAP); N,N′-diphenylurea; thidiazuron (TDZ); and benzyladenine. Also, a range of natural cytokinins have now been isolated like isopentenyladenine (iPA) and dihydrozeatin in addition to zeatin. With the exception of diphenylurea, all ... derivatives of the purine base adenine. ... across all plant

Gibberellins

Geetika Kalra and Satish C Bhatla

17

Gibberellins are growth hormones known to stimulate cell elongation and influence various developmental processes like stem elongation, seed germination, dormancy, flowering, sex expression, enzyme induction, and leaf and fruit senescence. Japanese scientists observed a common disease leading to excessive growth of rice plants. Eiichi Kurosawa (1926) investigated this *bakanae* (foolish seedling) disease in rice and found that tallness of diseased rice plants was induced by a chemical secreted by the fungus that had infected the plants. This chemical was isolated from the filtrate of the cultured fungus and was called **gibberellin**, after *Gibberella fujikuroi* (now renamed as *Fusarium fujikuroi*), the said fungus infecting rice plants. Kurosawa also noted that this active factor could promote the growth of maize, sesame, millet, and oat seedlings. In 1935, Yabuta and Hayashi successfully crystallized the fungal growth-inducing factor called gibberellin from the fungus *Gibberella fujikuroi*. The gibberellins are technically diterpene acids. They are either 19 or 20 carbon structures. A number of gibberellins are found in plants, of which only few are biologically active as hormones. The 19-carbon forms are, in general, biologically active gibberellins. Three most common biologically active gibberellins are GA_1, GA_3, and GA_4. All other GAs serve either as active GAs or their degradation products (Fig. 17.1). In view of their acidic nature, gibberellins are also referred to as gibberellic acids (GAs). GAs are named GA_1 through GA_n in order of discovery. GA_3 was the first GA to be structurally characterized. So far, 126 GAs have been identified in plants, fungi, and bacteria.

18 Abscisic Acid

Geetika Kalra and Satish C Bhatla

Some molecules produced by plants exert their effects as negative regulators of various plant responses. **Abscisic acid** is an inhibitory hormone that helps plants adapt to stress. It also maintains water balance, prevents seed embryos from germinating, and induces seed and bud dormancy. Initial attempts to identify abscisic acid were made by Fredrick T. Addicott and his coworkers in cotton fruits in 1963. It was earlier suspected that seed and bud dormancy are caused by some inhibitory compounds and attempts were made to extract these compounds from various plant tissues. Acidic compounds separated by paper chromatography from these tissues were tested for their ability to promote growth in oat coleoptile, but instead these compounds inhibited coleoptile elongation. This compound was referred as "β-inhibitor complex." Subsequently, high β-inhibitor levels were correlated with suppression of sprouting in *Solanum tuberosum* tubers, abortion of *Lupinus arboreus* pods, and bud dormancy in trees like *Betula pubescens*. This compound was subsequently named abscisin II, since it was identical to a substance that promotes abscission in cotton fruits (commercially important for mechanization of cotton picking). Another substance isolated a substance from *Betula pubescens*, a deciduous plant, inhibits growth and induces bud dormancy. It was named "**dormin**." "Dormin" was subsequently found to be structurally similar to "abscisin II." The compound was subsequently renamed as abscisic acid (ABA)—a compound which inhibits growth and stomatal opening when plants are under environmental stress.

ABA is ubiquitous in vascular plants and in several genera of fungi, it is

Physiology of Flowering

Geetika Kalra and Manju A. Lal

25

About 90% of the ≈ 350,000 known plant species are the flowering plants. Flowering is the most enigmatic phase in the life of a plant. It provides a mechanism to plants for genetic outcrossing which provides a means of securing a greater variety of genetic recombination. Flowers are specialized structures which differ extensively from the vegetative plant body in form and cell types. Numerous physiological and biochemical changes take place within the shoot apex when it prepares itself for transition into floral bud. The precise time of flowering is important for reproductive success of the plant. Plants need to sense when to produce flowers so that fruit and seed development can be attained which will ensure its survival in the next season. Synchronous flowering is significant in outcrossing plants. Since long, people have wondered how plants are able to flower in a particular season. Plants possess the ability to anticipate and sense change of seasons. It has always been a fundamental question as to how environmental signals influence flowering and how these signals are perceived.

Transition from vegetative to reproductive development is generally marked by an increase in the frequency of cell divisions within the central zone of SAM. The process by which the shoot apical meristem becomes committed to forming flowers is termed **floral evocation**. SAM has an undifferentiated dome of cells at the cente which, after the signal is perceived, triggers **quiescent** cells to enter into the phase ransition from vegetative meristem to floral meristem. T influenced by external factors. The comp The regulation of competence duction requires b mat

Senescence and Programmed Cell Death 30

Geetika Kalra and Satish C Bhatla

Both plants and animals go through onset and progress of certain processes leading to "aging" which ultimately causes death. **Aging** is defined as a degenerative biological change occurring over a period of time. Plants exhibit wide range of variations in life span, ranging from a week to few to many years. It is a common sight in temperate regions that the color of the leaves changes from green to yellow to orange or red before its final fall from the deciduous trees (Fig. 30.1). Such changes happen during the terminal phase of the life cycle of plants and are referred as senescence. **Senescence** is a self-digesting (autocatalytic) process controlled by environment and the genetic makeup of an organism. Changes taking place during this process are catabolic and thus irreversibly degenerative. Senescence is not just a passive decay of structural and biochemical machinery of cells; rather it is a precisely regulated series of events in which organelles, membranes, and macromolecules are broken down. Nutrients, like amino acids, sugars, and minerals, are reclaimed for export out of the senescing organ to other plant parts for later use. Nature is thus conservative as far as its precious resources are concerned. Another general term which is used for mechanisms underlying terminal events in the lives of a plant is **programmed cell death (PCD)**. PCD is also a genetically determined developmental event which leads to elimination of a cell or cells. Such eliminations determine the final shape and habit of a plant. PCD occurs in a wide range of developmental ... of unisexual flowers where cells destined ... (Fig. 30.2). Unlike PCD, sene... catabolic a...

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Effect of Concentration Variation In Graphene Oxide (GO) Membranes For Water Flux Optimization

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Abstract: Graphene oxide, sister material of Graphene has generated tremendous research interest in fields of energy storage, catalyst material, adsorbent material for heavy metals and dyes, green energy production, drug delivery agent, a gas sensing material as well as in membrane based water purification and desalination systems[1-3] etc. In this paper, we are reporting the effect of concentration variation in GO membranes on water flux. GO has been synthesized by Hummer's method with related characterizations like XRD, Raman, SEM and FTIR carried out. GO membranes have been developed using pressure assisted filtration assembly (Water Vac-100) over Cellulose Acetate membrane support (47 mm dia. and 0.45 μm pore size), Millipore.

Keywords: Graphene oxide membrane, water flux, Hummer's method

INTRODUCTION

Worldwide almost all countries are moving towards paucity of potable drinking water at a very rapid pace mainly due to anthropogenic activities. Therefore, conservation of this natural resource in conjunction with its recycling assumes importance and which necessitates development of an advanced water purification technique that could help overcome the problem of drinking water while offering the feasibility of scaling-up for industries. Literature indicates membrane based water purification techniques gaining interest wherein polymer based membranes are in demand due to low cost of development, high water flux and high life time. However, they suffer from problems including long term chemical, thermal and biological stability which reduce performance of these membranes[4-6]. Unusual properties of Graphite oxide membranes were reported by H.P. Boehm et al. who reported that the membranes are not permeable to gases but permeable to water vapors[7]. The same materials are now named mostly as graphene oxide papers or membranes. Interest in permeation properties of GO membranes was reborn recently by the study of Nair et al., [8] which reported that water vapors permeate through the membranes but not vapors of several other solvents, e.g. ethanol. Recent experiments showed that GO membranes also demonstrate selective ion permeation and can be used for filtering of some organic molecules[9]. Beyond the traditional polymer membranes, GO based membranes, restacking from two-dimensional GO nanosheets, have been regarded as a promising candidate for water purification and desalination[10-11]. By taking advantages of its high mechanical strength/flexibility, excellent hydrophilic surface properties and 2D interconnected nanofludic channels for ion and molecular transport, GO based membranes have exhibited extraordinary separation performance in respect of water flux and pollutant molecular/ions rejection[12-14]. However, there is a need to optimize graphene oxide membranes for water purification offering robust structural stability vis-à-vis efficient water purification capabilities. In the present work five different membranes over cellulose acetate support having varying concentration of GO solution, have been fabricated. The same are then checked for stability in performance and water flux so that amount of GO can be optimized (in mg over 40 mm effective Diameter of GO membrane) which can be further used for optimization of water flux and stability.

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2018 5th IEEE Uttar Pradesh Section International Conference on Electrical, Electronics and Computer Engineering (UPCON)

Impact of donor-layer doping & thickness, gate-length and temperature on potential and electron concentration in AlGaN/GaN Double-Heterostructure and Single-Heterostructure HEMT

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***Abstract*—This paper presents a comparative simulation based analysis of the impact of donor-layer doping & thickness, gate-length and temperature on channel potential and electron concentration of $Al_{0.25}Ga_{0.75}N/GaN/Al_{0.25}Ga_{0.75}N$ double heterostructure (DH) HEMT and $Al_{0.25}Ga_{0.75}N/GaN$ single-heterostructure (SH) HEMT. Due to the formation of two 2-DEGs at the two hetero-interfaces, potential and electron concentration of a double-heterostructure HEMT is found to be more sensitive to variation in gate-length, donor-layer doping, donor-layer thickness and temperature as compared to SH-HEMT.**

Keywords—***channel potential, donor layer thickness, doping concentration, double-heterostructure high electron mobility transistor; electron concentration, gate-length, temperature***

I. INTRODUCTION

III-V nitride wide band gap semiconductor materials are receiving much interest recently for their potential use in high power and high frequency applications. This is primarily due to the large 2-D electron gas induced by the polarization charge at the AlGaN/GaN hetero-interface [1].GaN-based high-electron-mobility transistors in particular are being considered as the most suitable choice due to high sheet-carrier density and large breakdown field strength (~3.5 MV/cm) [2-4]. The major feature of an AlGaN/GaN heterostructure system is spontaneous and piezoelectric polarization at the AlGaN/GaN hetero-interface which results in a very high sheet-carrier concentration of the order of (2-6) $x10^{13}$ cm^{-2}[1]. Polarization results in confinement of high concentration of electrons or holes at the hetero-interface [5-6]. For a net positive polarization at the interface this confinement results into two dimensional electron gas (2-DEG) and for a net negative polarization, this results into two dimensional holes gas (2-DHG) [7].

An attempt to obtain even better performance for future military communications, radar and intelligence applications has led to continuous downscaling of gate- length to sub-100 nm level. However, in order to maintain the device aspect ratio and to avoid deterioration in the device performance due to the emergence of various short-channel effects (shift of threshold voltage towards the more negative value, undesirable larger sub-threshold slope, deterioration of transconductance and output conductance etc), gate-length reduction has to be accompanied by shortening of gate-to-channel separation. To achieve larger 2DEG concentration and better carrier confinement interest has been grown from single heterojunction devices to double heterojunction high electron mobility transistors. DH-HEMT also exhibits higher value of transconductance with less modification over an extensive range of gate-source voltage as compared to a single heterostructure HEMT [8-13].

Modification in the conventional HEMT structure such as a double-heterostructure HEMT has emerged as a possible solution to obtain further improvement in the high-power, high frequency performance beyond the limit of device miniaturization [8-10]. DH-HEMT offers numerous advantages over conventional single-heterostructure HEMT (SH-HEMT), such as larger sheet carrier concentration, larger current, larger transconductance and higher cut-off frequency over SH-HEMT which leads to better RF performance of the device and shows better charge control in DH-HEMT over SH-HEMT [14-16].

Authors in their previous work [14-16] proposed an analytical approach for the evaluation of threshold voltage, sheet carrier concentration, drain current, transconductance and cut-off frequency of AlGaN/GaN/AlGaN DH-HEMT. A comparative analysis of the dependence of sheet carrier concentration and threshold voltage on donor-layer doping density and donor layer thickness of 100 nm gate-length AlGaN/GaN SH-HEMT with AlGaN/GaN/AlGaN DH-HEMT was also presented [14-15]. In this paper, extensive analysis has been carried out using ATLAS 2D device simulation [17], in order to study the effect of variation of donor layer thickness d_a, doping density N_D, temperature T and gate-length (L_g) on the channel potential and electron concentration of DH-HEMT as compared to SH-HEMT.

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Business Communication For Under Graduate Studen....

by Manoj Kumar Garg

General English

(for Undergraduate Students)

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Variation in the Insecticide-Resistance Spectrum of *Aedes aegypti* L. after Selection with Acetamiprid

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Continuous rise in mosquito-borne diseases worldwide, control of mosquitoes has become a principal concern. The outbreak of Zika, dengue and Chikungunya has caused momentous situations raising urgent need to control *Aedes aegypti*. Dengue is one of the most prevalent *Aedes*-borne viral diseases of humans in tropics. In India, *Aedes*-borne diseases have shown a significant rise during last decade. The most recommended plan to control mosquito-borne diseases primarily lies on mosquito management below threshold level and interrupting their disease-transmission cycle. Extensive use of different classes of organic insecticides for mosquito control has led to the development of high levels of resistance making them less effective at safe dosages, consequently, forcing us to explore novel insecticides. Present study investigates the bio-efficacy of a neonicotinoid, acetamiprid.on the survival, development of resistance, development changes and reproductive potential of *Ae. aegypti*.The development of cross-resistancein *Ae. aegypti* against different classes of insecticides has also been investigated. The parent population of early fourth instars of *Ae. aegypti* when exposed to acetamiprid, resulted in respective LC_{50} and LC_{90} values of 0.188 ppm and 1.315 ppm. Selection with acetamiprid for 10 successive generations (ACSF-10) reduced its efficacy by 25 fold. The cross-resistance studies performed to evaluate the insecticide resistance spectrum in parent as well as acetamiprid-selectedstrains showed that the larvae selected with acetamiprid also developed low levels of resistance to organophosphates and pyrethroids. The larvae developed 13-fold resistance to lambda-cyhalothrin while 11-fold resistance to fenitrothionwas observed as compared to the parent population. Remarkably, the ACSF-5 larvae did not develop any cross-resistance with organochlorines and carbamates. Studies on the impact of acetamipridon the development and reproductive potential of *Ae. aegypti* showed growth-inhibitory effects of acetamiprid. Our results highlight towards the probable use of acetamiprid as an efficient control agent against *Ae. aegypti* causing adverse impacts on their survival, development and reproductive fitness. Our investigations recommend acetamiprid as a promising control agent with growth inhibiting and hormono-mimetic effects. Further study is required to assess the probable development and characterization of acetamiprid resistance and probable development of cross-resistance to other insecticides in order to devise mosquito control strategies.

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Growth Inhibition and Growth Regulatory effects of Lufenuron on *Aedes aegypti* L.: A potential Mosquito Control Agent

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With the ever-rising *Aedes*-borne diseases; Dengue, Yellow fever, Chikungunya and Zika; *Aedes aegypti* has become the most devastating disease vectorand has gained the prime concern in health sciences. Extensive use of different classes of synthetic insecticides has not only led to the development of resistance making them less effective even at higher dosages but also has raised several environmental concerns. As known earlier, that IGRs are safe for most of the non-target biota including invertebrates, fish, birds, and other wildlife; as well as to man and domestic animals; present study, explores Lufenuron, an insect growth regulator (IGR)asa probable mosquito control agent. Lufenuron, a Chitin Synthesis Inhibitor (CSI), targetschitin, a molecule present in the exoskeleton of all life stages of insects.In the present study, the growth inhibition and growth arrest efficacy of Lufenuron was investigated by exposing third instar larvae of *Aedes aegypti*to graded dosesof Lufenuron under controlled laboratory conditions as per WHO protocol for IGRs. Simultaneous controls were run to assess the efficacy of Lufenuron on *Aedes aegypti*.The impact of the investigated IGR on larval growthof *Aedes aegypti* was monitoredby studying various life parameters; such as larval and pupal mortality, formation of intermediates at larval or pupal stage,larval and pupal longevityand the adult emergence.Our investigations showed that larval exposure to 0.002 ppm Lufenuronin *Aedes aegypti* increased the length of larval and pupal development period and resulted in formation of appreciable number of larva-pupal as well as pupal-adult intermediates. The pupal development to adults was delayed by 2 days as compared to that in control larvae. Apart from these the IGRinhibited the emergence of 50% adults (EI_{50}) causing suppression of next generation and also delayed the emergence of rest of the adults. Remarkably, even at lower concentrations, *Ae. aegypti* were arrested at fourth instar stage for a prolonged duration of 9-11 days. Nevertheless, larval exposure to 0.005 ppm Lufenuron induced 100% adult Emergence Inhibition (EI_{100}). The IGR couldarrest complete growth at the larval stagecausing appreciable mortality and, resulting in the formation of increased number of larval-pupal intermediates as compared to those recorded on exposure to 0.002 ppm. Our studies showed that Lufenuronis an effective Growth Regulator affecting various life parameters and development of *Aedes aegypti* negatively. Potential use of Lufenuron as control agent of *Ae. aegypti* will be discussed and recommendations will be made for mosquito control strategy in the fields.

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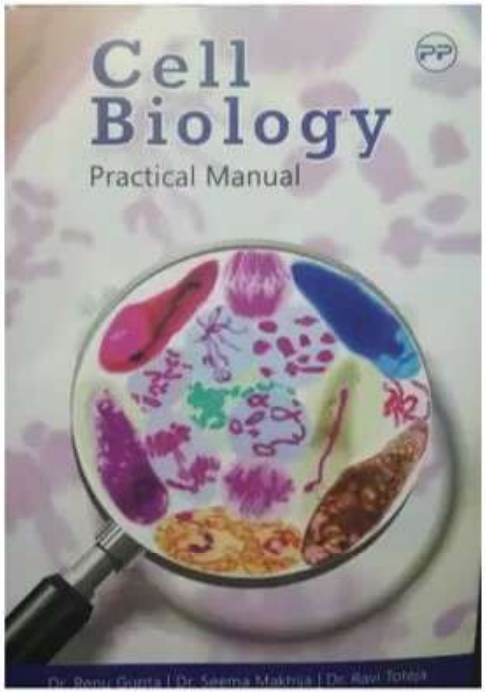

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Chapter

Design and Growth of Metal Oxide Film as Liquefied Petroleum Gas Sensors

Rakesh Kumar Sonker, Saroj Radheyshyam Shabajeet, Rahul Johari and Balchandra Yadav

Abstract

Nowadays innovations in synthesis methods for metal oxide-based nanomaterials such as nanostructured and both physical and chemical route techniques have been adopted by various researchers around the world. The investigation has been focus ing on various deposition parameters for fabricating nanostructured metal oxide. Gas sensors that use metal oxide materials are broadly utilized in industry to monitor combustion processes. While they are economical to powerful in high temperature environments, many of these instruments are not selective towards the species of interest when placed in a stream composed of multiple gases. Research on nanostruc tured metal oxide materials has generated great interest in scientific community. Metal oxide is a chemically stable, harmless, biocompatible, inexpensive material with very high dielectric constant and interesting photocatalytic activities. It is a wide-gap semiconductor and depending on its chemical composition, it shows a large range of electrical conductivity. Synthesis strategies regarding nanocomposites of metal oxide with other inorganic and organic materials sensing activities has been reviewed. The measure response of metal oxide film-based sensor highat low concentration of LPG.

Keywords: metal oxide, thin film, deposition technique, LPG sensor

1. Introduction

Liquefied petroleum gas (LPG) is the composition of hydrocarbons mainly propane and butane. The lower explosive limit (LEL) as specified by National Institute for Occupational Safety and Health (NIOSH) and Occupational Safety and Health Administration (OSHA) standards for chemical hazards is 21,000 ppm (2.1% by volume in air) for propane and 19,000 ppm (1.9% by volume in air) for butane. The permissible exposure limit (PEL) for LPG as specified by NIOSH and OSHA standards is 1000 ppm [1]. LPG is mostly used as fuel for vehicles and as cooking gas for household applications. Exact observing of leakages of LPG even at low concentrations can be useful to avoid accidental explosions [2, 3]. Sensors have turned into an indispensable piece of the cutting-edge human progress attributable to its significance, where metal oxides have played a major role as reliable sensor materials. Nanoparticle do research presents broad scope for the growth of novel solutions in the field of healthcare, cosmetics, optics and electronics. Varying their sub-atomic and nuclear states results in surprising results, which may not be conceivable by utilizing the materials in their unique states. A few metal oxides

Effect of concentration variation in graphene oxide (GO) membranes for water flux optimization

Shani Kumar, Amit Garg, and Arijit Chowdhuri

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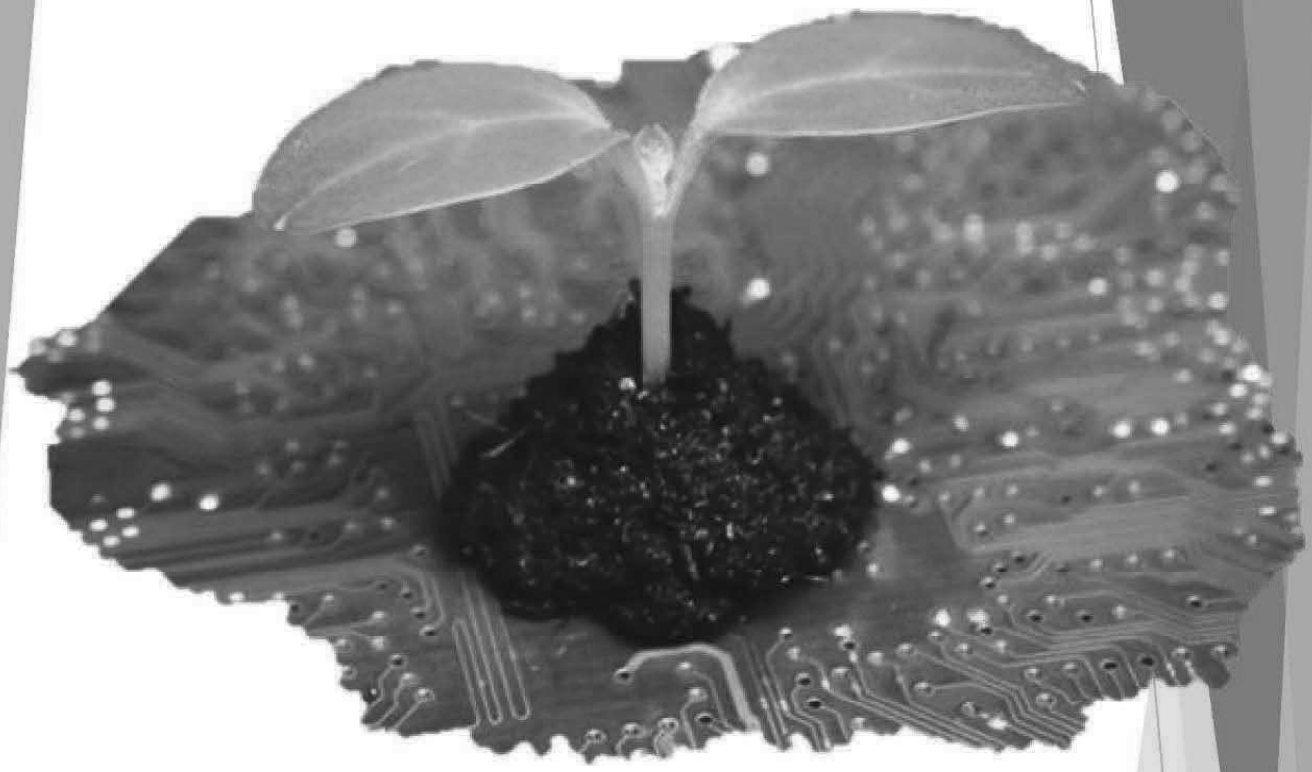

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Content

18/PP/01

Study of Particulate Matter Pollution in Different Modes of Public Transport in New Delhi, India

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Literature reports indicate that air pollution is a global problem that influences human health and well being, food production, climate, visibility to the greatest extent while degrading the ecosystem. Around 7 million people die annually from exposure to fine and ultra fine particulate matter (PM) which are known to penetrate deep into lungs and cardiovascular system causing diseases like eye irritation, skin problems, stroke, heart ailments, lung cancer, Chronic Obstructive Pulmonary Diseases (COPD) besides other respiratory infections [WHO 2018]. Further, 91% of the world's population inhales poor quality air that exceeds prescribed WHO guidelines and situation is worse in developing countries. Since transportation constitutes an integral part of daily life hence exposure to PM during the same is expected to greatly influence human health. In the current investigation real-time monitoring of ambient PM [both large >2.5µg/m^3 and small (0.5-2.5µg/m^3)] concentrations in different modes of public transport viz. Delhi Metro, AC bus, non-AC bus, Gramin sewa and walking) were studied. For PM measurement a true LASER particle counter based air quality monitor (DYLOS – 1700, USA) with automatic data acquisition facility was used. Spatial and temporal variation of coarse and fine PM concentration levels within different modes of transport catering to population belonging to different economic strata, were measured and the amount of exposure in 1 – hour (typical travelling time) studied. Observed values of fine PM concentrations (0.5 - 2.5µg/m^3) in different modes of transport indicate, alarmingly high values that sometimes are noted to be 5 to 12 times the prescribed limits set by NAAQS and WHO respectively. The current investigation assumes importance because it can be used for development of standardized methods for PM sensing including targeted research, advanced monitoring strategies and inter-comparisons. Also, the study can potentially be used for projecting the nature and magnitude of PM pollution in affected cities of India while developing strategies to mitigate the same.

Key words: Air Quality Monitoring, Particulate Matter, Public Transport, Human Health

18/PP/07

Gauging the Comprehension about Environmental Awareness, Conservation and Sustainability Amongst Primary, Secondary and Undergraduate Students for Precisely Defining Exposure–Response Relationships of Pollution on Health.

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Worldwide anthropogenic activities have led to degradation of environment in multitude of ways and this has in turn precipitated climate change. Unplanned urbanization and industrialization has impacted the quality of breathable air, quality of potable water and contamination of food through contaminants like chemical, nuclear, radioactive, gaseous and particulate matter etc. Rapid urbanization has its own pitfalls and which has led to unplanned development, deforestation, habitat destruction, depletion of water table due to construction etc. to name a few. Literature indicates fraction of the global burden of disease attributable to environment is 22% (WHO, 2016). Available statistics shockingly list 14 Indian cities amongst the list of 20 most polluted cities of the World in terms of fine Particulate Matter ($PM_{2.5}$). For mitigation of the same and alleviate related adverse health effects, there is an immediate need for targeted research, projecting the nature and magnitude of pollution and assessment of exposure–response relationships. Since the chasm of environmental pollution is exceedingly quite large between developing and developed countries a need was felt to gauge the level of environmental education amongst the citizens of tomorrow. In the current investigation a survey on Environmental Awareness amongst the students pursuing primary, secondary and undergraduate levels of study respectively was carried out addressing basic issues associated with environment - awareness, conservation and sustainability. The survey was conducted with 100 people revealing disappointing results. Today, when our future relies on sustainability; only 25 % people were completely aware of the term and could relate its concept with environment. It was saddening to realize that only 2 % students related themselves to environment or saw themselves as a part of it. Thus it has become a need of the hour to start stressing on Environmental Education more than ever before and make it a crucial part of our curriculums at both schools and colleges.

Key words: Environmental Education, Awareness, Sustainability, Mitigation

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Information and Communication Technology

Textbook for Class IX

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NCERT
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FOREWORD

Information and Communication Technology (ICT) has influenced our life in a great way. ICT has literally made inroads into almost all major disciplines across science, social sciences, languages, arts and medicine, etc. It has the potential to create newer avenues for employment, help us communicate and collaborate better, learn, and understand the nature and phenomena as well as improve our skills and standards of living. Policymakers across the globe today agree with the potential of ICT in the teaching-learning process and recommend ICT to be a part of school and teacher education curriculum.

Rapid advancements in Information and Communication Technology (ICT) have created unprecedented opportunities in the field of education and school education in particular. Mastering ICT skills and utilising ICT is of utmost importance for teachers and learners for creating a new learning culture.

ICT is stated to have motivational power. It enables students to enjoy learning as an active participant, such as by bringing the outside world into the classroom or by enhancing one-to-one, one-to-many and many-to-many interaction, among peers, teachers, experts and others. Furthermore, ICT has also helped the students in learning new skills, such as searching and locating appropriate information, making informed choices, learning to recognise the authenticity of sources and collaborating with other learners.

Today, we are living in an interconnected world where ICT-based applications influence the way we learn, communicate, commute or even socialise. Developments in the twenty-first century skills, such as communication, creative and critical thinking, problem solving, collaborative learning, etc., are essential at the school level. ICT plays a key role in developing these skills.

This book aims to introduce the world of ICT and its applications. It will help students to learn, prepare, present and communicate their thoughts, ideas and content through various digital formats, i.e., text, image, audio and video, etc.

The book will also help students to understand the potential of Internet as well as the safety and security issues related to it, and the ways in which one can safeguard themselves against malicious activities and incidents happening in the cyber world.

As an organisation committed to systemic reform and continuous improvement in the quality of its products, NCERT welcomes comments and suggestions from all the stakeholders, which will enable us to revise the content of the textbook.

HRUSHIKESH SENAPATY
Director
National Council of Educational
Research and Training

New Delhi
March, 2018

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PREFACE

It is well accepted that Information and Communication Technology (ICT) has an immense potential to impact learning. Also understanding the basics of ICT and mastering the skills is essential and must be regarded as a core part of education, along with reading, writing and numeracy. The recent efforts of the Government of India (GoI) seeks to deepen the use of ICT in almost every sphere of life. The Digital India Campaign (2015) strives to transform India into a digitally empowered society and knowledge economy by focussing on three vision areas — Digital Infrastructure as Core Utility to Every Citizen, e-Governance and Service on Demand and Digital Literacy and Empowerment of Citizens. The three cardinal principals of the draft New National Education Policy (2016) viz., access, equity and quality could be served well by harnessing the huge potential of ICT. The National Curriculum Framework (2005) recommends to recognise that given the space, time and freedom, children generate new knowledge by engaging with the information passed on to them by adults. The curricula for ICT in education lays an emphasis on empowering the students in a way so that they may get an access to a variety of resources, learn to critically appraise information and resources, and make safe, productive, ethical and legal use of resources.

The Present Class IX Textbook of ICT takes into account goals of the New Education Policy, the recommendations of National Curriculum Framework (2005), the Curricula for ICT in Education and visions of Digital India Campaign (2015). This textbook is an attempt to foster creativity, problem solving and to introduce students to the world of Information and Communication Technology (ICT), which may also shape their future career pursuits.

The textbook contains eight chapters under four learning strands viz. 'Connecting with the World', 'Connecting with Each Other', 'Creating with ICT' and 'Interacting with ICT'. It has been carefully designed with meticulous efforts of the Textbook Development Team comprising School teachers, subject experts, academicians and technical experts from government, non-government and private entities. Some of the members worked at the advisory level while others contributed towards the actual development activity as core team members and members of the textbook development committee. It is hoped that the students will appreciate the immense potential of ICT and will be encouraged to explore and learn further. The textbook writing team has tried to bring a conceptual

coherence. The pedagogy and the use of easily understandable language are at the core of the efforts without sacrificing the technical aspects of the subject.

This book has some features which are earnestly expected to enhance its usefulness for the students and teachers. The book contains nine Quick Response (QR) codes linked to relevant digital resources (text, audio, video, and interactive content, etc.). The first QR code is to access the complete digital textbook. The subsequent QR codes will help to access the relevant digital resources linked to each chapter. There are some questions which require critical thinking which would make students think about real-time applications of ICT. The textbook also includes a large number of examples in order to clarify the concept and to relate these concepts to everyday real-life situations. The inside box in the chapters are introduced to highlight the special features of the concepts covered, which require additional attention of the students.

Completion this book has only been possible due to the continuous support of many professionals and experts. We express our gratitude to Director, NCERT, for entrusting us with the task of developing this textbook as part of a national effort for improving school education.

The draft received excellent academic inputs from students, experts and other practitioners who sincerely suggested improvement during the development of this book. We are thankful to all those who provided these inputs to CIET, NCERT. We are also thankful to the all the members of development and review workshops, language editors and to team DIKSHA for rendering technical support for developing QR codes.

We welcome suggestions and comments from our valued users, specially students and teachers. We wish our young readers of Class IX have an exciting and enjoyable engagement with the world of ICT.

Amarendra Behera
Joint Director
Central Institute of Educational Technology

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CONTENTS

THE CONSTITUTION OF INDIA

PREAMBLE

WE, THE PEOPLE OF INDIA, having solemnly resolved to constitute India into a [1]**[SOVEREIGN SOCIALIST SECULAR DEMOCRATIC REPUBLIC]** and to secure to all its citizens :

JUSTICE, social, economic and political;

LIBERTY of thought, expression, belief, faith and worship;

EQUALITY of status and of opportunity; and to promote among them all

FRATERNITY assuring the dignity of the individual and the [2][unity and integrity of the Nation];

IN OUR CONSTITUENT ASSEMBLY this twenty-sixth day of November, 1949 do **HEREBY ADOPT, ENACT AND GIVE TO OURSELVES THIS CONSTITUTION.**

---

1. Subs. by the Constitution (Forty-second Amendment) Act, 1976, Sec.2, for "Sovereign Democratic Republic" (w.e.f. 3.1.1977)
2. Subs. by the Constitution (Forty-second Amendment) Act, 1976, Sec.2, for "Unity of the Nation" (w.e.f. 3.1.1977)

SYNTHESIS OF SILVER NANOPARTICLES USING *TERMINALIA BELLERICA*: PHYSICOCHEMICAL CHARACTERIZATION AND THEIR ANTI-BIOFILM EVALUATION

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INTRODUCTION

Synthesis of metallic nanoparticles is a momentous area of research in modern material science. Various research groups across the world are synthesizing these nanoparticles for their antibacterial, optical, catalytic and magnetic properties along with their use in targeted drug delivery in model organisms. Silver nanoparticles have attained a special focus because they show many applications in several fields like diagnosis, antimicrobials, catalysis and microelectronics. Many methods have been reported for the synthesis of silver nanoparticles. In the present study, green synthesis of silver nanoparticles was carried out using the stem extract of *Terminalia bellerica*.

OBJECTIVES

- ✓ Green synthesis of silver nanoparticles by using stem extract of *Terminalia bellerica*
- ✓ Physico-chemical characterisation of synthesised silver nanoparticles
- ✓ Determination of catalytic activity of synthesised silver nanoparticles
- ✓ Anti-biofilm activity of silver nanoparticles

APPLICATIONS

Metal Nanoparticles

- Antitumor
- Antioxidant
- Biosenser
- Antimicrobial
- Gene delivery
- Targeted drug deleivery
- Catalytic activity

METHODOLOGY

Stem of plant *Terminalia bellerica* converted into fine powder

↓

Aqueous stem extract was prepared by heating for 4hrs and thoroughly filtered (No turbidity)

↓

$AgNO_3$ solution was added to the aqueous plant extract and heated for 3hrs

↓

Pellet was collected after centrifugation and washing followed by lyophilisation to get dry powder

↓

Characterisation of silver nanoparticles by UV-Vis spectrophotometry, Dynamic Light Scattering and Zeta potential measurement

↓

Catalytic activity and antibiofilm evaluation of silver nanoparticles were evaluated

OBSERVATIONS

Fig 1: Plant extract

Fig 2: AgNPs solution

Change in colour of reaction mixture after 15 minutes

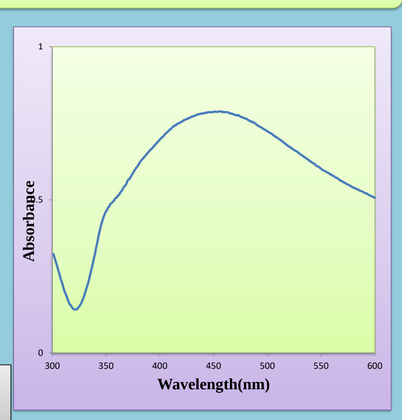

Fig 3: UV-Vis spectra : Absorbance peak of 0.376 was observed at 459 nm

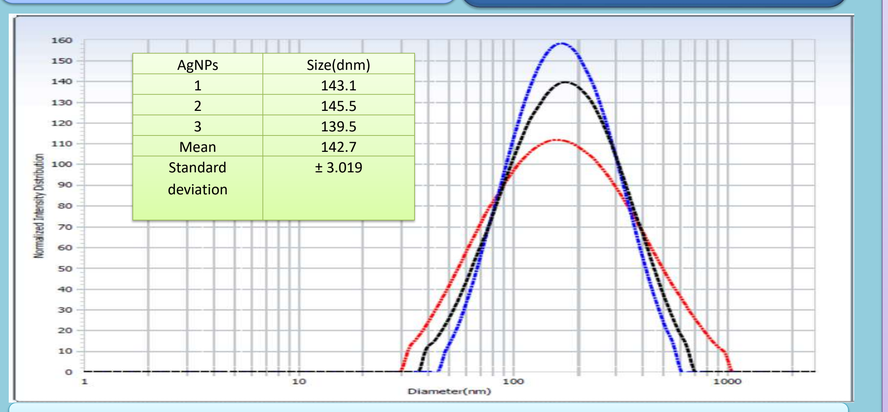

Fig 4: Size of AgNps (DLS)

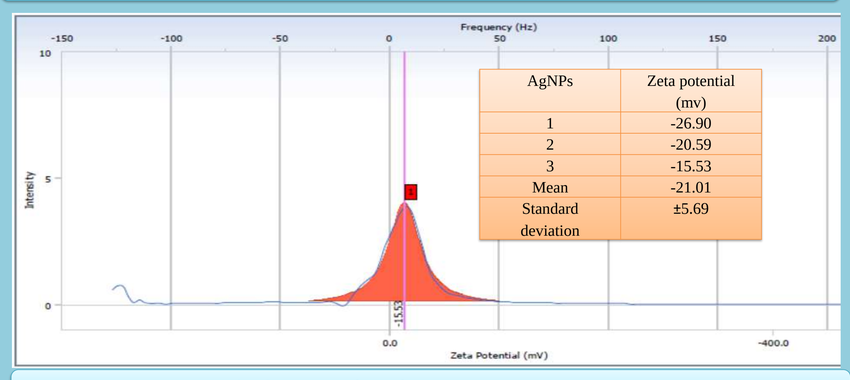

Fig 5 : Zeta potential of AgNps (DLS)

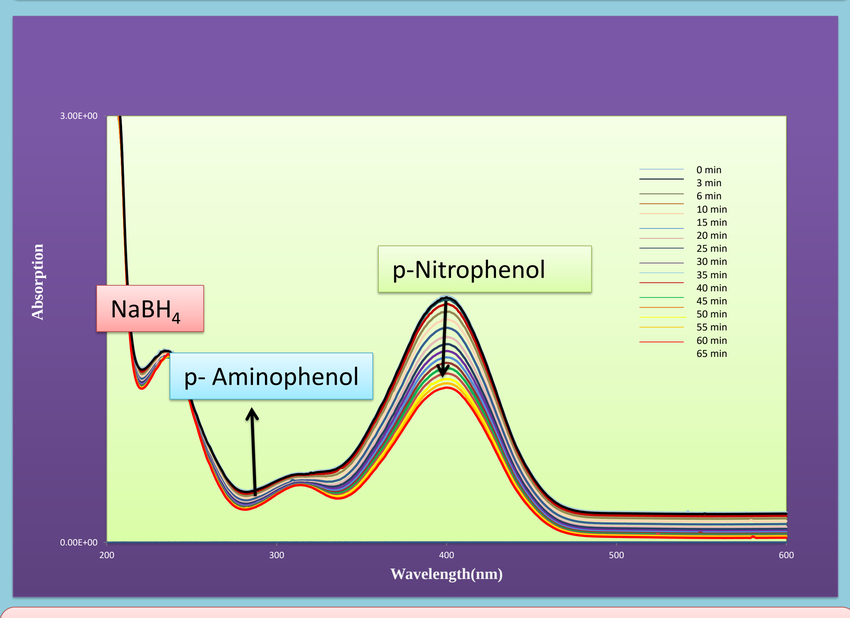

Fig 6: Catalytic Activity of silver nanoparticles with p-nitrophenol in presence of NaBH4

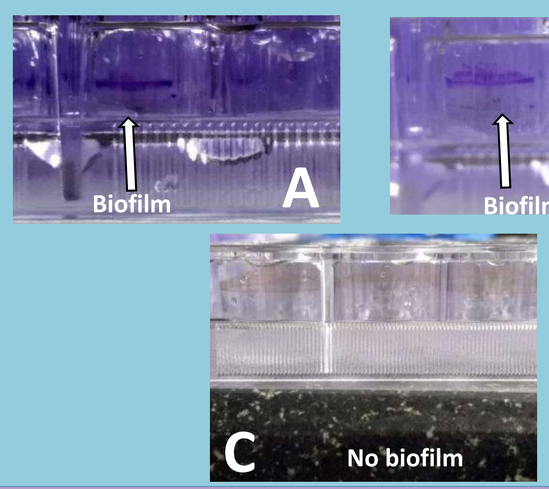

Fig 7: Antibiofilm assay on silver nanoparticles depicts (A) Control 1: Gram positive bacteria forms biofilm on microtitre plate wall (B) Control 2: Gram negative bacteria forms biofilm on the same substrate while in (C) Test : No biofilm formation was found on microtiter plate prior coated with silver nanoparticles.

ANTIBACTERIAL AND ANTI-BIOFILM ACTIVITY

Biofilms are multimicrobial communities enclosed in self-synthetized polymeric matrices, attached to biotic or abiotic surfaces. Biofilms are ubiquitous and nearly all species of microorganisms, bacteria, fungi, yeasts, algae, protozoa, and viruses are able to adhere to surfaces and/or to each other to form biofilms. Quorum sensing (QS) is a bacterial cell-cell communication process that involves the production, detection, and response to extracellular signaling molecules called autoinducers. Silver known for it promising effects against clinical pathogens either performing bactericidal or bacteriostatic effects. Herbal synthesized silver nanoparticles screened for different bacteria (*Pseudomonas auruginosa, Staphylococcus aureus*) and antibiofilm activity was evaluated using bacterial strains (*Escherichia coli, Staphylococcus aureus*).

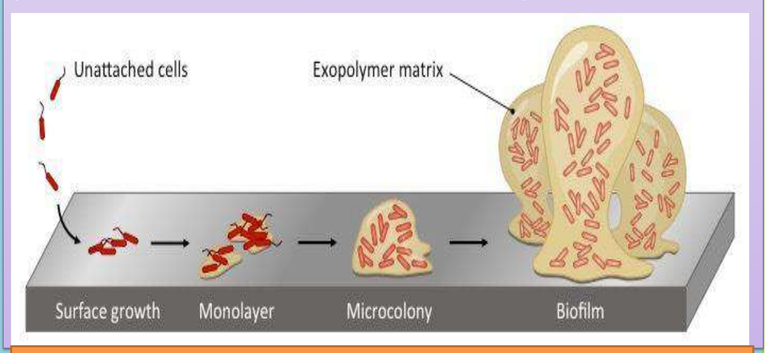

Fig 8: Biofilm formation by microbes
Image adapted from http://ib.bioninja.com.au

DISCUSSION

The silver nanoparticles were made by using Silver nitrate and aq. Stem extract of *Terminalia bellerica* and presence of silver nanoparticles were confirmed by colour change from light to dark and also from UV-Vis spectrophotometry, the characterised maximum absorption of 0.376 was shown by silver nanoparticles at 459nm wavelenth which confirmed their presence. AgNPs shows average size of 142.7 dnm. To measure the stability of AgNPs zeta potential was measured. Zeta potential was found to be -21.01 mv which confirms their high stability. The stem extract of plant contained reducing and capping agents which reduces silver ions from $AgNO_3$ into stable silver nanoparticles. It was found that AgNPs have catalytic property as $NaBH_4$ reduces p-nitrophenol into p-aminophenol significantly in the presence of AgNPs. Silver nanoparticles also screened for antibiofilm activity against *Escherichia coli* and *Staphylococcus aureus.* Silver nanoparticles shows significant bacterial growth inhibition by inhibiting biofilm formation.

REFERENCES

1. R.M. Tripathi, et al. "Catalytic activity of biogenic silver nanoparticles synthesized by *Ficus panda leaf extract", Journal of Molecular Catalysis B: Enzymatic*, 2013; 96:75-80.
2. X.F. Zhang, et al. "Review on Silver Nanoparticles: Synthesis, Characterization,Properties, Applications, and Therapeutic Approaches", *Journal of Molecular Science*, 2016; 17(9):1500-1534.
3. S. Ahmed, et al., "Green synthesis of silver nanoparticles usingAzadirachta indica aqueous leaf extract", *Journal of Radiation Research and Applied Sciences*, 2015; 9(1):1-7.
4. L.B. Devi and A.B. Mandal, "Self-assembly of Ag nanoparticles using hydroxypropyl cyclodextrin: synthesis, characterisation and application for the catalytic reduction of p-nitrophenol", *RSC Advances* , 2013; 3:5238-5253.
5. S. Miquel et al., "Anti-biofilm Activity as a Health Issue", *Frontiers in Microbiology*, 2016; 6;592: 1-14.

FUTURE DIRECTIONS

Work is under progress to perform further characterisation of AgNPs like TEM, FE-SEM, FT-IR, XRD and various biological activities like antimicrobial assay , catalytic activity with azo dyes. Undoubtedly, it is necessary to conduct further research on the toxicity of silver nanoparticles in relation to living organisms.

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Magnetic graphene oxide for adsorption of organic dyes from aqueous solution

Drashya, Shyam Lal, and Sunita Hooda

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Magnetic Graphene Oxide for Adsorption of Organic Dyes from Aqueous Solution

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Abstract: Graphene oxide (GO), a 2-D carbon nanomaterial, large surface area, oxygen-containing groups (like: hydroxyl, epoxy and carboxyl) and excellent water dispersibility due to it is good adsorbent dye removal from pollutant water[1]. But it's difficult to separate GO from water after adsorption. Therefore, Iron oxide was introduced in Graphene oxide by decorating method to make separation more efficient[2]. We present herein a one step process to prepare Magnetic Graphene oxide (MGO). The Fourier transform infrared spectrometer (FT-IR), X-ray diffraction (XRD) and Raman Spectroscopy characterized the chemical structure of the MGO composite. The adsorption of dyes onto MGO was studied in relation to initial concentration of Dyes, contact time, adsorbent dose, temperature and pH value of solution. We have studied adsorption capacity of different dyes (Methylene blue and crystal violet) by MGO.

Keywords: Graphene oxide, Iron oxide, methylene blue, crystal violet and Adsorption.

INTRODUCTION

The contaminants (dyes, heavy metals etc.) in water are growing rapidly due to the lack of knowledge about their effect on living species these contaminate effecting our life slowly but regularly. Therefore, we need a technology that can reduce effect of these contaminants. So many technologies are being used, adsorption technology is one of the growing technologies because it can be used in large scale and it is cost effective. For maximum adsorption a material should contain maximum oxide group, there are so many adsorbent materials available in the market. The new era going to start in the field of electronics, bio-sensing, gas-sensing, optics, water purification, mechanical, catalyst, and drug delivery agent etc., [3]due to the world first 2-D material (Graphene) has arrived. Graphene is a one atom thick, single sheet of carbon atom arranged in honeycomb structure. Its sister materials are also gaining tremendous interest of researchers in the above applications. Graphene oxide, oxidized form of Graphene is a unique 2-D material which has different types of oxide groups (-OH,-C-O-C-, C=O and –COOH) available on its basal plane[4], therefore GO is very suitable for adsorption of contaminants. But for maximum use of adsorbent material recyclability should be high. The recyclability of GO is low to overcome this drawback in GO, magnetic nanoparticles comes in the role[1]. In this paper we have synthesized MGO by co-precipitations method [2]and two dyes (methylene blue and crystal violet) were used for adsorption for different temperature, pH, contact time and concentration of dosage.

EXPERIMENTAL SECTION

Materials: All the chemicals used e.g. Graphite, methylene blue Sulfuric acid, KMnO4, sodium nitrate, and hydrogen peroxide were all of analytical grade.

Graphene oxide preparation: Graphene oxide (GO) will be prepared from graphite powder by a Hummer's method. In this method Graphite (1 g), sodium nitrate (NaNO3, 0.50 g) and concentrated sulfuric acid (H2SO4, 23 ml) added into a 500 ml flask kept at 5˚C in an ice bath under continuous stirring for 5 min. Then, potassium

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permanganate (KMnO4, 3 g) was slowly added into the flask to prevent strong reaction at local points. The reaction mixture was then maintained at 5˚C for 2 h and then the reaction temperature was slowly raised to 35˚C and kept for another 30 min with vigorous stirring. Deionized water (46 ml) was added to the suspension and as consequence of the hydration heat the temperature increased to 98˚C. The bath was kept at this temperature for 30 min with stirring. The reaction was then finished by adding deionized water (140 ml) and hydrogen peroxide (10% v/v, 10 ml). The resulting product has a brown yellowish color and was separated by vacuum filtration from the solution. The resulting GO powders were washed 5 times with diluted HCl (5%, 200 ml) solution and warm (70˚C) deionized water to remove the remnant Mn ions and acid respectively and later dried in air at 60˚C into an oven by 12 hours.5

Preparation of M/GO Composite: FeCl3 solution (1 M, 2 ml) and FeCl2·4H2O solution (0.5 M, 2 ml) were added in a flask, and the mixture was stirred at room temperature for 20 min to dissolve the iron salt. After that GO was added, the mixture was stirred for another 20 min. Subsequently, 20 mL of ammonia solution was added and black MGO was formed immediately.1

Dye Adsorption: 50ml of dye solution was shaken with 5mg MGO on shaker with 150 rpm at room temperature. pH value of dye solution adjusted by 0.1M NaOH or 0.1M HCl using pH meter. After this, adsorbent was separated using strong permanent magnet from dye solution. Dye concentration calculated by UV-vis spectrophotometer. The percent removal of dye solution by MGO was calculated using this formula:

$$A\% = \frac{(Co - Ce) * 100}{\text{Co}}$$

Where Co and Ce referred as initial and equilibrium concentration of dye solution respectively.

Characterizations: In FTIR spectra of MGO peak appeared at 566cm-1, which corresponds to the stretching mode of Fe−O.6The peaks at 1207.95, 1374.25, and 1720 cm-1 correspond to C−O−C stretching vibrations, the C−O−H deformation vibrations, and the C=O stretching vibrations of the −COOH groups, respectively.7 The broad and intense band observed at 3365.04cm-1 can be ascribed to the stretching vibrations of –OH and at 1529.86 cm-1 corresponds to aromatic skeletal C=C stretching vibrations8.In the Raman Spectroscopy of MGO, the peaks at 278,504 and 936 cm-1which corresponds to Fe3O49. We are getting signature peak of GO, D peak (1348cm-1) , which relates to defects and G peak (1603cm-1) which contributes to carbon-carbon stretching (SP2 hybridization). For the XRD pattern of pure Fe3O4, the peaks of 30.22°, 35.66°, 43.23°, 53.70°,58.45° and 62.78°corresponded to (220), (311), (400), (422), (511), and (440) planes.10 The FTIR, Raman and XRD spectra of synthesized composite are shown in Fig. 1.

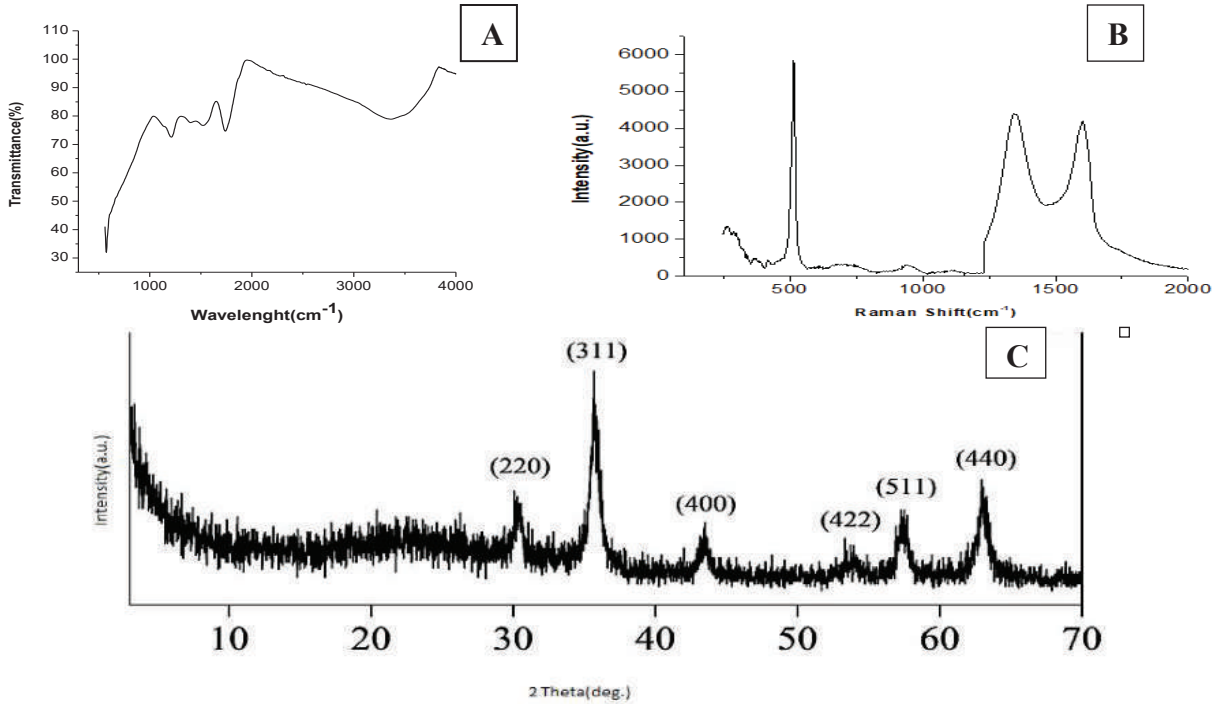

FIGURE 1: Showing FTIR (A) , Raman (B) and (C) XRD of MGO .

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RESULTS AND DISCUSSION

The adsorption percentage of MB (4ppm) and CV (4ppm) at different temperatures, contact times, dose of composite of MGO and pH was studied in detail as shown in Fig.2. The maximum adsorption was observed at 328 K for both the dyes and calculated percentage adsorption was 100% for MB and 85.25% for CV. In the contact time analysis, exponential increase was found for both dyes up to 35 min. of contact time after that constant adsorption, (88.6% for CV) and (96.34% for MB) was observed. The MGO dose was found to be 5mg for both dyes and percentage adsorptions were 96.34% for MB and 85.65% for CV. At last, pH analysis shows maximum adsorption at pH-6 and percentage adsorptions were 82.92 % for MB and 78.65% for CV. The adsorption capacity for MB is 114.45 mg/g and for CV 82.94 mg/g, the concentration of MB and CV were 4 mM. Adsorption depends on oxide groups present in the GO. The oxide group depends on synthetic process used for GO preparation. In our synthesized magnetic GO we are getting higher adsorption for MB then the reported one[1]. Chang et al[1] had reported the adsorption of 85.64mg/g MB dye at concentration of dye 4mM but in this article the adsorption of 114.45mg/g was observed.

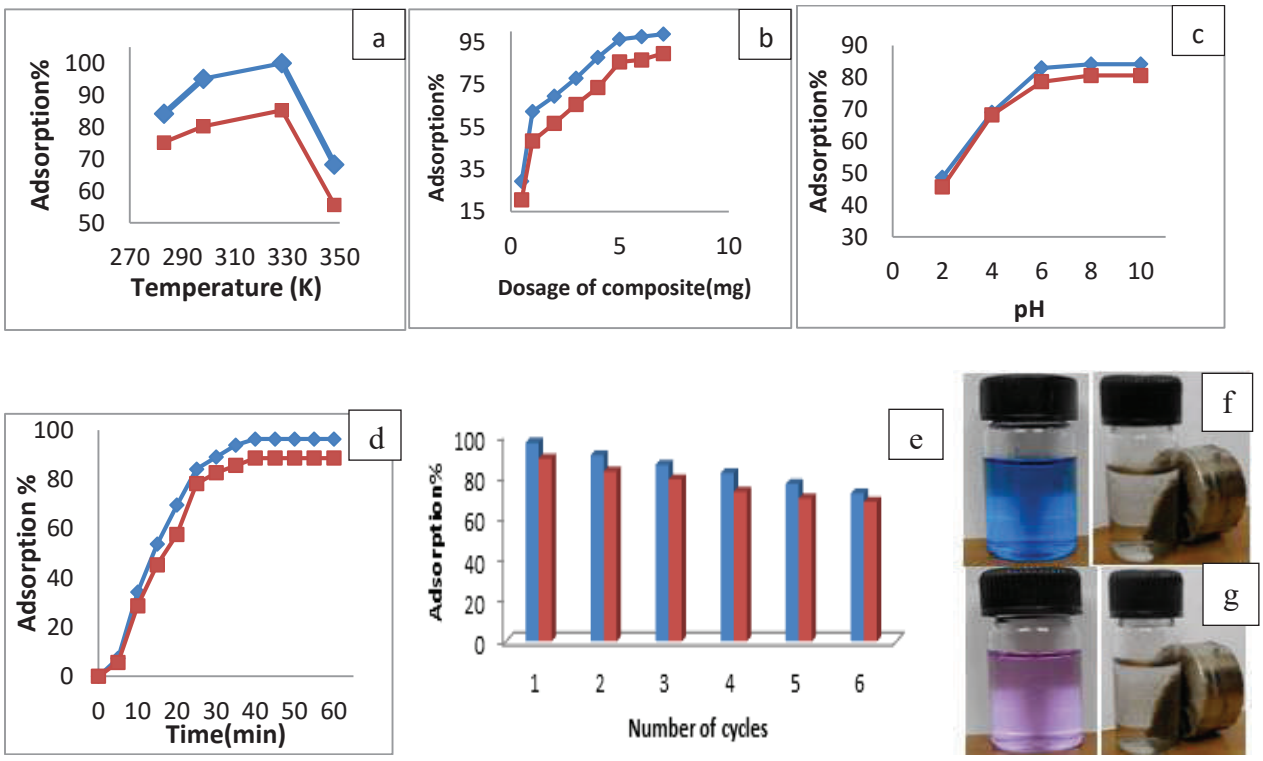

FIGURE 2: showing Percentage adsorption at different temperature(a), Dose of composition (b), pH(c), and contact time(d).(e) Removal efficiency of MGO adsorbent in six successive cycles of desorption-adsorption compared with the original adsorption capacity, (f & g) before and after adsorption of MB and CV respectively. Blue color indicates to MB and Dark brown to CV.

CONCLUSION

The M-GO composite has been synthesized by co-precipitation method, related characterizations conforms the formation of composite. Percentage adsorption of MB and CV were checked at different temperatures, contact time, pH and dose of adsorbent. Maximum adsorption capacity for MB is 114.45 mg/g and for CV it is 82.94 mg/g.

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REFERENCES

1. Zehong Cheng, Jie Liao, Benzhao He, Fan Zhang, Faai Zhang, Xiaohua Huang, and Li Zhou One-Step Fabrication of Graphene Oxide Enhanced Magnetic Composite Gel for Highly Efficient Dye Adsorption and Catalysis. ACS Sustainable Chem. Eng. 2015, 3 (7), pp 1677–1685.
2. Haochun Shi, Weisong Li, Lei Zhong, and Chunjian Xu. Methylene Blue Adsorption from Aqueous Solution by Magnetic Cellulose/Graphene Oxide Composite: Equilibrium, Kinetics, and Thermodynamics. Ind. Eng. Chem. Res. 2014, 53, 1108−1118.
3. Novoselov KS, Fal'ko VI, Colombo L, Gellert PR, Schwab MG, Kim K. A roadmap for graphene. Nature 2012;490(7419):192–200.
4. Lerf, A.; He, H. Y.; Forster, M.; Klinowski, J. J. Phys. Chem. B 1998, 102, 4477–4482.
5. Materials Chemistry and Physics 153 (2015) 209e220 Graphene oxide powders with different oxidation degree, prepared by synthesis variations of the Hummers method Jesus Guerrero-Contreras, F. Caballero-Briones.
6. Kassaee, M. Z.; Motamedi, E.; Majdi, M. Magnetic Fe3O4−graphene oxide/polystyrene: Fabrication and characterization of a promising nanocomposite. Chem. Eng. J. 2011, 172, 540−549.
7. He, G. Y.; Liu, W. F.; Sun, X. Q.; Chen, Q.; Wang, X.; Chen, H.Q. Fe3O4@graphene oxide composite: A magnetically separable and efficient catalyst for the reduction of nitroarenes. Mater. Res. Bull. 2013, 48, 1885−1890.
8. He, G. Y.; Chen, H. Q.; Zhu, J. W.; Bei, F. L.; Sun, X. Q.; Wang,X. Synthesis and characterization of graphene paper with controllable properties via chemical reduction. J. Mater. Chem. 2011, 21, 14631−14638.
9. Marcin Wysokowski, Mykhailo Motylenko, Synthesis of nanostructured chitin–hematite composites under extreme biomimetic conditions RSC Adv., 2014, 4, 61743.
10. Guo, J.; Ye, X.; Liu, W.; Wu, Q.; Shen, H.; Shu, K. Preparation and characterization of poly(acrylonitrile-co-acrylic acid) nanofibrous composites with Fe3O4 magnetic nanoparticles. Mater. Lett. 2009, 63,1326−1328.

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FOREWORD

Information Technology has continuously been crossing the barriers of access and communication and reaching more and more people. The number of internet users in India has been on the rise. The tremendous growth in computer science, telecommunications and information technology has resulted in automation of various tasks and contributed to the ease of living. Technology has made continuous inroads into diverse areas—be it business, commerce, science, sports, health, transportation or education. Today, we are living in an interconnected world where computer based applications influence the way we learn, communicate, commute, or even socialise.

With so many users of information and communication technology (ICT), huge volumes of data are continuously generated at an unprecedented rate. Many innovative business models are being evolved which utilise such data to reach potential customers in a more targeted way. Government agencies are also using data to deliver services and fast track progress of different programmes, strengthen accountability and to make more informed decisions. This has been creating better opportunities for our youth not only to enter the field of technical education but also in the world of work. NCERT, for the first time, has developed a textbook on 'Informative Practices' to develop skill sets in students to make use of the opportunities provided by ICT.

This book focuses on the fundamental concepts related to handling of data while opening a window to the emerging areas of data processing. It seeks to address the dual challenges of reducing curricular load as well as introducing the latest development in the field of ICT.

As an organisation committed to systemic reforms and continuous improvement in the quality of its curricular material, NCERT welcomes comments and suggestions to enable us to bring about necessary changes in its further publications.

HRUSHIKESH SENAPATY
Director
National Council of Educational
Research and Training

New Delhi
July 2019

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PREFACE

In the present education system of our country, specialised/discipline based courses are introduced at the higher secondary stage. This stage is crucial as well as challenging because of the transition from general to discipline-based curriculum. The syllabus at this stage needs to have sufficient rigour and depth while remaining mindful of the comprehension level of the learners. Further, the textbook should not be heavily loaded with content.

We are living in an era where information drives many of our socio-economic decisions. Millions of people are accessing internet round the clock for availing various services and thereby generating vast amount of data. Processing of data is becoming a key skill with applications across the disciplines. Thus, study of basic concepts of data handling and analysis is becoming more and more desirable. There are courses offered in the name of computer science, Information and Communication Technology (ICT), Information Technology (IT), etc. by various boards and schools up to the secondary stage, as an optional subject. These mainly focus on using computer for word processing, presentation tools and application software.

Informatics Practices (IP) at the higher secondary stage of school education is also offered as an optional subject. At this stage, students can take up IP with the aim of pursuing a career in data science or related areas after going through professional courses at higher levels. Therefore, at the higher secondary stage, the curriculum of IP introduces the basics of database management systems and data processing. The book has eight chapters covering the following broader themes:

- Basic understanding of computer systems and their evolution, introduction to software and their categorisation, computer memory, awareness of emerging trends in the field of information and communication technology.
- Basic constructs of a program using Python programming language — program structure, identifiers, variables, flow of control, advanced data types like Lists and Dictionaries.
- Handling data using specialised Python library called NumPy — concept of single and multi-dimensional Array.
- Concepts of data, database, and relational database management system using MySQL. Structured query language — data definition, data manipulation and data querying.

Python programming language and NumPy are introduced using both the interactive and script mode. A number of hands-on examples are given in Python, NumPy and MySQL to gradually explain the methodology to solve different types of problems and handle data. The programming and database related examples as well as the exercises in those chapters are required to be solved in a computer and verified with the given outputs.

The chapters in this book have two additional components — activities for self assessment and 'think and reflect' to generate further interest in the learner.

Group projects through case studies are proposed to solve complex problems. Some exercises have been made in case-study form to promote problem-finding and problem-solving skills.

These chapters have been written by involving practicing teachers as well as subject experts. These have been iteratively peer-reviewed. Several iterations have resulted into this book. Thanks to the authors and reviewers for their valuable contribution.

Comments and suggestions are welcome to make this endeavour par excellence.

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This is to certify that Dr. Harita Ahuja, Assistant Professor, Acharya Narendra Dev College, University of Delhi, actively contributed in editing the below mentioned lessons of Certificate in Computer Applications Vocational course of National Institute of Open Schooling (NIOS).

Sr. No.	Lesson Name
1	Computer concepts and Networking
2	Computer Software
3	Basics of Data Management
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(Radhika. B)

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Impact of fabrication of pyramidal structure on silicon wafer surface in ZnO/Si heterojunction

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Manju Rani, Jyoti Kashyap, Udaibir Singh, and Avinashi Kapoor

Impact of Fabrication of Pyramidal Structure on Silicon Wafer Surface in ZnO/Si Heterojunction

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Abstract. We have demonstrated the impact of fabrication of pyramidal structure on Silicon (Si) wafer substrate in ZnO/Si heterojunction on its structural and optical properties. The texture on Si substrate is obtained using wet etching method for different time durations. Patterns of photoresist have been used to get desired size of the structure. Scanning electron microscopy (SEM) of the samples shows a pyramidal structure on the surface of Si substrate. The thin film of ZnO material on p-type planar silicon (100) and textured Si (100) substrate has been deposited by using RF magnetron sputtering technique. ZnO thin films produce an anti reflection (AR) effect when deposited on silicon substrate. The structural and optical properties of ZnO/Si (TS) heterojunction were studied by x-ray diffraction (XRD) and UV-Vis spectrophotometer respectively. XRD patterns of the ZnO/Si and ZnO/Si (TS) heterojunctions show the orientation of the ZnO film fabricated on silicon substrate. Their reflectance spectra show reduction in reflectance proportional to increase in time duration of texturization. This study indicates that ZnO/Si (TS) heterojunction may be utilized in various heterojunction and photovoltaic devices for reduction in reflection of incident light.

INTRODUCTION

Silicon is the first choice for manufacturing solar cells in present scenario due to the facts that it has the potential for high efficiency, reliability, easily availability in the earth's crust, most widely studied literature. In silicon based solar cells one of the prominent issues is high reflection of the solar radiation by the silicon surface. Due to this optical loss, a limited efficiency of the solar cell is achieved. To reduce the reflectance, an anti- reflection coating is used on the silicon surface. ZnO (Zinc Oxide) thin films have got an important place in ZnO/Si heterojunction solar cells as anti-reflection (AR) coating [I,2]. The reason for using ZnO as an anti- reflecting coating is that there is much difference in the refractive indices of Si and ZnO [4,5,6]. ZnO has a large optical bandgap in the range of 3.3 to 3.7 eV, which are transparent in the visible region. Also ZnO has good adhesion properties and hardness. ZnO thin films have got multiple applications ranging from UV light emitters, varistors, transparent high power electronics, surface acoustic wave devices, piezo-electric transducers, chemical and gas sensing devices etc. ZnO has a direct band gap (3.37 eV), a high exciton binding energy (60 meV) at room temperature and a wurtzite crystal structure. ZnO thin films have been proved to be a good choice as anti-reflection coating (ARC) in solar cells.

Texturization of the silicon surface (TS) can further enhance the light trapping in the ZnO/Si (TS) heterojunction. Texturization provides better absorption of incident light by means of second reflection. Fig. 1 shows an indicating diagram of light getting reflected from a texturized surface [17]. Also bigger surface area becomes available for absorption of light which in turn reduces the level of reflectance by the silicon surface [3].

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Absorption enhancement by surface texturing in ZnO/Si heterojunction

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Jyoti Kashyap, Poonam Shokeen, Manju Rani, Udaibir Singh, and Avinashi Kapoor

Absorption Enhancement by Surface Texturing in ZnO/Si Heterojunction

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Abstract. In this paper, thin film of ZnO nanoparticles deposited on a planar Si (100) and a textured Si (100) substrate are investigated. Chemical etching is used to prepare textured Si substrate and RF magnetron sputtering is used to deposite ZnO thin films. The surface morphology and reflectance are studied with SEM and UV-VIS Spectroscopy, respectively. Structural morphology of the etched wafer indicate random pyramidal structures. Optical study indicates a significant reduction in reflectance for textured silicon (TS) heterojunction in comparison to planar Si (PS) heterojunction. This study promotes the study of heterojunction devices and surface texturing for light management in various optoelectronic devices.

INTRODUCTION

Silicon is widely used in optoelectronic devices under various structural morphologies [1]. Surface reflections contribute to major optical losses in the system. It has motivated a group of scientists to tackle this problem [2]. One of the popular methods to reduce the reflection is Surface Texturing. The texturization of the silicon surface leads to an increase in its topographic irregularities which results in an increased effective surface area. Anisotropic etching is one of the most accepted for texturization of industrial silicon solar cells to reduce reflection losses from the front surface [3-6]. Alkaline solutions are the main anisotropic etchants, where the main component can be either an organic or an inorganic compound [7]. Sodium Hydroxides (NaOH) or Potassium Hydroxide (KOH) are the popular inorganic solutes which are mixed with isopropyl alcohol (IPA) and water. In this study, texturization based on alkaline anisotropic etching was investigated using KOH as alkaline etchant and IPA as a surfactant [8]. Adding IPA can improve the wettability of silicon surface and control the etching rate. It prevents an explosive reaction between the silicon surface and the OH-ions [9-10]. Etching of silicon in KOH solution has the advantages of simplicity, ease of handling, low-cost and homogeneous etching rate of the (100) crystal plane [11].

Zinc oxide (ZnO) is a low-cost, non-toxic material. It has high optical transparency and low resistivity. It can be deposited at low temperatures. As a result, it finds applications in a wide range of semiconductor devices [12-15]. ZnO films can be deposited by a variety of techniques like spray pyrolysis, molecular beam epitaxy, thermal evaporation, RF magnetron sputtering, sol-gel and others [16]. It acts as a n-type semiconductor when deposited on top of p-Si. ZnO/Si heterojunction shows an excellent response in optical spectrum and relatively simple to fabricate.

In the present work, we optimize the process of surface texturization to reduce reflections from the top surface of solar cell. We have also fabricated ZnO/Si heterojunction solar cells with textured and plane Si wafer. A thin film of

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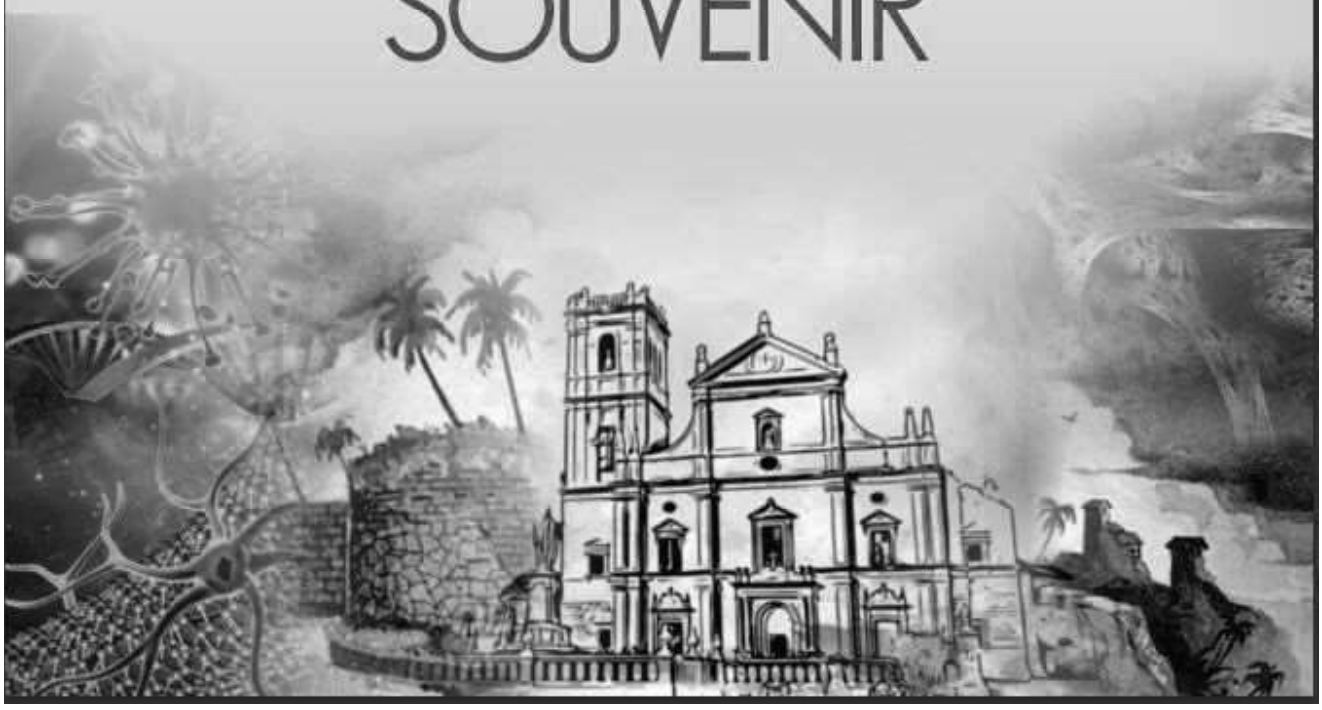


Time	Day 3, Friday, 18 October, 2019		
Parallel Sessions	**Hall I (Mandovi)**	**Hall II (Zuari)**	**Hall III (Sal)**
	Innovative Fibres and Fibrous Material **Chairs:** Apurba Das & Satyendra Mishra	**Smart Biomaterials and Drug Delivery** **Chairs**: Seema Agarwal & Sunita Rattan	
09:00-09:20 h	IL: Jitendra Pratap Singh	IL: Vikas Gite	**Wisdom Contest**
09:20-09:40 h	IL: Shubham Joshi	IL: Sofia Coppari	
09:40-09:50 h	OL: Purnima D	OL: Ashwini Wali	
09:50-10:00 h	OL: Upama Baruah	OL: Sravendra Rana	
10:00-10:10 h	OL: Richa Sharma	OL: H S Nanda	
10:10-10:20 h	**Break**		
Parallel Sessions	**Hall I (Mandovi)**	**Hall II (Zuari)**	
	Miscellaneous Materials **Chairs:** J K Rathour & Amar Yadav	**Polymers for Advanced Technology** Chairs: Narayan C Mishra & Anupama Sharma	
10:20-10:40 h	IL: Seema Agarwal	IL: Deepak Gupta	
10:40-11:00 h	IL: Navinchandra G. Shimpi	IL: Nilay Kanti Pramanik	
11:00-11:10 h	OL: Monika Chhajed	OL: Sanjay Singh	
11:10-11:20 h	OL: Dinesh Kumar	OL: Akhtarul Islam Amjad	
11:20-11:30 h	OL: Madan Lal Regar	OL: Parthiv Trivedi	
11:30-11:45 h	**Tea**		
11:45-13:00 h	Valedictory Function Felicitation Function Award Ceremony		
13:00-14:00 h	**Lunch**		
End of the event !			

Session	Miscellaneous Materials	
Chairs: J K Rathour & Amar Yadav		**Venue: Hall I**
Time	**Lecture**	**Title/Author**
10:20-10:40 h	IL:	Non-Flammable and High Barrier Polymer Electrospun Membranes **Seema Agarwal** Universität Bayreuth, Bayreuth, Germany
10:40-11:00 h	IL:	Fabrication of the PAN/Ag-gC_3N_4 Nanofibers towards the Visible Light Mediated Green and Sustainable Approach for the Selective Oxidation of Styrene, -CH_2 Bonded Molecule and Benzene **Navinchandra G. Shimpi** University of Mumbai, Mumbai, India
11:00-11:10 h	OL:	Esterified Superhydrophobic Nanocellulose Based Aerogel for Oil Spill Treatment **Monika Chhajed** Indian Institute of Technology Roorkee, Saharanpur, India
11:10-11:20 h	OL:	Physico-Chemical Modifications Induced by 70 MeV Carbon Ions in Alpha Phasedpolyvinylidene Fluoride (Alpha PVDF) –Ag(NPs) Composites **Dinesh Kumar** Acharya Narendra Dev College, New Delhi, India
11:20-11:30 h	OL:	Effect of Strain on Conductivity of High Lycra Yarn Fabric **Madan Lal Regar** Uttar Pradesh Textile Technology Institute, Kanpur, India

Chapter

Design and Growth of Metal Oxide Film as Liquefied Petroleum Gas Sensors

Rakesh Kumar Sonker, Saroj Radheyshyam Shabajeet, Rahul Johari and Balchandra Yadav

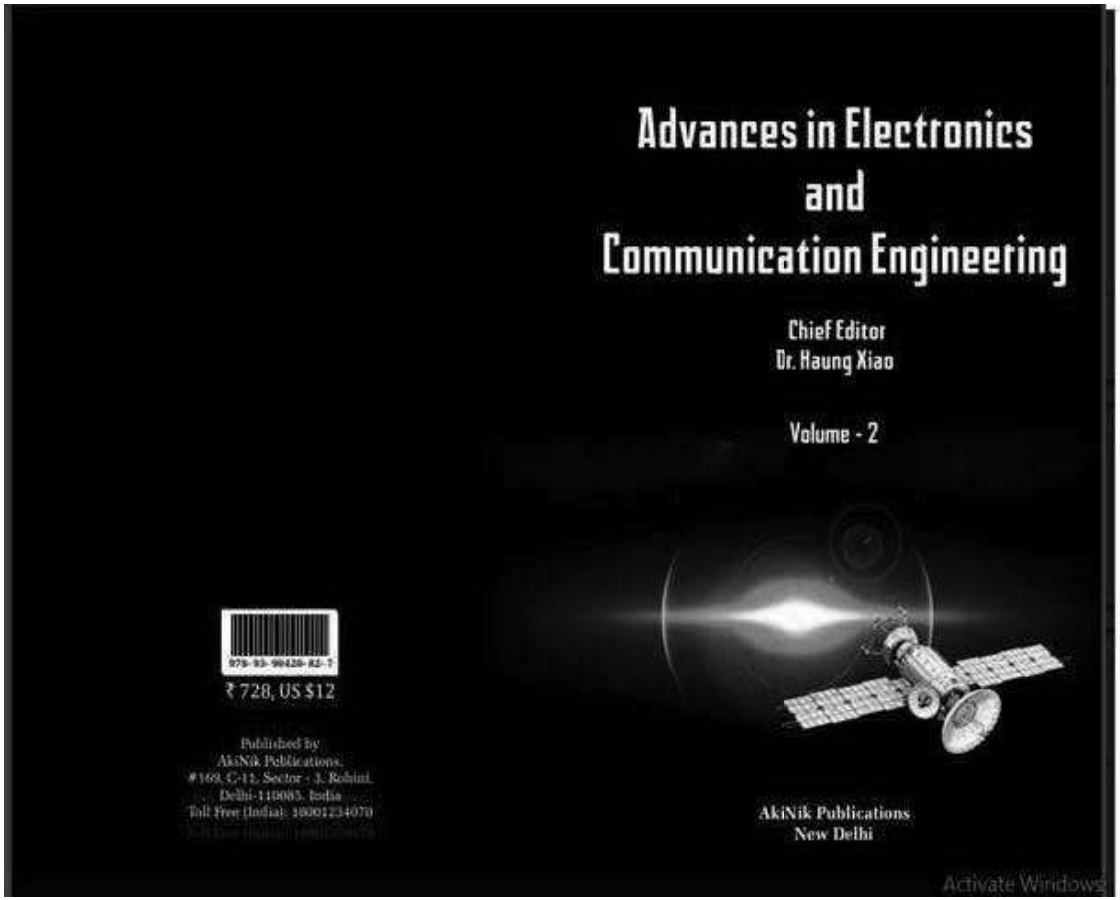
Abstract

Nowadays innovations in synthesis methods for metal oxide-based nanomaterials such as nanostructured and both physical and chemical route techniques have been adopted by various researchers around the world. The investigation has been focusing on various deposition parameters for fabricating nanostructured metal oxide. Gas sensors that use metal oxide materials are broadly utilized in industry to monitor combustion processes. While they are economical to powerful in high temperature environments, many of these instruments are not selective towards the species of interest when placed in a stream composed of multiple gases. Research on nanostructured metal oxide materials has generated great interest in scientific community. Metal oxide is a chemically stable, harmless, biocompatible, inexpensive material with very high dielectric constant and interesting photocatalytic activities. It is a wide-gap semiconductor and depending on its chemical composition, it shows a large range of electrical conductivity. Synthesis strategies regarding nanocomposites of metal oxide with other inorganic and organic materials sensing activities has been reviewed. The measure response of metal oxide film-based sensor highat low concentration of LPG.

Keywords: metal oxide, thin film, deposition technique, LPG sensor

1. Introduction

Liquefied petroleum gas (LPG) is the composition of hydrocarbons mainly propane and butane. The lower explosive limit (LEL) as specified by National Institute for Occupational Safety and Health (NIOSH) and Occupational Safety and Health Administration (OSHA) standards for chemical hazards is 21,000 ppm (2.1% by volume in air) for propane and 19,000 ppm (1.9% by volume in air) for butane. The permissible exposure limit (PEL) for LPG as specified by NIOSH and OSHA standards is 1000 ppm [1]. LPG is mostly used as fuel for vehicles and as cooking gas for household applications. Exact observing of leakages of LPG even at low concentrations can be useful to avoid accidental explosions [2, 3]. Sensors have turned into an indispensable piece of the cutting-edge human progress attributable to its significance, where metal oxides have played a major role as reliable sensor materials. Nanoparticle do research presents broad scope for the growth of novel solutions in the field of healthcare, cosmetics, optics and electronics. Varying their sub-atomic and nuclear states results in surprising results, which may not be conceivable by utilizing the materials in their unique states. A few metal oxides



Chapter - 3

Semiconductor Materials in Electronic Devices

Dr. Neelakshi Nili Kachari Borah, Jyotsna Sharma and Dr. Siddhartha

Abstract

The three semiconductor materials used most frequently in the construction of electronic devices are Ge, Si and GaAs. The construction of every discrete solid-state electronic device or integrated circuits begins with a semiconductor material. Use of semiconductor has brought an incredible change in the design, operation and application techniques of the devices.

Keyword: semiconducting materials, semiconductor technology

Introduction to semiconductor materials in electronic devices

The history of electronic devices technology has taken a big leap after the discovery of semiconducting elements. The devices which control the flow of electrons are called electronic devices. These devices are the main building blocks of electronic circuits. Such devices have established wide applications because of their reliability, compactness and low cost. These are discrete components which are used in power devices, optical sensors, and light emitters, including solid-state lasers etc. Though the basic fundamental principles have changed very little over the time, the devices are now incredibly smaller, operation speeds are truly excellent and new gadgets are coming to the surface every alternate day. Altogether the discovery of semiconducting materials has brought major changes in the construction techniques, general characteristics and application techniques of the decade old electronic devices. It has lead us to the miniaturization era of these devices and the recent developments have left us wondering about its limits.

The study of semiconductor materials began in the early 19th century. Over the years, many semiconductor materials have been investigated. The electronic properties of the semiconductor materials have allowed us to easily manipulate their behaviour by the addition of impurities known as doping. The conductivity of a semiconductor is generally sensitive to temperature, illumination, magnetic fields and minute amounts of impurity atoms. Current conduction in a semiconductor occurs due to free electrons

Page No. 117

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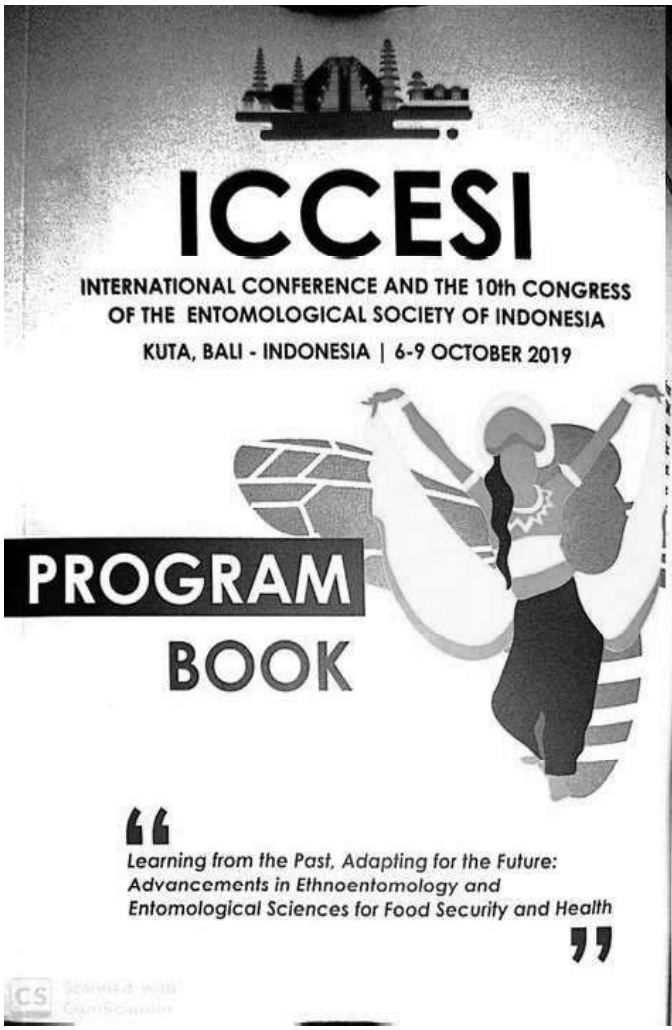
Prof. Neera Kapoor
Professor in Life Sciences

Dated: 6th October, 2020

To whom it may concern

This is to certify that Dr. Sarita Kumar, Associate Professor, Department of Zoology, Acharya Narendra Dev College, University of Delhi attended a workshop at IGNOU on Feb 19-20, 2020 and developed the Course Material and Laboratory Manual of the BZYCL-136 Course (Physiology and Biochemistry: Laboratory) for the students of B.Sc. General (With Zoology), IGNOU, New Delhi.

(Neera Kapoor)



Abstract ID: P-07

BIOCHEMICAL CHARACTERIZATION OF ACETAMIPRID RESISTANCE IN LABORATORY-BRED POPULATION OF *Aedes aegypti* L. LARVAE

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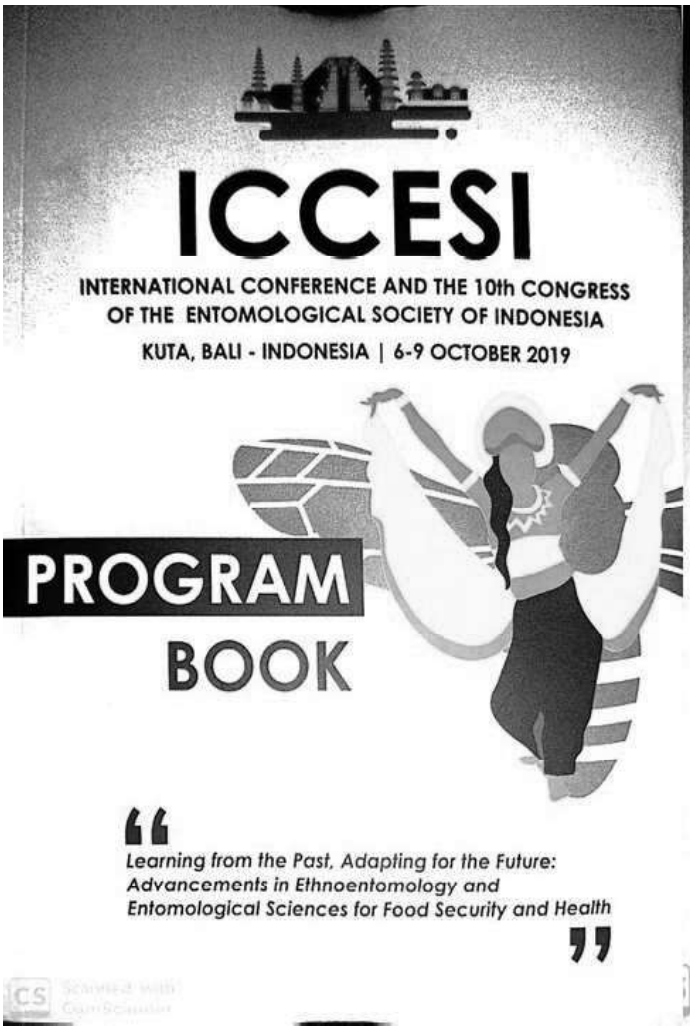
With constant rise in cases of Zika, dengue and Chikungunya worldwide, control of *Aedes aegypti* has become a principal concern. The most recommended plan to control mosquito-borne diseases primarily lies in vector management and disturbing their disease-transmission cycle. Wide-ranging use of different classes of organic insecticides for mosquito control has led to the development of high levels of resistance making them less operative at safe dosages imposing us to explore novel insecticides. Present study investigates the bio-efficacy of a neonicotinoid, acetamiprid on the *Aedes aegypti* larvae, development of resistance after subjecting acetamiprid selection pressure for 10 successive generations and biochemical characterization of the resistance developed. Acetamiprid exposure of the parent population of *A. aegypti* early fourth instars resulted in respective LC_{50} and LC_{90} values of 0.188 ppm and 1.315 ppm. Selection with acetamiprid for 10 successive generations (ACSF-10) reduced its efficacy by 20-fold. Involvement of four enzymes; alpha esterases, beta esterases, Glutathione-S-transferases and acetylcholine esterases in development of acetamiprid resistance was investigated to uncover mode of action of acetamiprid. An elevation of 1.4-fold and 2.1-fold was observed in alpha-esterases and beta-esterases activity in ACSF-10 as compared to ACSF-5. However, activity of glutathione-s-tranferases decreased in ACSF-5 which rose to 12-fold in ACSF-10. Similarly, the activity of acetylcholine esterases was found to be much higher in resistant generations as compared to the parental strains. Our results indicate individual/synergistic contribution of different enzymes leading to acetamiprid detoxification. Further research is being conducted to identify the role of target site mutations in resistance development.

Keyword: *Aedes aegypti*, acetamiprid, resistance, esterases, acetylcholine esterases



Abstract ID: P-08

LUFENURON: A POTENTIAL CHITIN SYNTHESIS INHIBITOR AGAINST *Aedes aegypti* L

Kungreiliu Panmei[1,2*], Sarita Kumar[2]

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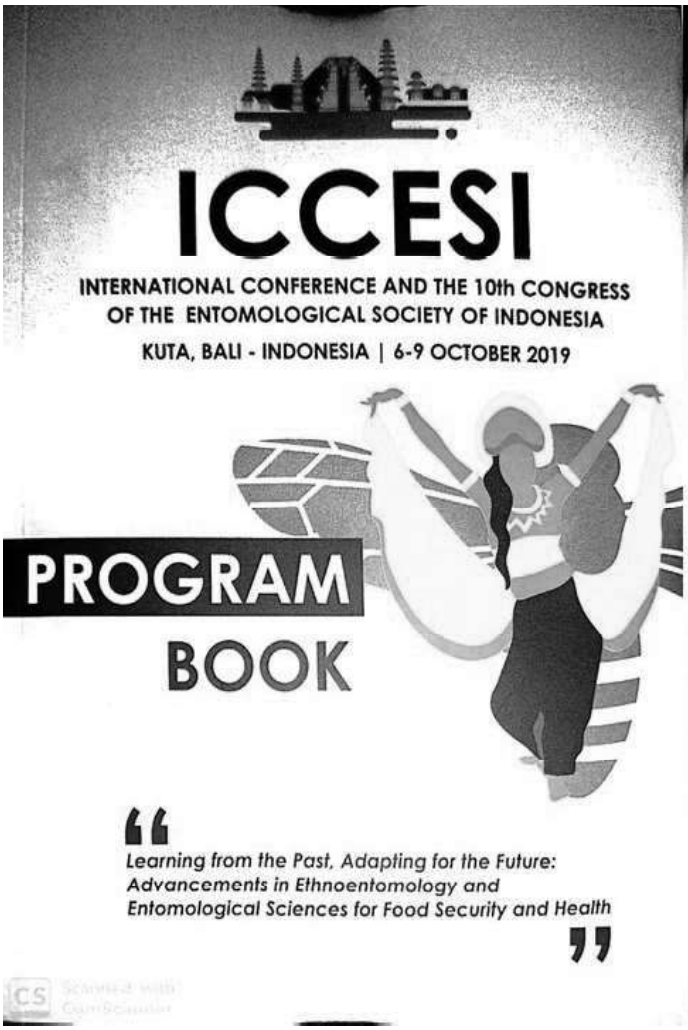
Chemical control of dengue vector, *Aedes aegypti* is impaired due to development of resistance to conventional insecticides. Insect Growth Regulators (IGRs) are considered more suitable and effective vector control agents as they specifically inhibit chitin biosynthesis, a process absent in vertebrates, and impose less adverse effects on beneficial insects and the environment. Present study investigates Lufenuron, a Chitin Synthesis Inhibitor (CSI), as a control agent of *Ae. aegypti*. Different instars of *Ae. aegypti* were exposed to a range of concentrations of Lufenuron as per WHO protocol. The investigations showed the effective hormone-mimetic effect of Lufenuron resulting in the formation of a significant number of larval-pupal and pupal-adult intermediates with the maximum number observed on exposure to L3 (L-P=17%, P-A=21%). Approximately 20% of L2 instars either could not moult and remained trapped inside the new exuviae or possessed bulged abdomen while some showed ruptured exoskeleton. Our results showed increase in IE30 ¬from L1 (0.00010 ppm) to L4 stage (0.00013 ppm); the L2 stage exhibiting maximum IE30 (0.00025 ppm). The median emergence suppression (IE50) doses of the Lufenuron were found to be 0.00057 ppm for L1, 0.00047 ppm for L2, 0.00050 ppm for L3 and 0.00096 ppm for L4. The results also revealed increased duration of larval development and inability of pupae to develop into adults, as compared to the controls. Our investigations indicate the potential use of Lufenuron as the control agent of *Ae. aegypti*. Further research is being conducted to understand its mode of action to develop effective control strategies.

Keyword: *Aedes aegypti*, emergence, growth inhibition, intermediates, lufenuron



Abstract ID: P-26

ASSESSMENT OF TOXICITY AND GROWTH REGULATORY EFFECTS OF BETA-CYFLUTHRIN AGAINST RED COTTON BUG, *Dysdercus koenigii* (FABR.) (HETEROPTERA: PYRRHOCORIDAE): AN EMERGING COTTON PEST

P Lanbiliu[1, 2*], Sarita Kumar[2]

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Red Cotton Bug, *Dysdercus koenigii* (Fabr.) (Heteroptera: Pyrrhocoridae) is a destructive pest of cotton and other economical crops in Asia. Nymphs, as well as the adult of this pest, suck the sap from the green bolls and leaves of cotton causing shedding of young bolls, rotting of green bolls, stained cotton fibers and loss of seed viability. The present study evaluates the toxic and growth regulatory effects of a pyrethroid, beta-cyfluthrin against *D. koenigii*. The newly emerged fifth instars nymphs were exposed to beta-cyfluthrin at a concentration ranging from 0.00008% to 0.00128%. A volume of 1 µl of beta-cyfluthrin was topically applied on the dorsal anterior thoracic region of nymphs (in 3 replicates, each replicate containing a batch of 25 insects) and were observed for mortality after 24 h. The nymphs were further reared till adults to observe delayed toxicity effects and developmental abnormalities if any. Our result revealed significant lethal effects of beta-cyfluthrin on *D. koenigii* nymphs with LD_{50} and LD_{70} values as 0.00051% and 0.00076%, respectively. A positive correlation was observed between percent nymphal mortality of *D. koenigii* and the dose of insecticide. The survived nymphal instars developed several development malformations; partial molting, shrunk abdomen, abnormal adults with wing deformities, adultoids and adults with attached exuviae. Further studies are being conducted to assess the development of beta-cyfluthrin resistance in *D. koenigii* and strategies to counter resistance. These results can provide an important base for developing effective and desired strategies to control and monitor insecticides resistance in *D. koenigii*.

Keyword: *Dysdercus koenigii*, mortality, beta-cyfluthrin, toxicity, adultoids

Proceedings of National Conference

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Insect-Plant Biology in 21st Century

November 4-5, 2019

Insect Taxonomy & Systematics/ Reproduction/Development/ Behaviour

Insect Plant Physiology/ Insect Pest Management

Molecular Analysis of Plant-Interaction/Insect Pest Resistance

Medical Entomology & Public Health

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ज्ञान-विज्ञान विमुक्तये

सत्यमेव जयते

PP-03

Development of Acetamiprid Resistance in *Aedes aegypti* L.: Correlation with Growth and Reproductive Fitness

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Continuous rise in the diseases transmitted by mosquitoes have created a grave situation globally. Novel insecticides are continuously being explored for management of mosquitoes due to their inherent ability to develop resistance against them. In current investigations, the early fourth instars of *Aedes aegypti* L. were selected with acetamiprid for 10 successive generations. The potential of *Ae. aegypti* to develop resistance to acetamiprid, and cross-resistance to different classes of insecticides was assessed using standard WHO protocols. The resistant larvae were investigated for the variability in their growth parameters and reproductive fitness. Larvicidal assays with acetamiprid against susceptible strain of *Ae. aegypti* larvae resulted in respective LC_{50} and LC_{90} values of 0.188 ppm and 1.315 ppm. Selection with acetamiprid for 10 successive generations (ACSF-10) caused 20-fold larval resistance and low levels of cross-resistance to organophosphates and pyrethroids. These ACSF-10 larvae exhibited 13-fold resistance to lambda-cyhalothrin and 11-fold to fenitrothion. The acetamiprid selections also exerted growth-inhibitory effects and reproductive disadvantage in *Ae. aegypti*. Larval exposure to the sublethal dose of acetamiprid (LC_{30}) delayed the larval development in *Ae. aegypti* considerably and induced hormono-mimetic effects resulting in substantial arrested growth and formation of intermediates. A negative correlation between the acetamiprid resistance and reproductive fitness in *Ae. aegypti* was also observed causing reduced fertility and fecundity. Our results highlight the probable use of acetamiprid as a promising control agent against *Ae. aegypti*, exerting multifarious effects. Despite causing development of larval resistance, the reproductive disadvantage in resistant genotypes in the population can eliminate heterozygotes and resistant homozygotes by implementing different resistance management strategies against *Ae. aegypti*.

Keywords: *Aedes aegypti*, Acetamiprid, Cross-resistance, Hormono-mimetic, Intermediates, Resistance

PP-05

Lufenuron: A Potential Agent to Control Insecticide Resistant Population of *Aedes aegypti* L.

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Continuous increase in *Aedes*-borne diseases at global platform has raised concerns about human health. In addition, use of insecticides as prime mosquito control method has not only aggravated human and environment health issues; but has also made mosquitoes resilient. As an alternate and eco-safe strategy, we aim to evaluate the effect of lufenuron; a chitin synthesis inhibitor; on susceptible (SS) and acetamiprid-resistant (AR) *Ae. aegypti* L. population. Early fourth instars of AR and SS strains were exposed to graduated dosages of lufenuron and controls were exposed to the solvents alone as per WHO protocol with some minor modifications. The comparative impact of lufenuron was monitored by studying different life parameters; larval and pupal mortality, formation of intermediates at larval or pupal stage, larval and pupal longevity and the adult emergence. Lufenuron resulted in significant negative impact on the growth of *Ae. aegypti* larvae pre-exposed to acetamiprid resulting in 1.3-fold higher emergence inhibition (IE_{30} and IE_{50}) than that observed in SS population. A total of 80% larval-pupal and pupal-adult intermediates were observed in AR population on exposure to just 0.005 ppm lufenuron; 52.5% higher than the SS *Aedes* population. Other growth parameters were also more adversely affected in acetamiprid-resistant larvae. Present study shows the growth regulatory activity of lufenuron against AR population of *Ae. aegypti*. As mosquitoes resistant to a particular class of insecticide have tendency to develop cross-resistance to other classes of insecticides, lufenuron can be an effective alternate mosquito control agent. Potential use of lufenuron as mosquito control agent will be discussed and recommendations will be made for mosquito management control strategy in the fields.

Keywords: *Aedes* aegypti, Emergence, Growth inhibition, Intermediates, Lufenuron

PP-07

Bioefficacy of Beta-Cyfluthrin against Red Cotton Bug, *Dysdercus köenigii* (Heteroptera: Pyrrhocoridae)

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Dysdercus köenigii (Fabr.) (Heteroptera: Pyrrhocoridae is a widespread destructive pest of cotton and other economical crops in Asia. Despite of various control strategies, the pest is still not under control. This study aims to evaluate the possible use of beta-cyfluthrin against as a control agent. The toxicity and morphogenetic effects of beta-cyfluthrin was evaluated against 5th instar nymphs of *D. köenigii* by conducting topical and seed dip bioassay. One set of nymphs were applied with 1µl of graded concentrations of beta-cyfluthrin on the dorsal anterior thorax for 24 h; while other set were fed with beta-cyfluthrin-treated seeds. The toxic effects were recorded. Exposed nymphs were reared till adults to observe the delayed toxic and morphogenetic effects of insecticidal exposure. The topical application of beta-cyfluthrin on 5th instar nymphs of *D. köenigii* resulted in LD_{50} and LD_{70} values of 0.00051%, 0.00076%; while the values obtained in seed dip bioassay were 0.002% and 0.003%, respectively. This demonstrated 4-fold higher efficacy of beta-cyfluthrin as a contact insecticide than the stomach poison. Furthermore, developmental malformations in insecticide-exposed survived nymphal instars; partial moulting, abnormal adults with shrunk abdomen, attached exuviae or wing deformities, and appearance of adultoids; indicate the delayed toxic and growth inhibiting effects of beta-cyfluthrin. Beta-cyfluthrin can be used as an effective contact poison and growth regulating agent against *D. köenigii*. As pyrethroids are considered safe insecticides as compared to other conventional insecticides, these results can provide an important base for developing effective and desired strategies against *D. köenigii*. Further studies are being conducted to assess the development of beta-cyfluthrin resistance in *D. köenigii* and strategies to counter resistance.

Keywords: *Dysdercus köenigii*, Beta-cyfluthrin, Topical bioassay, Seed dip bioassay, Malformations

PP-09

Effect of Dietary Stress of Emamectin Benzoate on the Survival and Feeding Potency of *Helicoverpa armigera* (Lepidoptera: Noctuidae)

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Present study assesses the effect of Emamectin benzoate, a soil actinomycetes-derived insecticide, on the survival and feeding of *Helicoverpa armigera*. The leaf dip bioassays were conducted on the early fourth instars of *H. armigera*, at controlled temperature (27±1°C) and humidity (80±5% RH) conditions. The castor leaves were cut in small discs measuring 3.5 cm in diameter and were soaked in aqueous solutions of different concentrations (0.05-1.5 µg/mL) of Emamectin benzoate. The initial area of each leaf disc was measured and provided to the larvae. The post-consumption area of each leaf disc was again measured to assess the dietary stress in larvae. The larval mortality was recorded, if any. Feeding of *H. armigera* larvae with Emamectin benzoate-treated castor discs caused negative impact on their nutrition and survival. The bioassays resulted in 0.26 µg/mL, 0.095 µg/mL and 0.043 µg/mL LD_{50} values, respectively, after feeding for 24h, 48h and 72h. In addition, a remarkable 93.59% reduced larval consumption was observed indicating appreciable feeding inhibitory property of Emamectin benzoate. A positive correlation between concentration of Emamectin benzoate and Larval Consumption Index was recorded; the index dropped to 1.48-fold with decrease in Emamectin benzoate concentration. The investigations demonstrated efficacy of Emamectin benzoate against *H. armigera* larvae. Employing selective insecticide as a control agent of *Helicoverpa* in the fields can be an effective control strategy tackling traditional issues such as pest resistance and pest resurgence; but only after establishing its safety against non-target organisms.

Keywords: Antifeedant, Emamectin benzoate, *Helicoverpa armigera*, Insecticidal, Leaf dip assay, Survival

PP-11

Phyto-mediated Silver Nanocomposites as a Control Agent of *Aedes aegypti* L.: Optimal Formulation with *Citrus limetta* Peel Extract

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Botanicals are considered safe and effective mosquito control agents, as compared to conventional insecticides. Use of effective botanicals as nanoformulations can further enhance their efficacy at lower dosages. Thus, silver nanocomposites (AgNCs) were formulated with *Citrus limetta* peel extract (CLPE) and evaluated against *Aedes aegypti* for their larvicidal potential. The silver nanocomposites from CLPE were formulated. The biosynthetic process was optimized by varying impacting factors; temperature; concentration and volume of silver nitrate solution; and the volume of catalyst. The larvicidal bioassay with AgNCs was conducted against early fourth instars of *Ae. aegypti* using standard WHO protocol. Synthesis of silver nanocomposites in the reaction mixture was primarily marked by the conspicuous colour change of the solution; from initial pale yellow to final dark brown; which was then traced through UV-Visible spectroscopy. The spectroscopic peaks were obtained in the range of 416-420 nm. The optimal formulation of CLPE-AgNPs was obtained by incubating the mixture of 4 mL $AgNO_3$ (3mM concentration) and 3 mL CLPE at 60°C and 1 mL NaOH. The 24 h larvicidal bioassay with CLPE-AgNPs against *Ae. aegypti* resulted in respective LC_{50} and LC_{90} values of 26.82 µg/mL and 99.32 µg/mL; which decreased to 19.51 µg/mL and 71.99 µg/mL after 48 h of exposure. The bioassay with crude *Citrus limetta* peel extract resulted in much higher toxicity values while no mortality was observed in controls. Synthesis of AgNCs utilizing peel extract of *C. limetta* is a facile, cost-effective method. The application of these NCs can be an eco-safe and effective alternative to conventional insecticides for mosquito management.

Keywords: Silver nanocomposites, *Citrus limetta*, Larvicidal, *Aedes aegypti*, Spectroscopy

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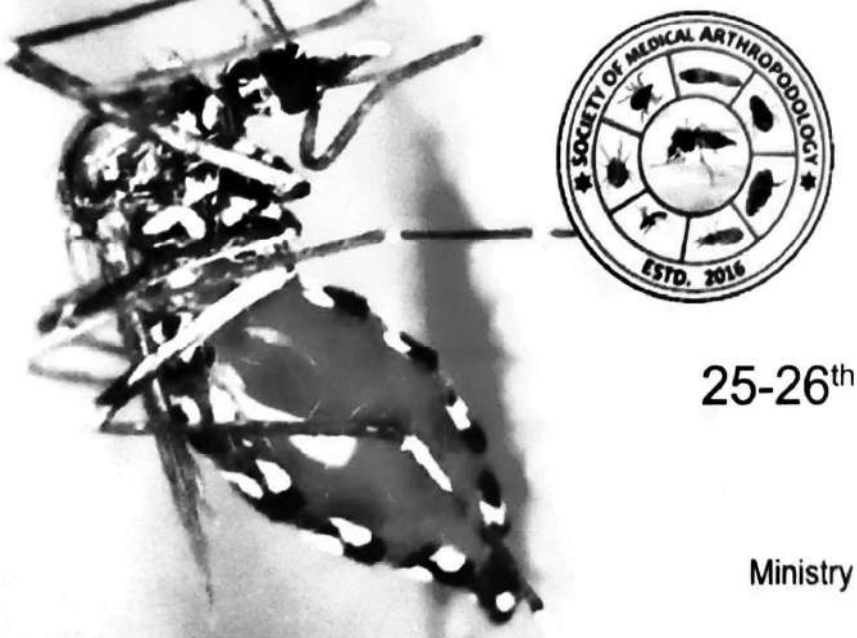
Ministry of Environment, Forest and Climate Change

12th National Conference on VECTOR-BORNE AND ZOONOTIC DISEASES

Identification to Management



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ABSTRACTS

OP-15

Vector Management

ENHANCED LARVICIDAL POTENTIAL OF A-CYPERMETHRIN AGAINST *AEDES AEGYPTI* L. WHEN SYNERGIZED WITH CITRUS PEEL EXTRACT

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Aedes aegypti (Linnaeus, 1762)is a widely spread disease vector of great concern throughout the world. With the continuous rise in cases of Zika, dengue, and Chikungunya worldwide, control of *Ae. Aegypti* has become a prime concern. The present study investigated the larvicidal effects of individual and various combinations of *Citrus sinensis* hexane peel extract and a synthetic pyrethroid, alpha-cypermethrin against *Ae. Aegypti*. Larvicidal bioassays were performed using the WHO protocol with minor modifications. The investigated compounds were found effective individually as well in binary mixtures indicating the efficient synergism. The hexane extract of *Citrus sinensis* peels assayed against *Ae. aegypti*larvae resulted in LC_{50} of 46.53 ppm after exposure for 24 h, while alpha-cypermethrin treatment resulted in an LC_{50} value of 0.0063 ppm. The binary mixtures of both the compounds in 1:1, 1:5 and 1:10 ratios also showed significant larvicidal potential. The 1:1 mixture was found most effective with co-toxicity coefficient and synergistic factor as 23.456 and 3.865, respectively, for the LC_{50} at 24h. The binary mixtures showed synergism as well as additive effects in all the ratios tested except 1:5 ratio for LC_{90} at 48h which showed inconsequential antagonistic effect. Results showed decreased synergistic effects with an increase in the citrus extract proportion in the binary mixtures. We suggest that phytoextract/cypermethrin mixtures can be more operative than insecticide/phytoextract alone, and can be used as a good ecofriendly approach in vector control programs. Such mixtures could reduce the costs, reduce insecticide dose, and regulate insecticide resistance as part of integrated vector management.

Keywords: *Citrus sinensis*; *Aedes aegypti*; synergism, additive, antagonism, binary mixtures

RT-16

Vector Management

CHARACTERIZATION OF ACETAMIPRID RESISTANCE IN THE LABORATORY POPULATION OF *AEDES AEGYPTI* L.

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Over the last decade, the constant rise in dengue worldwide has made the control of *Aedes aegypti* principal concern. The most recommended plan to control mosquito-borne diseases mainly lies in vector management and disturbing their disease-transmission cycle. Wide-ranging use of different classes of organic insecticides for mosquito control has led to the development of high levels of resistance making them less functioning at safe dosages imposing us to explore novel insecticides. The present study explores the bio-efficacy of a neonicotinoid, acetamiprid on the *Ae. aegypti*larvae, development of resistance after subjecting acetamiprid selection pressure for 10 successive generations and biochemical characterization of the resistance developed. Acetamiprid exposure of the parent population of *Ae. aegypti*early fourth installs resulted in respective LC_{50} and LC_{90} values of 0.18799 ppm and 1.31547 ppm. Selection with acetamiprid for 10 successive generations (ACSF-10) reduced its efficacy by 20-fold. Involvement of four enzymes; non-specific esterases, Glutathione-S-transferases and acetylcholine esterases in the development of acetamiprid resistance was investigated to uncover mode of action of acetamiprid. An elevation of 1.4-fold and 2.1-fold was observed in alpha-esterases and beta-esterase activity in ACSF-10 as compared to ACSF-5. However, the activity of glutathione-s-transferases decreased in ACSF-5 which rose to 12-fold in ACSF-10. Similarly, the activity of acetylcholine esterases was found to be much higher in resistant generations as compared to the parental strains. Our results indicate the individual/synergistic contribution of different enzymes leading to acetamiprid detoxification. The probable target site mutations in resistance developmentare being identified. Possible ways for mosquito management will be discussed.

Keywords: *Aedes aegypti*, acetamiprid, resistance, esterases, glutathione-s-transferase acetylcholine esterases

PP-3

VBD Transmission and Management

REVIEW THE ECOLOGY, BEHAVIOR, PHYSIOLOGY & DEVELOPMENT OF TRANSMISSION OF VECTOR-BORNE DISEASES IN URBAN AREAS IN JALGAON, MAHARASHTRA

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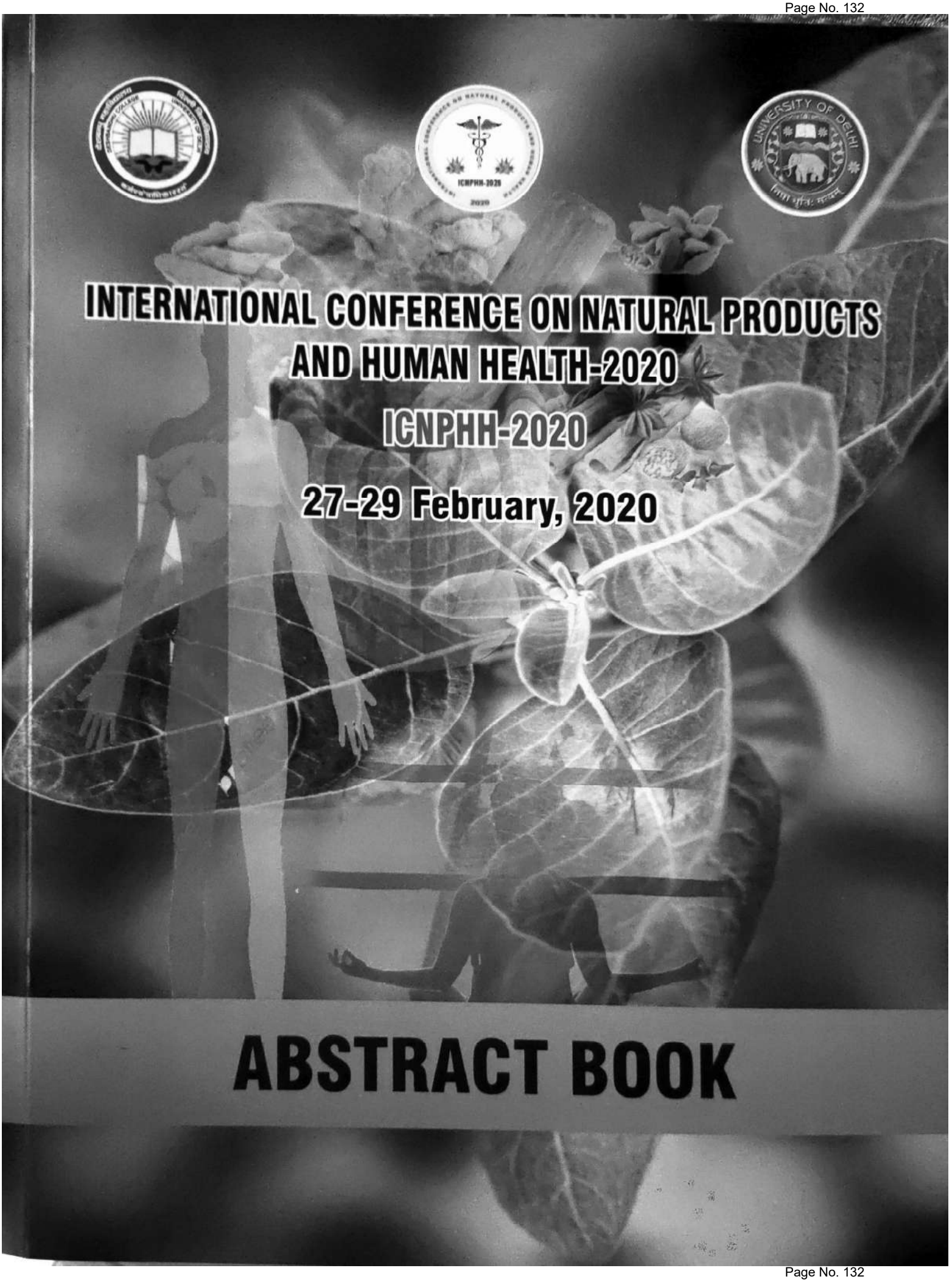
Urban transmission of the arthropod-vectored disease has increased in recent decades. Understanding and managing transmission potential in urban areas require the integration of sociological and ecological processes that regulate vector population dynamics, feeding behavior, and vector-pathogen interactions in these unique ecosystems. Underdeveloped countries continued to suffer as much as several diseases such as malaria and African sleeping sickness are still highly prevalent in specific countries. "New" vector-borne diseases, like dengue, swine flu, and Mad cow fever, have emerged and are invading previously disease-free regions. The discovery of new drugs and vaccines has made great advances and allows for the effective treatment and control of many diseases. In contrast, vector control has lagged behind in development, even though it is realized that effective vector control would allow for immediate interruption of the transmission of disease, and aid in disease control and eradication. In the last 20 years, new initiatives on vector control have been undertaken, leading to the rapid development of effective and lasting methods of vector control. The development of molecular genetics has provided new insight into vector biology and behavior, which is being used for developing new strategies of vector control. Arthropod vectors are ectothermic organisms and their growth, survival, and behavior are highly sensitive to environmental temperatures. The vector response to urban heat island (UHI) conditions is dependent on regional temperature profiles relative to the vector's thermal performance range. In temperate climates, UHI can facilitate increased vector development rates while having countervailing influence on survival and feeding behavior. Understanding how urban heat island (UHI) conditions alter thermal and moisture constraints across the vector life cycle to influence transmission processes is an important direction for both empirical and modeling research. This study evaluates how urban conditions, specifically habitat suitability and local temperature regimes, and the heterogeneity of urban areas can influence the biologically-relevant parameters that define vectorial capacity: vector density, survivorship, biting rate, extrinsic incubation period, and vector competence.

Keywords: Ecology, behavior, development, vector-borne diseases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27-29 February, 2020
ABSTRACT BOOK

VBD0019

Bio-efficacy of *Achyranthes aspera*-derived silver nanocomposites against early fourth instars of *Aedes aegypti* L.

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Introduction: *Aedes aegypti (Ae. aegypti)*-borne diseases, such as dengue, Chikungunya and Zika, are on the rise at the global level since the past few years. Present study attempts to design an eco-friendly approach; alternative to chemical insecticides; for control of dengue vector.

Aim and Objectives: To formulate silver nanocomposites (AgNCs) from the leaf extract of *Achyranthes aspera* and estimate their efficacy against *Ae. aegypti* larvae and non-target organisms.

Methods: The aqueous leaf extract of *A. aspera* was assayed against *Ae. Aegypti* larvae, alone or in combination with silver nitrate added in different concentrations (1mM- 5mM). Bioassays were carried out at different time intervals; 24h, 48h and 72h. Bioreduction of AgNCs was characterized by UV-Vis spectroscopy, Dynamic light scattering (DLS), Scanning Electron Microscopy (SEM), Energy dispersive X-ray (EDX) spectroscopy, Transmission Electron Microscopy (TEM), X-ray Diffraction (XRD) and Fourier Transform Infrared Spectroscopy (FTIR).

Results: The aqueous extract of *A. aspera* leaves (AALE) demonstrated insignificant larvicidal effects. However, the synergism of extract with silver nitrate in form of AgNCs increased the larvicidal effects significantly displaying LC_{50} values of 37.570, 6.262 and 1.041 µg/mL; 5.819, 1.412 and 0.489 µg/mL; and 5.519, 1.302 and 0.267 µg/mL after 24, 48 and 72 h of exposure. Biophysical characterization of the synthesized AgNCs confirmed the uniform distribution of spherical nanocomposites with an average size ranging from 1-25 nm. The XRD analysis established their crystalline and face-centred-cubic structure, the EDX pattern showed the presence of Ag, O and C in their order of weight%, while the FTIR displayed the intricacy of silver nanocomposites. The NCs were also found non-toxic to non-target organisms; *Gambusia affinis*, *Daphniamagna* and *Moinamacrocopa*; indicating their safe use in fields.

Conclusion: The synthesized AgNCs from *A. aspera* were highly potent against *Ae. Aegypti* larvae in comparison to the extract alone suggesting the probable synergism for toxicity or more efficient delivery of toxicants. These NCs can be potential, cheap and promising bioresource against dengue vector larvae.

Keywords: *Aedes aegypti*, EDX, FTIR, Larvicidal, SEM, Silver nanocomposites (AgNCs), TEM, XRD

Further, gas chromatography-mass spectroscopy (GC-MS) analysis was carried out to identify the bioactive chemical constituents of *S. arvensis*. Histopathological investigations were perfomed to know the mode of action. Toxicity of the extracts towards non-target organism, *Poecilia reticulata* was also evaluated

Results: Among the various extracts, methanol extracts exhibited 100% larvicidal activity with LC_{50} 6.843 µg/mL. Further methanol extracts was analysed using technique of GC-MS to characterize the phytochemicals present in the extract. GCMS analysis of methanol extract revealed 52 componds, among them major compounds are mome inositol (38.11), n-Hexadecanoic acid (10.86). Octadecanoic acid(1.46), Etradecanoic acid (2.22), Linoleic acid (6.79). N-9-Hexadecenal (8.18) Heneicosane (1.28) and Phytol (1.67). Histopathological studies have clearly shown the toxic effect of extract on mosquito larvae. Further the extract was observed to be non-toxic towards non target organism at concentrations that were found to be toxic against the mosquito larvae.

Conclusion: *Spergula arvensis* could serve as an ideal eco-friendly, single-step and inexpensive source for the control of *An. culicifacies* larvae.

Keywords: Larvicides, GC-MS, *An. culicifacies*

VBD0018

Knockdown and irritability response to deltamethrin in the susceptible and deltamethrin-resistant adults of *Culex quinquefasciatus*

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Introduction: Pyrethroids are the most widely used insecticides against mosquitoes because of their toxic properties, rapid action and safety to humans and non-target organisms. However, extensive usage of pyrethroids as residual domestic sprays, and active ingredient in mosquito mats, coils and bed nets, etc. mosquitoes are developing resistance against it. Today, pyrethroid resistance is envisioned to be a major problem for the vector control program since, at present there are no suitable chemical substitutes for pyrethroids.

Aim and Objectives: To assess speed of resistance development to deltamethrin in *Culex quinquefasciatus;* and assess the impact of deltamethrin resistance on the behavioural responses of adults.

Methods: The parent susceptible adults of *Cx. quinquefasciatus* (PS) were selected with 0.05% deltamethrin (diagnostic dosage) for 40 successive generations (DAS_{40}). Knockdown and irritability tests were carried on freshly blood-fed 3day old adult females of PS as well as DAS_{40} strain using 0.05% deltamethrin-impregnated papers. Parallel negative control tests were run with siliconoil-impregnated papers and positive control tests were conducted with 4% DDT-impregnated papers. The effect of deltamethrin resistance was estimated on the knockdown response and the irritability behaviour of adults by computing KT_{50}, knockdown resistance, relative irritability and irritability ratio.

Results: Forty generations of selections with deltamethrin resulted in 6.1-fold deltamethrin resistance in *Cx. Quinquefasciatus* adults. The adults of DAS_{40} strain developed just 0.8-fold cross-resistance to DDT despite of similar mode of action. The knockdown studies resulted in KT_{50} of 22.7 min in PS adults with no signs of recovery even after 24 h, whereas DAS strains showed 2.5-fold knockdown resistance (KDR). Knockdown response of *Cx. quinquefasciatus*to 4% DDT was 3 times slower than that to deltamethrin. Both the PS and DAS strains exhibitsignificant irritability response towards deltamethrin, though DAS strain wasmore irritant to deltamethrin as well as DDT as compared with PS strain.

Conclusions: Results suggest that deltamethrin can be used as a promising adulticide against *Cx. quinquefasciatus*, as adults are unable to develop significant resistance to deltamethrin. A strong irritability and knockdown response, and insignificant knockdown resistance towards deltamethrin even after 40 generations of deltamethrinselection also indicate the potential use of deltamethrin in fields.

Keywords: *Culex quinquefasciatus*, Deltamethrin, DDT, Knockdown, Irritability, Resistance

Conclusion: Plumbagin can be employed as safe alternative to synthetic pesticides for the control of *D. cingulatus*. Further studies are needed to explore its mode of action and possible use in fields.
Keywords: Agriculture, *Dysdercus cingulatus*, Naphthoquinones,Necrosis, Pathological Effects,Plumbagin

SA0019

Effect of emamectin benzoate-induced dietary stress on the nutritional performance of American bollworm, *Helicoverpa armigera*

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Aim and Objectives: *Helicoverpa armigera*, an agricultural pest, is known to attack a wide variety of crops across the globe. As overuse of conventional insecticides has led to the development of insecticide resistance in *H. armigera* leading to more severe attacks on crops and loss of yield; researchers have diverted their interest to explore alternatives as control agents. Present study evaluated the effects of emamectin benzoate (EMB) on the survival, growth and nutritive fitness of *Helicoverpa armigera*.

Methods: The systemic toxicity and feeding (Choice and No Choice) assayswere carried outagainststarved (4h) early fourth instars of *H. armigera*.Theexperimental diet was provided to the larvae for 24 h and mortality was scored to assess the systemic toxicity of EMB. The consumption of the diet was measured by recording the diet remaining after 24 h of feeding.Various nutritional parameters, such asgain in larval weight, dried frass, etc. were measured to estimate the nutritional indices.

Results: Emamectin benzoate-induced dietary stress caused a significant systemic toxicityin *H. armigera* larvae resulting in LC_{50}andLC_{90} values of 0.092 µg/mL and 0.156 µg/mL, respectively.Dietary 0.1µg/mL-1.6µg/mL EMB deterred larval feeding significantly with 10-100% larval mortality at 0.05 µg/mL-0.2 µg/mL EMB. Nutritive performance assessment with dietary 0.05µg/mL-0.01µg/mL EMB also revealed a pronouncedpost-ingestive toxicity impairing ingestion as well as digestion. The larvae displayed reduced Relative Growth Rate (RGR) and Relative Consumption Rate (RCR) in the range of 0.385-0.978 and 1.653-3.985, respectively, which may also be attributed to incompetence in food utilization and assimilation, as evident by 10-24% and 02-52% diminished Efficiency of Conversion of Ingested Food (ECI) and Efficiency of Conversion of Digested Food (ECD); and 09–63% diminished Approximate Digestibility (AD).

Conclusion: These results advocate the effective utilization of Emamectin benzoate in Integrated pest management program of *H. armigera*. Sub-lethal doses of dietary EMB impaired gut biochemical machinery of *H. armigera* larvae impacting their nutritive fitness and thus, growth and development. Additional investigations are being conducted to comprehend the specific mode of action of EMB causing biochemical and genomic-altering effects in*H. armigera*.

Keywords: *Helicoverpa armigera*, Emamectin Benzoate, Growth-inhibitory, Nutritive Performance, Post-ingestive toxicity

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Chapter 7

METABOLIC PROFILING OF *STREPTOMYCES* SP. STRAIN 51 FOR DETECTION OF BIOACTIVE COMPOUNDS

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ABSTRACT

Actinomycetes are Gram- positive bacteria having high GC content in their genome. They are crucial from industrial perspective as they have great ability for production of bioactive secondary metabolites. Compounds produced by them possess diverse biological activities such as

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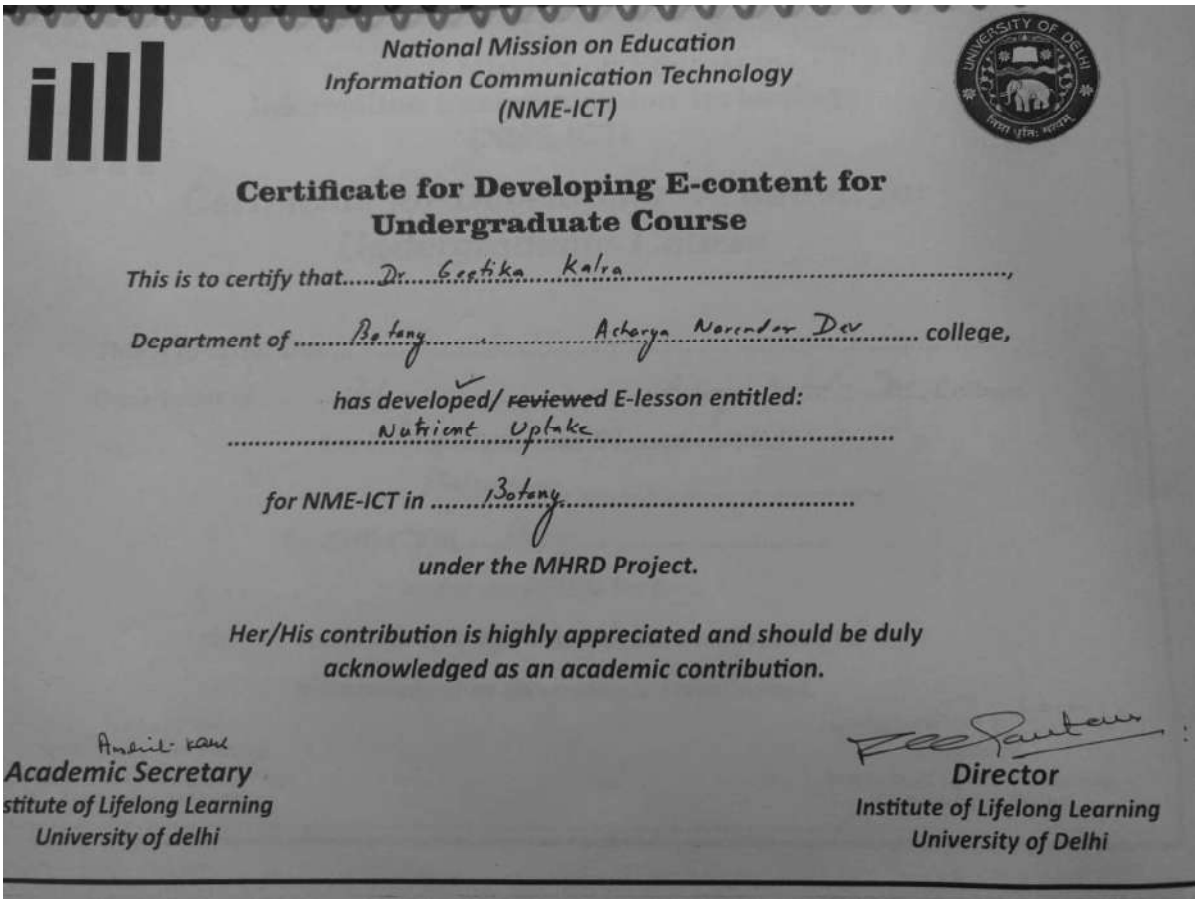

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Dynamics of Eco-Evolutionary Forces in Shaping Dioecy

9

Yash Mangla, Manisha, Rajesh Tandon, and Shailendra Goel

Abstract

Evolution of dioecy among plants is a distinct phenomenon, debated extensively among biologists. It has now been realized that besides the underlying gender determination mechanisms, it is equally important to understand the contextual framework of eco-evolutionary forces that are instrumental in shaping dioecy in general. The theoretical framework of evolution of dioecy is well-argued in literature. Several empirical studies have indicated ecological factors like habitat, floral features, wind pollination, and clonality to be advantageous for establishing dioecy. Further, resource partitioning among genders is known to modulate the sex ratios, which is crucial for its evolutionary maintenance. How these factors influence evolutionary pathways and evolution of dioecy, has not been sufficiently investigated. Available phylogenetic analyses indicate that the factors are interlinked, and that they serve as usual correlates of dioecy. Although, such associations are not clearly elucidated in literature due to paucity of information about the prevailing sexual systems, further obscured by low species richness in existing dioecious clades. In this chapter, we present a conspectus of present understanding of ecological correlates of evolution and maintenance of dioecy, especially among the flowering plants. The information which has emerged so far indicates the involvement of multivariable eco-evolutionary suites. However, in order to appropriately characterize them, there is need to extend empirical studies on the complete range of sexual variation.

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R. Tandon et al. (eds.), *Reproductive Ecology of Flowering Plants: Patterns and Processes*, https://doi.org/10.1007/978-981-15-4210-7_9

Secondary Pollen Presentation in Flowering Plants

Reproductive Ecology of Flowering Plants: Patterns and Processes pp 197-214 | Cite as

- Chandan Barman (1)
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Chapter
First Online: 08 August 2020

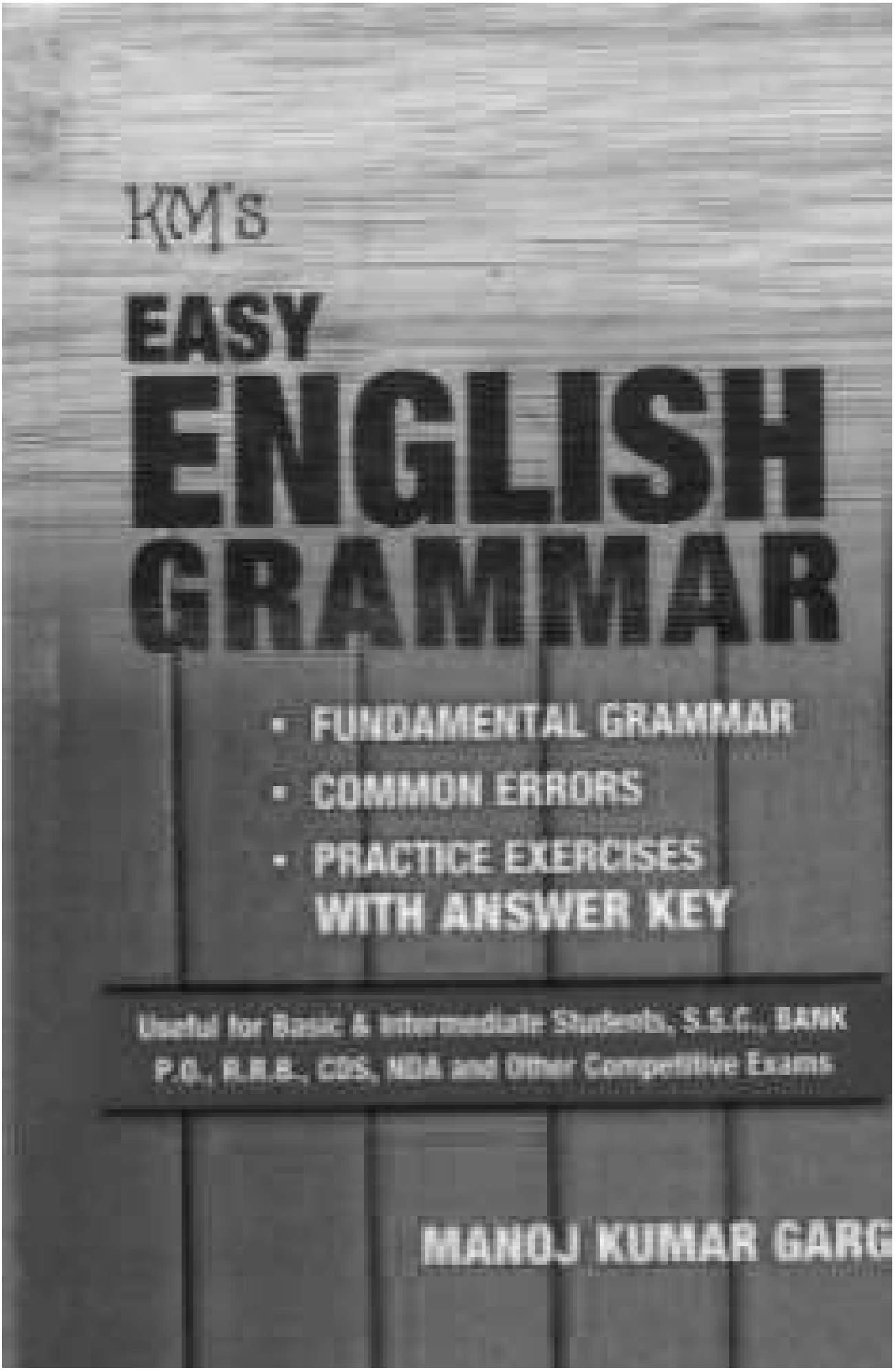
Abstract

Successful pollen transfer among the compatible conspecifics is an essential attribute of sexual reproduction among flowering plants. The plants maximize their male fitness by improving the efficiency of pollen dispersal to as many conspecifics as possible. The precision with which pollen is carried by biotic vectors is also influenced by the manner in which the pollen is presented by the flowers. The method of presenting the pollen to the vectors can be either from the anthers directly (primary presentation) or that from the other floral organs (secondary presentation). The significance of these methods mainly lies in the targeted deposition of pollen for successful mating. Here, we focus on the structural and mechanistic diversity of secondary pollen presentation among angiosperms. The knowledge of these floral attributes is important to understand the intricacy of reproductive mechanisms that are integral to the selection for establishing successful plant-pollinator interaction and maximizing plant fitness.

Keywords

Floral morphology Floral rewards Floral specialization Pollination Pollen dispersion Pollen presenter Non-sexual organ presenter

References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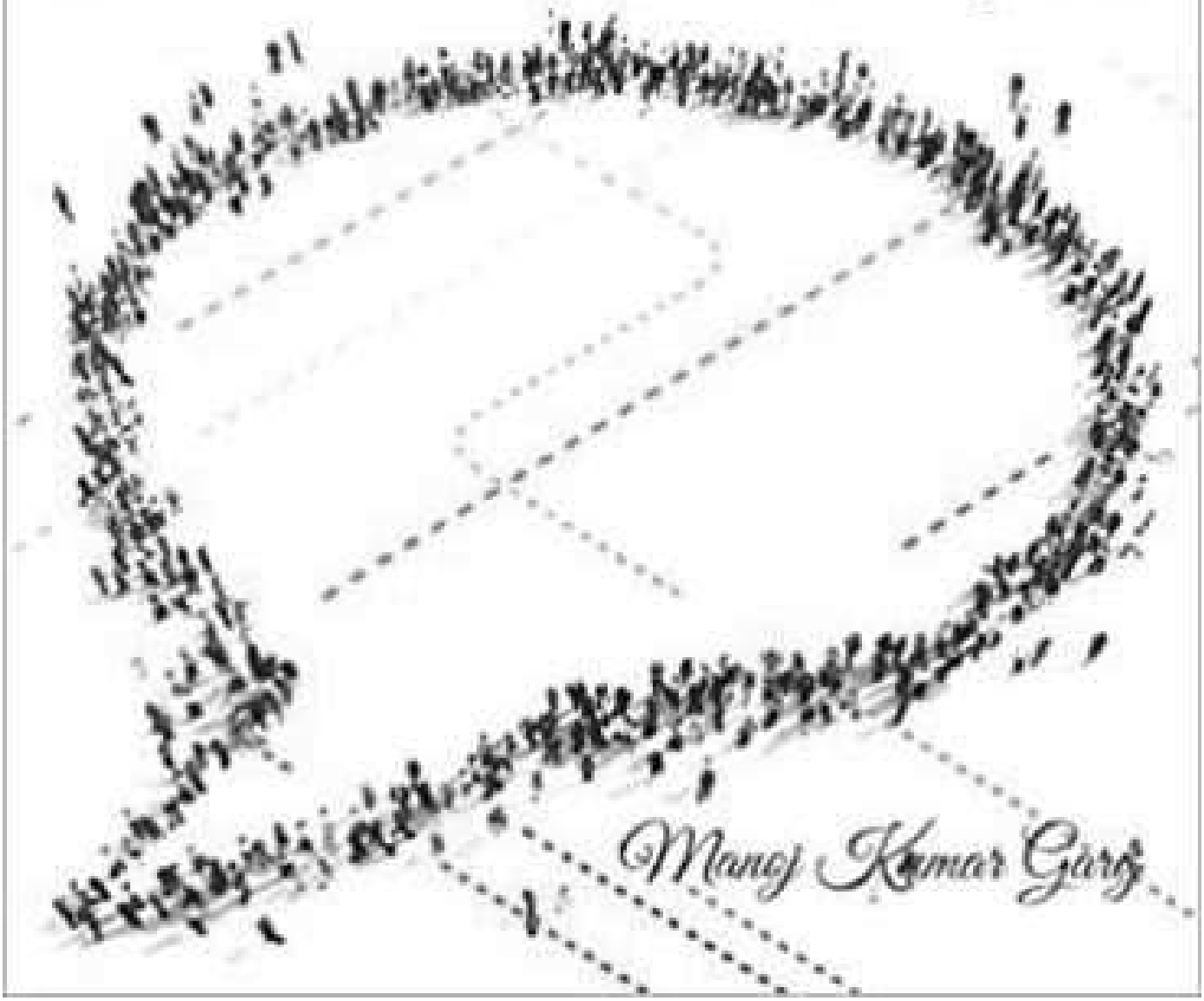

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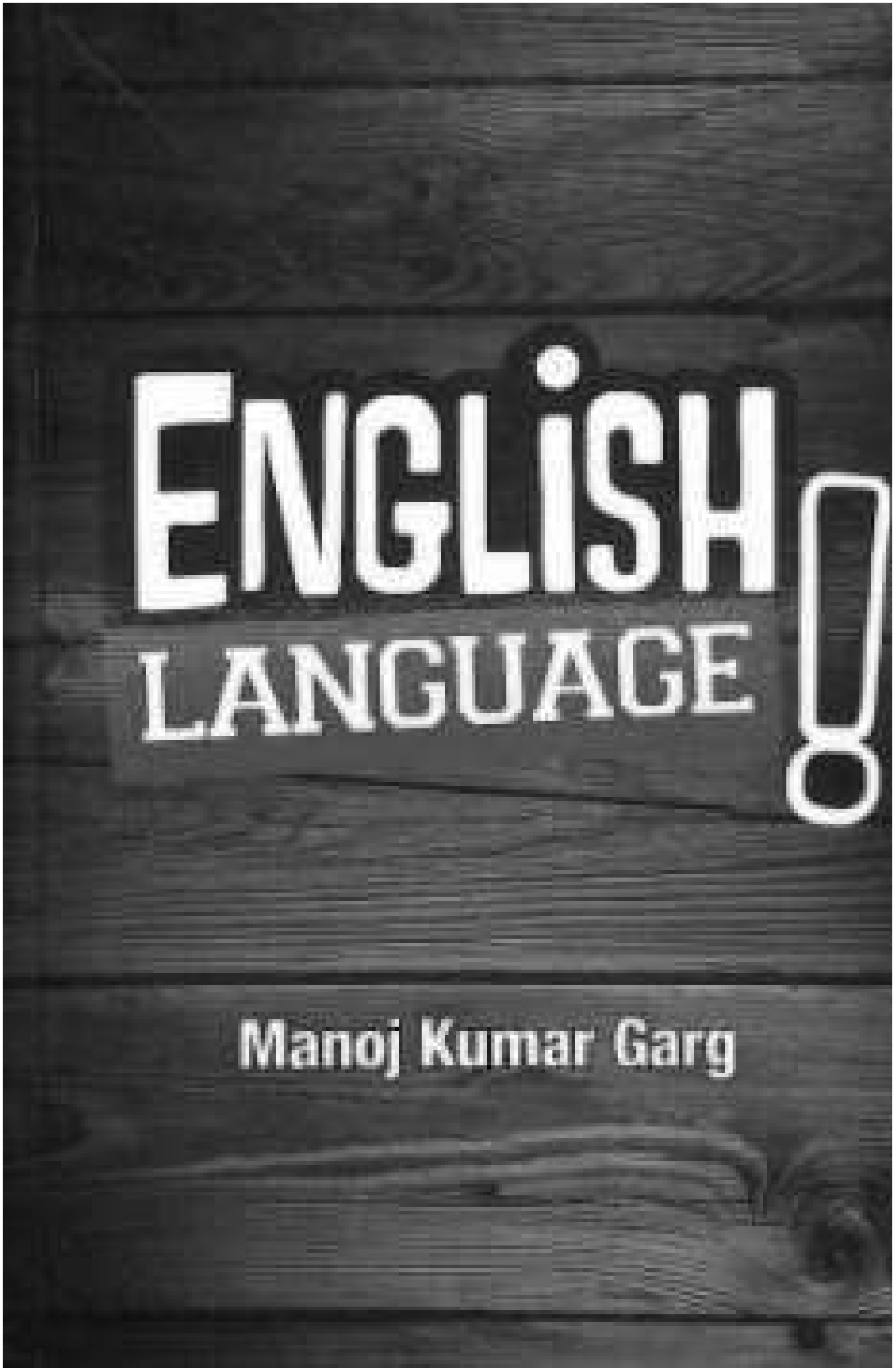
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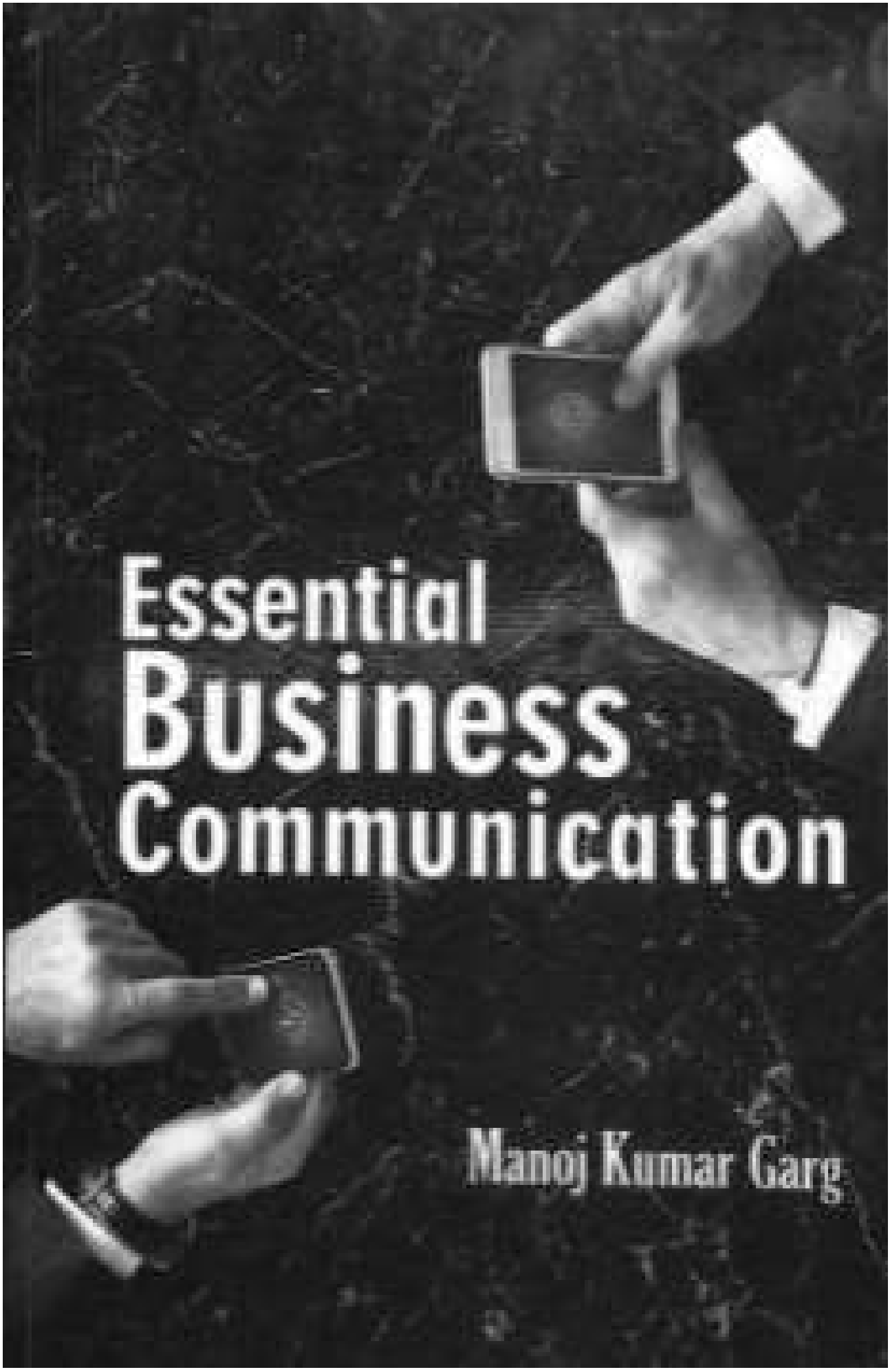
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Currently, marketed rivastigmine products are either twice daily oral tablets or once daily transdermal patch. However, these products cause side effects such as gastrointestinal adverse reactions, allergic dermatitis and extrapyramidal symptoms, resulting in poor patient compliance and therapeutic effects. The purpose of this study is, therefore, to develop novel rivastigmine formulation that overcomes these disadvantages and relatively short duration. The biodegradable polymer used in this study has properties of long-acting and controlled-release, which makes it convenient to administer the drug once a month and minimizes the incidence of side effects. **Methods:** InnoLAMP technology was introduced to prepare the monodispersed microspheres encapsulating rivastigmine using various kinds of polymers. The morphology of the microspheres was observed by electron microscope, and the particle size distribution was measured by laser diffraction analysis. The amounts of rivastigmine in microspheres were analyzed using HPLC. The pharmacokinetic effects of long-acting formulations were estimated through plasma concentration of rivastigmine in male SD rats following single intramuscular injection. **Results:** Various rivastigmine microspheres were prepared using different types of polymers and different content of drug. All of the microspheres exhibited a monodisperse and similar particle size with span value of less than 0.8. In addition, the microspheres were observed a smooth surface in spherical shape. As a result of single intramuscular injections of rivastigmine-loaded microsphere formulations, the plasma concentration of rivastigmine in rats was kept within the therapeutic range over a month. **Conclusions:** In conclusion, the monodispersed microspheres were able to release rivastigmine continuously over one month as the property of long-acting of the polymers. The release profile could be controlled by the types of polymers and the contents of the drug. These rivastigmine-loaded microsphere formulations can be considered a promising alternative therapy for the treatment of Alzheimer's disease with an improved patient compliance. Preclinical studies and scale-up of formulations have been currently conducting for clinical studies in human.

P1-096

HEPATIC LIPOPROTEIN RECEPTOR RELATED PROTEIN MODULATORS AS POTENTIAL THERAPEUTICS FOR ALZHEIMER'S DISEASE

Arathy Ramachandran[1], Khader Valli Rupanagudi[1], Pankaj Khanna[2], Mahesh Chand[2], Subhash C. Jain[2], Hema Saranya Ilamathi[3], Suman S. Thakur[3], Vijayalakshmi Ravindranath[1,4], *[1]Indian Institute of Science, Bangalore, India; [2]Delhi University, Delhi, India; [3]Centre for Cellular and Molecular Biology, Hyderabad, India; [4]Centre for Brain Research, Indian Institute of Science, Bangalore, India.*
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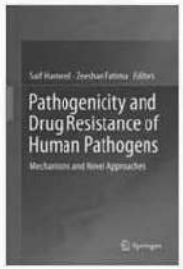
Background: Several risk factors for Alzheimer's disease (AD), such as amyloid precursor protein, presenilins, insulin degrading enzyme and apolipoprotein E, are all associated with amyloid beta. Therefore, targeting Aβ production, aggregation and clearance has been at the forefront of research on therapeutic strategies for AD. Lipoprotein receptor related protein 1 mediates transport of Aβ across the blood brain barrier and also binds Aβ circulating in the blood in its soluble form (soluble LRP or sLRP). Hence, upregulating hepatic LRP expression in periphery results in increased clearance of Aβ from the brain. In agreement with this, semi-purified extract of root of Withania somnifera completely reverses behavioural deficits and plaque pathology in nine months old APPSwe/PS1dE9 mice via upregulation of hepatic LRP. The main objectives of this study were to identify the compounds in the crude extract of WS that upregulate hepatic LRP and to understand transcriptional upregulation of hepatic LRP. Identification of these compounds and proteins involved in the regulation of hepatic LRP expression will help in designing new drugs that target Aβ clearance via the periphery. **Methods:** The extract was fractionated using flash chromatography. Luciferase-based reporter assay was used to screen the fractions in vitro and also to identify the site of action of the active principle(s) in the extract within the LRP promoter region. The efficacy of fractions was validated in vivo in 9 months old APPSwe/PS1dE9 mice based on performance of animals on radial arm maze, cortical amyloid load and upregulation of hepatic LRP. **Results:** We found that the site of action of the compounds in the crude extract is most probably within the first 400 base pairs upstream sequence of LRP promoter. An in silico analysis of this region revealed transcription factor binding sites for AP-2, Sp-1, NF- kappa β and Cox-2. We also found that one of the fractions, fraction 4.4, reversed behavioural deficits and plaque pathology in transgenic mice at a substantially lower dose as compared to the crude extract. **Conclusions:** The active principle(s) is present in fraction 4.4. Mass spectrometry and high-pressure liquid chromatography helped in identification of four potential compounds in fraction 4.4.

P1-098

OPTIMAL CONCENTRATIONS OF LUTEOLIN AND DHA TO EXHIBIT SYNERGISTIC EFFECTS AGAINST A$\beta_{1\text{-}42}$-INDUCED NEUROTOXICITY

Dona P. W. Jayatunga[1], Veer Bala Gupta[2], Eugene Hone[3], Giuseppe Verdile[4], Manohar L. Garg[5], Ralph N. Martins[6], *[1]Edith Cowan University, Perth, Western Australia, Australia; [2]Deakin University, Melbourne, Victoria, Australia; [3]Edith Cowan University, Perth, Australia; [4]Curtin University, Perth, Australia; [5]University of Newcastle, Callaghan, Australia; [6]Edith Cowan University, Joondalup, Australia.*
Contact e-mail: d.jatatunga@ecu.edu.au

Background: Luteolin, a flavone compound found in various foods has shown beneficial effects for Alzheimer's disease (AD) due to anti-inflammatory and anti-oxidant activities (Kwon et al., 2017). Decosahexaenoic acid (DHA) is an essential long-chain omega-3 polyunsaturated fatty acid naturally occurred in healthy brains, however, there is evidence for reduced DHA levels in AD brains (Pan et al., 2015). While effects of these nutraceutical compounds individually have been reported extensively, their combined action has not been investigated in AD. The objective of this study was to evaluate the protective effects of luteolin and DHA against beta amyloid (Aβ) toxicity and to determine whether in combination they act synergistically. **Methods:** Human neuroblastoma M17 cells were treated with A$\beta_{1\text{-}42}$ peptide (20μM). The ability of luteolin and DHA *per se*, to protect M-17 cells was evaluated by treating the cells with different doses (2.5-40μM) for 72h. Cell viability was determined by CellTiter glo assay. In the same manner, nine compound combinations (Luteolin(μM): DHA(μM)- 5:5, 5:10, 5:20, 10:10, 10:20, 10:30, 20:10, 20:20, 20:30) were tested against A$\beta_{1\text{-}42}$-induced toxicity. The results were further validated by MTS and LDH assays. Synergism arising from combination of luteolin



Pathogenicity and Drug Resistance of Human Pathogens pp 337-350 | Cite as

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Chapter

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Page No. 149

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PP-11

Phyto-mediated Silver Nanocomposites as a Control Agent of *Aedes aegypti* L.: Optimal Formulation with *Citrus limetta* Peel Extract

Aggarwal, D.[1], Sharma, A.[2], Samal, R.R.[3], Dagar, V.S.[3] and Kumar, S.[3*]

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Botanicals are considered safe and effective mosquito control agents, as compared to conventional insecticides. Use of effective botanicals as nanoformulations can further enhance their efficacy at lower dosages. Thus, silver nanocomposites (AgNCs) were formulated with *Citrus limetta* peel extract (CLPE) and evaluated against *Aedes aegypti* for their larvicidal potential. The silver nanocomposites from CLPE were formulated. The biosynthetic process was optimized by varying impacting factors; temperature; concentration and volume of silver nitrate solution; and the volume of catalyst. The larvicidal bioassay with AgNCs was conducted against early fourth instars of *Ae. aegypti* using standard WHO protocol. Synthesis of silver nanocomposites in the reaction mixture was primarily marked by the conspicuous colour change of the solution; from initial pale yellow to final dark brown; which was then traced through UV-Visible spectroscopy. The spectroscopic peaks were obtained in the range of 416-420 nm. The optimal formulation of CLPE-AgNPs was obtained by incubating the mixture of 4 mL $AgNO_3$ (3mM concentration) and 3 mL CLPE at 60°C and 1 mL NaOH. The 24 h larvicidal bioassay with CLPE-AgNPs against *Ae. aegypti* resulted in respective LC_{50} and LC_{90} values of 26.82 µg/mL and 99.32 µg/mL; which decreased to 19.51 µg/mL and 71.99 µg/mL after 48 h of exposure. The bioassay with crude *Citrus limetta* peel extract resulted in much higher toxicity values while no mortality was observed in controls. Synthesis of AgNCs utilizing peel extract of *C. limetta* is a facile, cost-effective method. The application of these NCs can be an eco-safe and effective alternative to conventional insecticides for mosquito management.

Keywords: Silver nanocomposites, *Citrus limetta*, Larvicidal, *Aedes aegypti*, Spectroscopy

Rhodamine 6G Adsorbed by Eco-Friendly Adsorbent Needle-Shaped Chitin Nanoparticles in Day Light

*Drashya' and Sunita Hooda**

Department of chemistry, Acharya narendra dev college (University of Delhi), Kalkaji, New Delhi -110019, India

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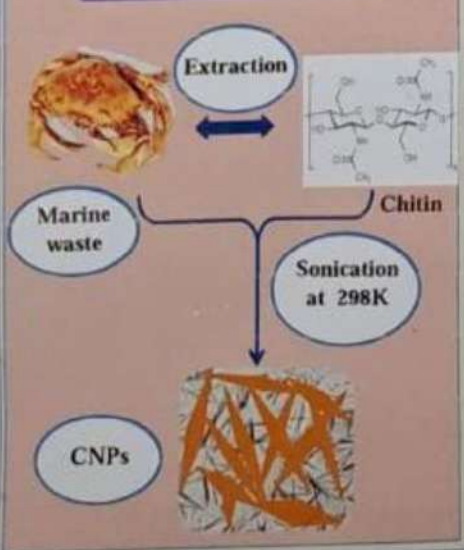
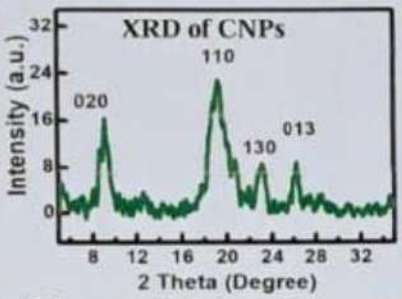
Objectives

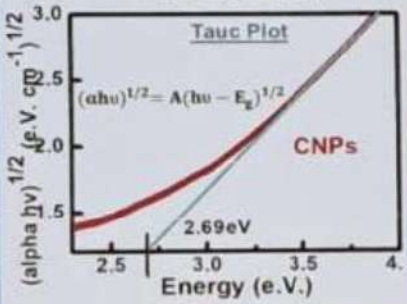
- Chitin has received great attention in the field of surface and interface science and technology.
- The adsorption behavior of various Chitin modified systems have been investigated, and it is generally accepted to consist of huge number of oxides group and its long polymeric chain imparts a large surface area.
- Here we report the development of Needle-Shaped Chitin nanoparticles (CNPs) as a promising adsorbent for dye adsorption process under visible light conditions, without any new modification.
- These Chitin nanoparticles were produced via simple preparation route. Needle-Shaped morphology of Chitin nanoparticles were analyzed by the Transmission Electron Microscopy (TEM).
- The size of the nanoparticles was calculated by the Debye-Scherrer equation using X-Ray Diffraction technique.
- Band gap energy was calculated by the Tauc's plot using UV-Visible spectroscopy, which lies in the visible region.
- Under visible light, CNPs exhibit an adsorption activity of 150 mg/g of Rhodamine 6G dye, which is the best adsorption reported for any adsorbent material.

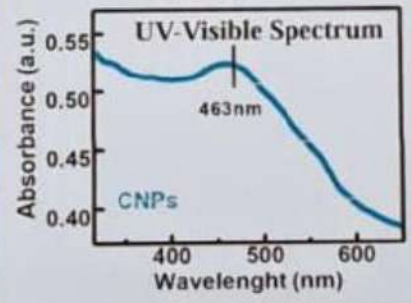
Experimental

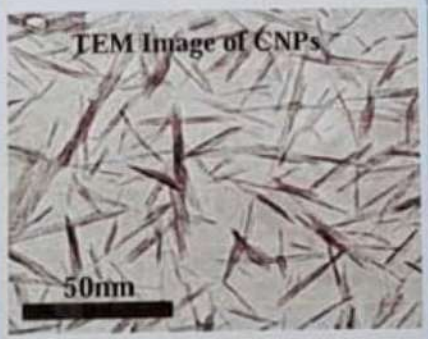


Characterization









Debye-Scherrer equation

$$D = \frac{K\lambda}{\beta Cos\theta}$$

Where,
θ = Bragg angle
D = Crystallite size
λ = Wavelength of X-Ray (0.154nm)
K = Crystallite shape factor (0.9)
β = Full width at half maximum

Adsorption capacity

$$q_e = \frac{(C_o - C_e)V}{m}$$

where,
m = Mass of adsorbent
V = Volume of dye solution
q_e = Maximum adsorption capacity
C_o = Initial concentration of dye solution
C_e = Final concentration of dye solution

Results

- Powder XRD pattern of CNPs matches well with reported data and 7.5 nm size evaluated by the Debye-Scherrer equation.
- Band gap energy values calculated from Tauc plot (2.69eV) and through UV-Visible spectra (2.68eV) are observed to be close enough.
- Needle shaped morphology of CNPs was confirmed by TEM at 50nm scale.

R6G Adsorption through column process

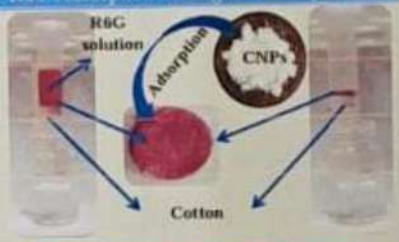


Table: Some Properties of CNPs

S.No.	Properties	CNPs
1.	Colour	White
2.	Shape	Needle
3.	Size (nm)	7.5
4.	Band Gap Energy (eV)	2.69
5.	Wavelength (nm)	469
6.	Adsorption Capacity (mg/g)	150

Conclusion

- Needle-Shaped nanoparticles of Chitin successfully synthesized by sonication effect. XRD, UV-Visible and TEM characterization confirms the formation of nanoparticles.
- Size and band gap energy of CNPs shows that these nanoparticle are excellent adsorbent for Rhodamine 6G dye in visible region.
- Encouraged by these results, further investigation on the kinetic and thermodynamic properties was carried out.

Acknowledgement

Authors are thankful to Principal, Acharya Narendra Dev College, University of Delhi, for providing infrastructure for research work in the college. Special thanks to CSIR for financial support.

References

- A. O. Ahmed, J. W. Rhim, Carbhydrate Polymers, 197, 349-358 (2018).
- Gautam, D., Lal, S. and Hooda, S., *J. NanoSci. Nanotech., 20,* 2939-2945 (2020).
- E. Z. Gomaa, J. Poly. Envir., 26, 3638–3654 (2018).

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ABSTRACT BOOK

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ABSTRACT BOOK

Acetamiprid resistance in *Aedes aegypti*: Evaluation of metabolic detoxification and target site mutations as defense mechanisms

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saritakumar@andc.du.ac.in, sarita.sanjay90@gmail.com

Introduction: Mosquito-borne diseases are a major public health problem in the tropical and subtropical regions of the world; especially in the developing as well as resource-poor countries. Mosquito vectors, *Aedes, Culex* and *Anopheles* are responsible for transmitting a range of disease pathogens causing dengue, Chikungunya, malaria, filariasis and Zika, etc. Global preponderance of these cases has increased the need of mosquito management at a large scale. Till today, the most endorsed strategy to tackle and control mosquito-borne diseases principally lies on interrupting the disease-transmission cycle. Majority of the control programs are reliant on chemical insecticide-based interventions. Use of these insecticides and those with similar or different modes of action has increased the problem of environmental pollution and bioaccumulation of insecticides undermining their effectiveness. In addition, prowess of development of resistance amongst mosquitoes has risen sharply over the last decade and the relationship between current indicators of resistance and the impact of vector control interventions is still uncertain due to the diverse mechanisms of resistance. Consequently, novel and safe strategies employing natural products are necessitated for mosquito control.

Aim: Present study explores the bio-efficacy of acetamiprid, a neonicotinoid, against *Aedes aegypti* larvae and development of larval resistance after subjecting to acetamiprid selection pressure for 10 successive generations. The variations in the levels of three metabolic detoxifying enzymes - Non-Specific esterases, Glutathione-S-transferases and acetylcholine esterases and insensitivity in target protein were determined in the resistant population.

Results: Exposure of the susceptible population (PS) of *Ae. aegypti* early fourth instars to acetamiprid resulted in LC_{50} and LC_{90} values of 0.18799 ppm and 1.31547 ppm, respectively. Acetamiprid selection with 10 successive generations (ACSF-10), however, reduced its efficacy by 19.7-fold. The activity of alpha-esterases and beta-esterases elevated by 1.32-fold and 1.38-fold in ACSF-10 as compared to the PS. In addition, a rise of 1.5-fold was observed in the activity of glutathione-s-transferases in ACSF-10 as compared to PS exhibiting an increase in activity by 0.91 nanomoles/min/mL. Similarly, the activity of acetylcholine esterases was found to be higher in resistant generations as compared to the parental strains. The resistance resulting from insensitive acetylcholinesterase was also indicated by point mutations in ace-1 gene, at Y456C codon (Tyrosine to Cysteine) and at R495M (Arginine to Methionine).

Conclusion: The results indicate that larvae of *Ae. aegypti* were highly susceptible to acetamiprid, though, they developed 19.7-fold resistance after subjection to selection pressure for 10 generations. Individual/synergistic contribution of different enzymes leading to acetamiprid detoxification in *Ae. aegypti* was observed. Mutations in ace-1 gene leading to insensitivity in the target protein further added to the development of acetamiprid resistance. The rotational use of toxicants with different modes of action and use of synergists, etc. are recommended for mosquito management in fields.

Keywords: *Aedes aegypti*, Acetamiprid, Acetylcholine esterases, Ace-1, Esterases, Glutathione-s-transferase, Mutation, Resistance

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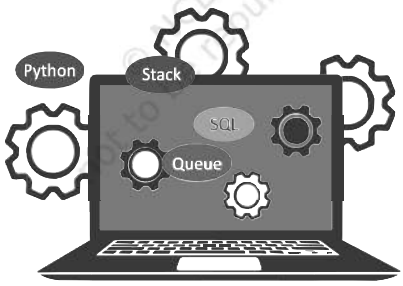

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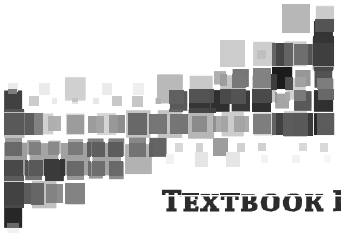

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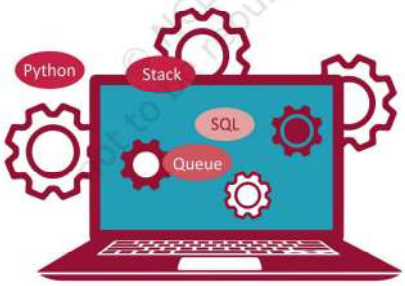

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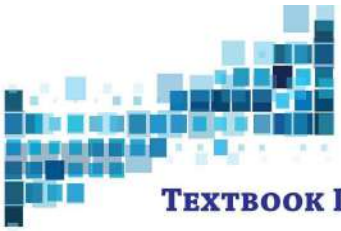

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Computer Science & Information Management

The Internet of Drones

AI Applications for Smart Solutions

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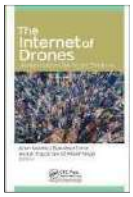

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In recent years, drones have been integrated with the Internet of Things to offer a variety of exciting new applications in different sectors. This volume provides a detailed exploration of adapting and implementing Internet of Drones (IoD) technologies into real-world applications, with the emphasis on solutions to architectural challenges, providing a clear overview of standardization and regulation, implementation plans, and privacy concerns.

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The Internet of Drones: AI Applications for Smart Solutions discusses the architectures and protocols for drone communications, implementing and deploying of 5G-drone setups, security issues with drone technology, deep learning techniques applied on real-time footage, and more. It also explores some of the varied applications of IoD, such as for use in monitoring and analysis of troposphere pollutants, providing services and communications in smart cities (such as for weather forecasting, healthcare, communications, transport, agriculture, safety and protection, environmental reduction, service delivery, and e-disposal), for disaster relief management (such as for scanning the affected areas for radiation intensity in cases of nuclear disaster, gathering the location of hotspots, looking for the victims, assessing damage), and more. The authors cover package delivery, movement of traffic, crop monitoring, and mass detection. The problems and challenges associated with IoD in air traffic monitoring, communication between drones, optimum route discovery, and security are also addressed.

This detailed exploration of adapting and implementing IoD technologies into real-world applications in this volume will be valuable for graduate students in computer science and especially drone technology, as well as researchers and professionals.

CONTENTS:

Portunid Crabs of World Seas
• Biology and Ecology of Edible Marine Gastropod Molluscs

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"I'm very pleased with the books you have edited. It shows a very good and careful work by everyone involved along the whole production process, and so the final result is a beautiful piece: it has come out as a very nice and appealing book, easy to handle and read, ... and hopefully of interest for people from diverse related fields!" — Enrique Macia-Barber, PhD, Professor of Condensed Matter Physics, Universidad Complutense de Madrid, Spain; Author of **The Chemical Evolution of Phosphorus: An Interdisciplinary Approach to Astrobiology**

"As the Principal Editor for the trending 3-volume set book of Phytochemistry, I wish to express my sincere gratitude to the management of AAP for their excellent publishing services. Our publishing experience is positive, and the outcome of the book is one that is

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"I would like to thank Dr. Mahmood Khan and AAP warmly for offering me the opportunity to publish my book Sustainable Viticulture: The Vines and Wines of Burgundy. I found a lot of pleasure in reflecting on my experience and observations as a viticulturist in Burgundy and other regions of the world. I enjoyed putting in writing thoughts, memories, and ideas I've had for years. I also found pleasure in synthesizing discussions I've had with wine professionals and wine buffs as well as

Programmable Joint Computing Filter for Low-Power and High-Performance Applications

Abhineet Bawa[1(✉)], Rama Kanta Choudhury[1], Chandra Kanta Samal[2], and Navneet Yadav[1]

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Abstract. A high-performance programmable joint computing for low power and high-performance filter (PJA) is presented in this paper. It emphasizes on low power and high efficiency, which is reliable for filter operation. The architecture is designed based on CSHM which can be implemented effectively in vector-scalar products at the circuit level. The products of the premultiplier are shared with all A&As, which assist significantly in the performance of the system. A programmable digital10-tap PJA filter, which accepts the input signal and values of coefficients of up to 17 bits (signed), is designed using VHDL and implemented on the XilinxSpartan-7 XC7S100FGGA676FPGA. It contains a total of 64000 LUT (Look-Up Table) elements and is based on 28 nm HKMG (High K metal Gate) transistor. The implementation was done using Xilinx Vivado 2019.2, and the power is measured using Xilinx Power Analyzer.

Keywords: High order carry-select adder · PJA FIR filter · Premultiplier · Selection contingent

1 Introduction

Presently, digital media and multimedia with various computational applications demand various high performance, and low power consuming filters. The use of filters in VLSI design with help of FPGA is predominantly applicable in various DSP applications. The computationally intensive operation used in DSP can be obtained by a convolution operation. It can be visualized by the help of moving weighted mean, i.e. the weighted mean of every input stream over a suitable number of inputs. Here 10-taps or 10 inputs are considered for the weighted mean. Specific weights are assigned to the past and current values of the input signal, which determines the frequency band to be handled. Taking 1/10 weights for every input for a10-tap filter it gives an arithmetic average of the inputs, thus implementing a low pass filter by smoothening out the sudden high bursts or high-frequency element in the signal. A large amount of multiplication and accumulation processes increase power consumption by an increase in the hardware requirements for these operations, i.e. due to demand of high-order PJA filters with high sampling rate. The Fig. 1 shows the structure of transposed direct form

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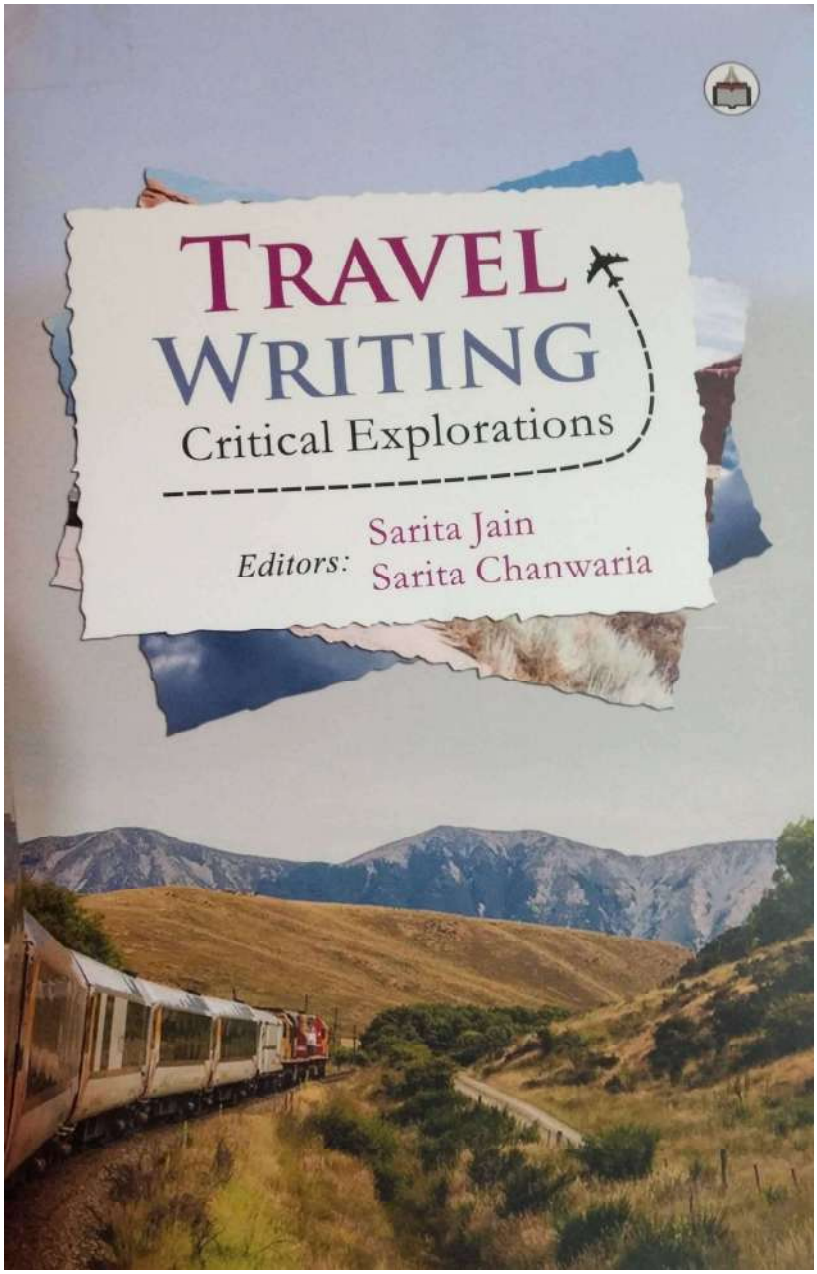
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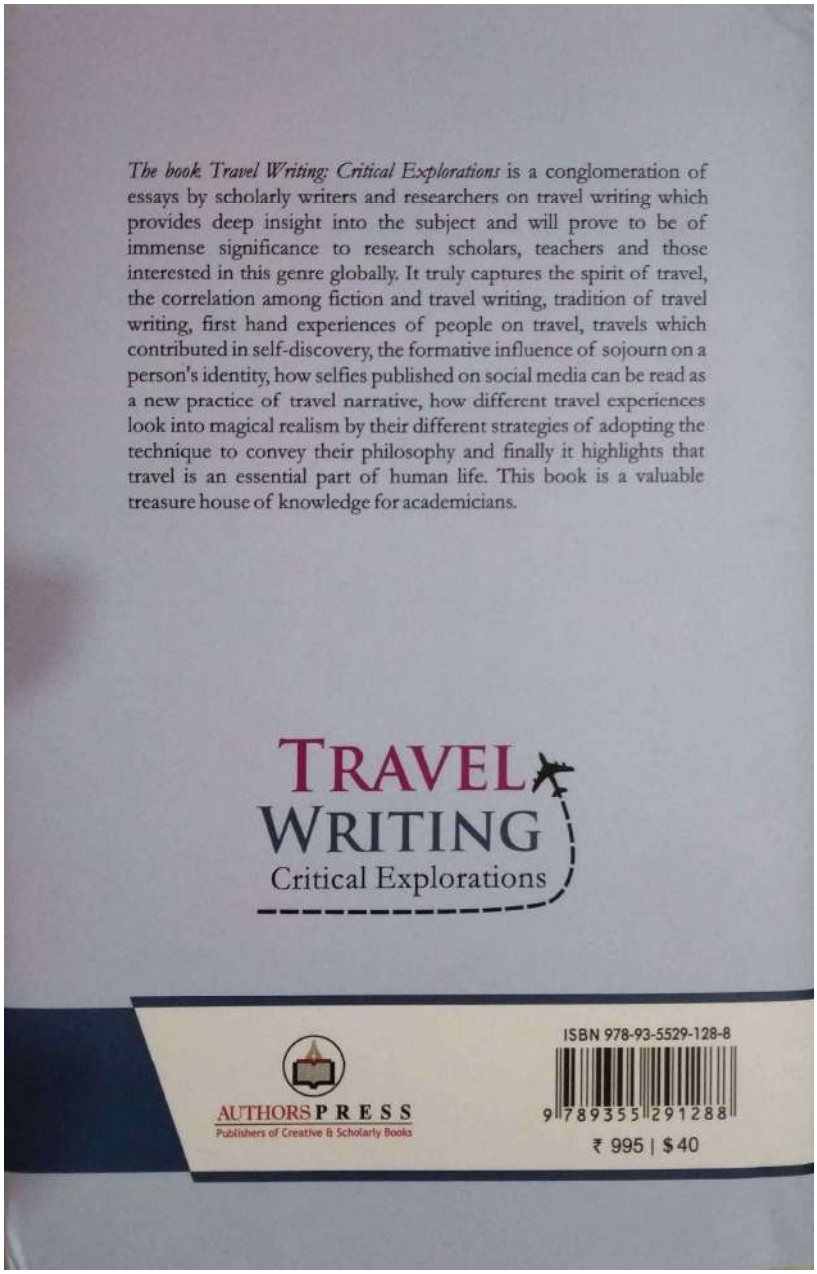
Contents

The book Travel Writing: Critical Explorations is a conglomeration of essays by scholarly writers and researchers on travel writing which provides deep insight into the subject and will prove to be of immense significance to research scholars, teachers and those interested in this genre globally. It truly captures the spirit of travel, the correlation among fiction and travel writing, tradition of travel writing, first hand experiences of people on travel, travels which contributed in self-discovery, the formative influence of sojourn on a person's identity, how selfies published on social media can be read as a new practice of travel narrative, how different travel experiences look into magical realism by their different strategies of adopting the technique to convey their philosophy and finally it highlights that travel is an essential part of human life. This book is a valuable treasure house of knowledge for academicians.



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Varying sonication conditions to tailor surface morphology of GO thin films for enhanced gas sensing performance

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Vishal Dhingra, Shani Kumar, Arijit Chowdhuri, Amit Garg, et al.

Varying Sonication Conditions to Tailor Surface Morphology of GO Thin Films for Enhanced Gas Sensing Performance

Vishal Dhingra[1,3], Shani Kumar[1,3], Arijit Chowdhuri[2]and Amit Garg[1, a)]

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Abstract. Efficient and enhanced gas sensing especially at room temperature is the demand for contemporary industrial applications. This has been made possible due to a paradigm shift from semiconducting metal oxides to 2D materials including Graphene Oxide (GO) and reduced GO (RGO). GO and its derivatives have ushered in a revolution mainly because of their high surface to volume ratio and presence of various oxygen groups. Literature reports since 2010 indicate existence of investigations by many research groups wherein multiple approaches have been employed to enhance the gas sensing capabilities of GO and RGO. Some of the more radical approaches have been fabrication of free standing GO films, adoption of green fabrication techniques, thermal reduction and even implantation of nitrogen ions. However, quantitative augmentation of favourable oxygen species on the GO films envisaged to act as active sites for the target gas molecules (H_2 and SO_2 in the current investigation) is yet to be carried out. The present study reports enhancement in detection of gaseous species due to twin mechanisms of a) advantageous tailoring of surface morphology and b) presence of favourable oxygen species. Both the processes are shown to occur due to intentional incorporation of variations induced in the sonication process during synthesis of GO films.

INTRODUCTION

Graphene Oxide (GO) has over the last decade, due to its multifunctional properties, found myriad applications of interest. One of the fields wherein GO and its derivatives (doped GO, reduced GO etc.) have found extensive usage include gas sensing. Traditionally, gas sensing applications have been dominated by semiconducting metal oxides (MOX) [1]since 1962. Researchers worldwide, in order to cater to industry requirements, have always aspired to developgas sensors operating at room temperature that has hitherto not been possible with MOX sensors including SnO_2, ZnO, WO_3, TiO_2 etc. Some other drawbacks associated with MOX based gas sensors, besides high temperatures of operation, have been, long stabilization times, size reduction constraints and reduced sensing response due to grain growth over period of time. Graphene and its derivatives like GO / reduced GO have been reported to exhibit 2D characteristics including advantageous electrical properties besides displaying beneficial high specific surface area. Graphene's intrinsic gas sensing property is attributed to its occurrence of resistivity variation due to adsorbed gas molecules that further actas donors or acceptors. However, pristine graphene is not preferred for gas sensing since its mass production as single layer is difficult, there is a problem of missing band-gap and existence of dangling bonds on surface, which tend to constrain the adsorbed ions on its surface. Due to the aforementioned limitations, GO with excess of active sites in the form of epoxy groups, hydroxy groups and defects on its surface and basal planes has been preferred for gas sensing. Conditions employed during chemical preparation technique of graphene directly influence the number and nature of these active sites on which chemisorption of reactive gas occurs. Further, these active sites are also known participate directly in formation of products [2]. In case of graphene (which is a sp^2-hybridized carbon material), the different types of chemicals used in its synthesis, thermal and/or chemical treatments used therein besides physical processing techniques used affect some or all of

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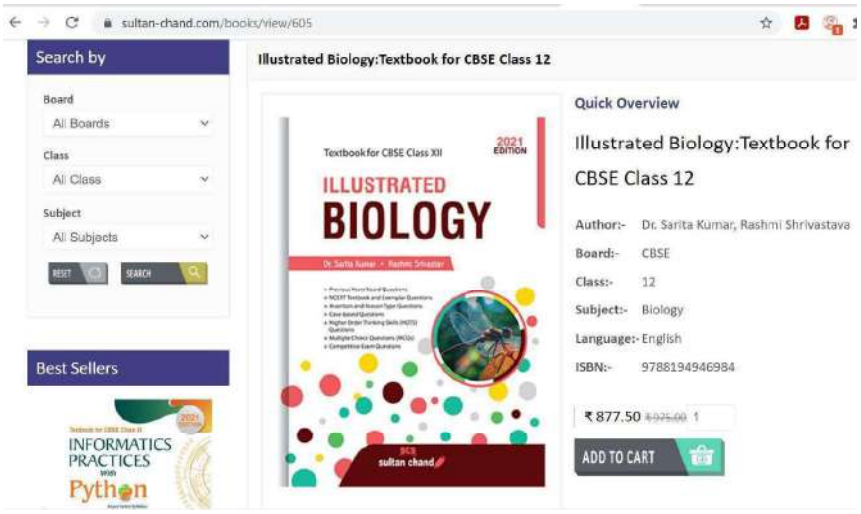
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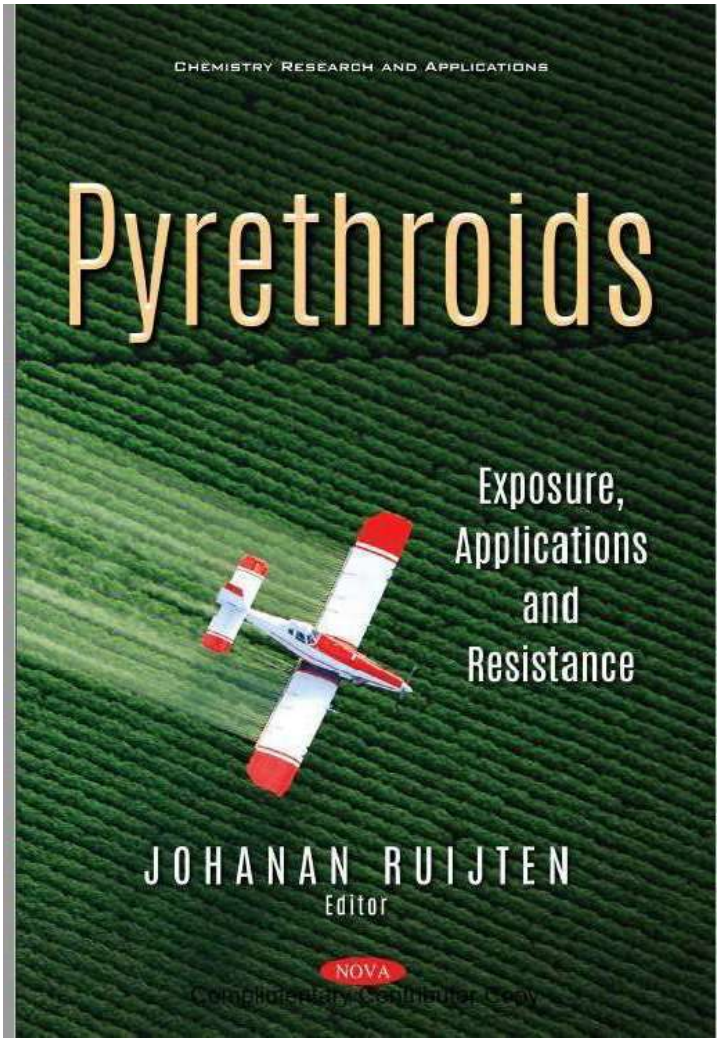
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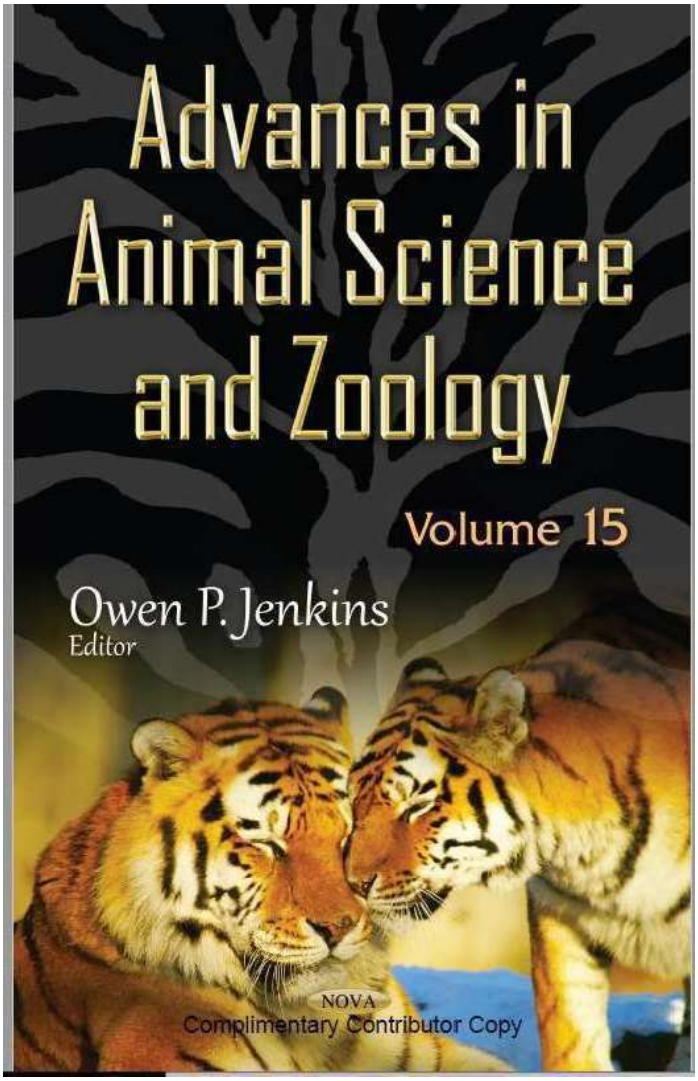
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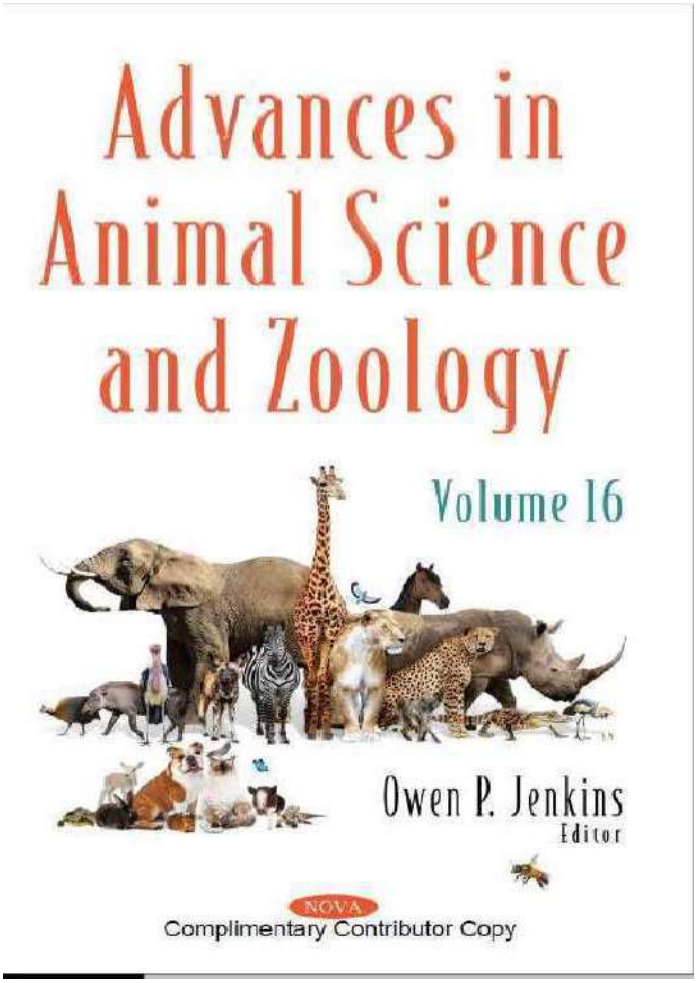
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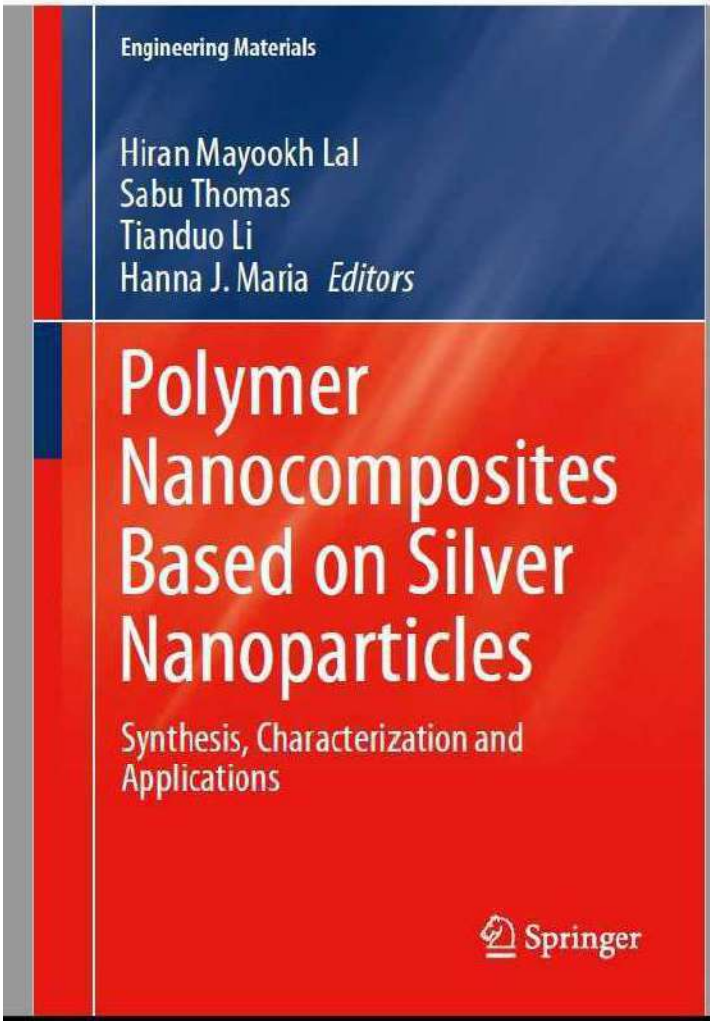
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Professor in Life Sciences

Dated: 6th October, 2020

To whom it may concern

This is to certify that Dr. Sarita Kumar, Associate Professor, Department of Zoology, Acharya Narendra Dev College, University of Delhi wrote the following Units of the Course 'Insect and Vectors-borne Diseases' – An Elective Course for the students of B.Sc. (General) with Zoology, IGNOU.

a) Unit 3: Basic Classification of Class Insecta
b) Unit 6: Medically Important Insect Orders

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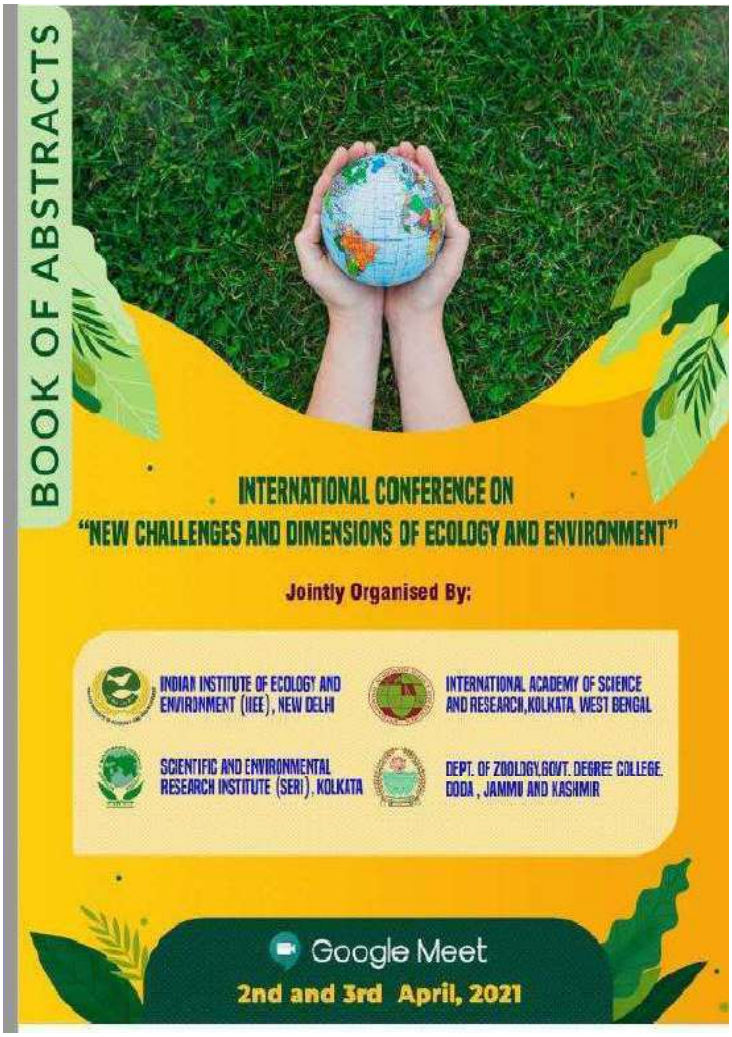
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Google Meet
2nd and 3rd April, 2021

Book of Abstracts: International Conference on "New Challenges and Dimensions on Ecology and Environment"

Diversity of some Pollinator Bee Fauna *vis-à-vis* Crop from Delhi

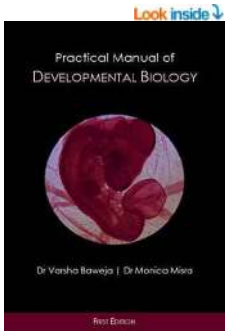
[1,2]**Jyoti Falswal,** [1]**Debjani Dey and** [2]**Sarita Kumar**

[1]*Division of Entomology, ICAR – IARI, New Delhi*

[2]*Acharaya Narendra Dev College, University of Delhi*

Pollinators are essential components of almost all of the world's terrestrial ecosystems and more than 75% of all flowering plants on the earth need pollinators. The pollinators not only provide pollination services, but are also excellent indicators of the state of terrestrial environments including responses to global warming. Moreover morpho - taxonomy is most often the lifeline for studies on biodiversity, conservation for improving agricultural production. Among all pollinators *viz.*, hummingbirds, bats and insects, bees are unique. Bees are excellent pollinators because most of their life is spent collecting pollen and nectar. They have specialized pollen-carrying structures called scopa, either on the hind legs or on ventral surface of the abdomen, made up of thick, plumose setae. Some bees who do not have a scopa, have a modified structure called the corbicula or the "pollen basket" on their hind leg. Some solitary bees like Megachilidae are oligoleges (bees that visit narrow and specialized preference for pollen sources), in that they only collect pollen from one or few species or genera of plants. Oligolectic bees also visit multiple plants for their nectar. Worldwide 20,000 species of bees under Superfamily Apoidea are known. An intensive survey was conducted in Delhi during 2018 – 2020 for recording the diversity of bee pollinators in the fields of Mustard, Maize, Cauliflower, Brinjal, and Tomato and in some flowers like *Calendula*, Rose, *Dahlia*, *Dianthus* and *Petunia* to explore the fauna of pollinator bees of Delhi. Some crops like Mustard, Rice and Maize are essential in that environment so their pollinators are also should be known so that we can enhance the native crop productivity. Collections were made with yellow pan traps and sweep nets. The collected specimens were brought to the lab and processed suitably for taxonomic studies. Pollinator bees were found to belong to 5 families i.e. Apidae (subfamily: Ceratinini and Apini), Halictidae (subfamily: Halictinae and Nomiinae), Megachilidae (subfamily: Megachilinae), Colletidae (subfamily: Colletinae) and Andrenidae (Andreninae). Among them, family Apidae is the largest family with over 5700 species of bees and includes the well-known honey bees and bumble bees. Not all members of Apidae are social, whereas Halictidae, Megachilidae, Colletidae include exclusively solitary bees.

Keywords: *Apoidea, Bees, Pollinators, Taxonomy, Biodiversity.*



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Developmental Biology deals with the processes by which single celled stage transforms into a multicellular and a well differentiated organism and how the structures change with time morphologically, anatomically and physiologically, etc. Embryogenesis and further development of any species depends on the type of its egg and also on its habitat. In this book we have restricted ourselves to only three model organisms namely: frog, chick and Drosophila by which we have tried to explain various stages of external development in water as well as on land. The concept of metamorphosis is also explained by describing the stages of frog and fruit fly.
In the beginning of the book timeline of developmental biology is given where major break-through experiments have been enlisted. The first chapter is on model organisms which are generally used in research on various concepts of development. In the second chapter all stages of frog development are discussed in detail. Third chapter deals with the development of chick and the methods for determining the chronological age of the chick embryo. Development of Drosophila is discussed in fourth chapter and histological details of placenta are discussed in the last chapter. A detailed Glossary is provided at the end of the book to help students understand various terms related to developmental biology.
This book is based on the syllabi for the undergraduate courses of Zoology and Life Sciences under Choice Based Credit System (CBCS) and will cater to the needs of undergraduate students of various universities and colleges in India and abroad.
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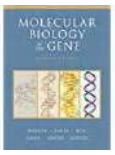

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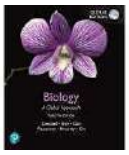

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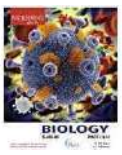

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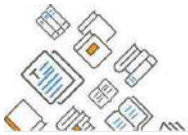

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Book Review
Reviewed in India on 8 March 2021
Verified Purchase
As we know there is a lack of practical books for developmental biology, I feel this book provides wholesome information on related topics. It provides us with some very beautiful microscopic illustrations along with it's necessary labelling.
I am really intrigued.
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Ravi Toteja

Is at present the Officiating Principal of Acharya Narendra Dev College, University of Delhi. Dr. Toteja has done his M.Phil. in Tumor Immunology and Ph.D. in Molecular Parasitology from the University of Delhi. He has a vast teaching experience. He has been teaching Immunology to UG students since 2005. He is actively involved in research and has a number of research papers in International and National Journals. He has also been awarded with the Meritorious Teachers' award by the Government of National Capital Territory of Delhi.

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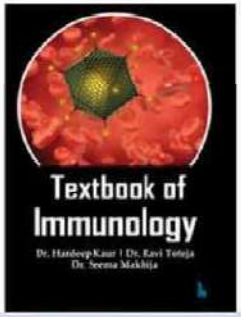

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By : Hardeep Kaur , Ravi Toteja & Seema Makhija

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Price : ~~₹675.00~~
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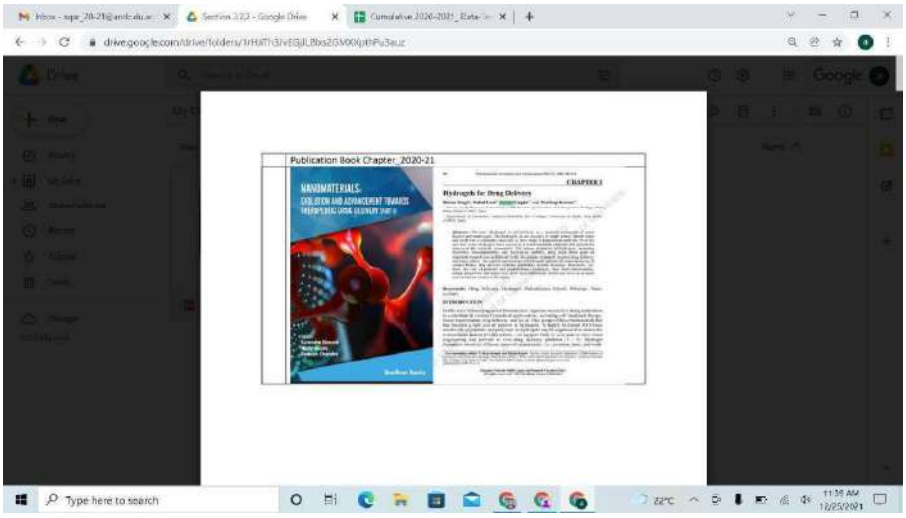
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Chapter

Herbs and Spices—New Processing Technologies. *Syzygium aromaticum*: Medicinal Properties and Phytochemical Screening

Vikrant Kumar, Deepak Mishra, Mukesh Chandra Joshi, Priyanka Mishra and Megha Tanwar

Abstract

All over the world, Plants have found to be a valuable source of herbs and spices for a long period of time to maintain the human health. Varieties of herbs and spices have been used to impart an aroma and taste to food for last few centuries. Several applications of plants species have been reported as antioxidative, anti-inflammatory, antidiabetic, antihypertensive and antimicrobial activities. Currently efforts are focused on their scientific merits, to provide science-based evidence for their traditional uses and to develop either functional foods or nutraceutical behavior. India is well recognized all over the world for their variety of herbs, spices and medicinal biodiversity. The WHO has listed more than 21000 plants, which are used for their medicinal purposes either in the form of essential oil or in the form of flavor. Among these, more than 2500 species and herbs are found in India, however; among them more than 150 species are used commercially on large scale. In India, the use of spices and herbs in the form of essential oil or in the form of flavor are traditionally used in routine treatment. For example, Curcumin which is found in turmeric are frequently used in medical facilities to wound healing, rheumatic disorders, and gastrointestinal symptoms etc.

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Chapter

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By Jyoti Rani, Urmi Bajpai, Srinivasan Ramachandran

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ABSTRACT

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Bioaugmentation for the treatment of waterborne pathogen contamination water

Manoj Kumar Singh[1], Anurag Maurya[2], Sushil Kumar[3]
[1]Department of Botany, Acharya Narendra Dev College, University of Delhi, New Delhi, India; [2]Department of Botany, Shivaji College, University of Delhi, New Delhi, India; [3]Delhi College of Arts and Commerce, University of Delhi, New Delhi, India

1. Introduction

Water is an important natural resource utilized for domestic, industrial, recreational, and agricultural purpose by human society. Quality of water is negatively affected by contamination of various pollutants. Various types of physical, chemical, and biological pollutants emerge from different sources and they deteriorate respective qualities of water. Physical property of water includes electrical conductivity, total dissolved solids, and suspended solids. Chemical property is given by composition of various minerals, carbon content, dissolved oxygen, and nitrogen and phosphorus (Christensen et al., 2015). Biological property refers to presence of various types of microbes and pathogens, especially viruses, bacteria, algae, protozoan, nematodes, insects, and their propagules. Waterborne diseases are any sickness caused by drinking of water polluted with pathogenic microorganisms. There are a variety of pathogenic microorganisms which can cause various types of illness in humans (Table 10.1).

Based on the source of pollution, wastewater is broadly classified as stormwater runoff, agricultural runoff, industrial wastewater, and domestic wastewater. Stormwater is a kind of raw water formed by natural contamination of pollutants in rain-catchment areas like agricultural field, pond, and forest, etc. (Rippy, 2015). Other examples of raw water are groundwater abstracted through borehole, rivers, natural and man-made lakes, and reservoirs. The raw water can be supplied for potable use after simple filtration steps and disinfection. After domestic or industrial usage, water is discharged in sewage system. This water, burdened with pollutants and pathogenic microbes, is called as wastewater. Domestic wastewater is categorized as

Waterborne Pathogens. https://doi.org/10.1016/B978-0-12-818783-6.00010-4

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Biofiltration technique for removal of waterborne pathogens

Anurag Maurya[1], Manoj Kumar Singh[2], Sushil Kumar[3]
[1]Department of Botany, Shivaji College, University of Delhi, New Delhi, India; [2]Department of Botany, Acharya Narendra Dev College, University of Delhi, New Delhi, India; [3]Delhi College of Arts and Commerce, University of Delhi, New Delhi, India

1. Introduction

Water is an important natural resource utilized for domestic, industrial, recreational, and agricultural purpose by human society. Utility of water is negatively affected by contamination of various pollutants. Pollutants are physical, chemical, and biological in nature and they deteriorate respective qualities of water after contamination. Physical properties of water includes electrical conductivity (EC), total dissolved solids, and suspended solids. Chemical properties are given by composition of various minerals, carbon content, dissolved oxygen, nitrogen and phosphorus. Biological property refers to presence of various types of microbes and pathogens specially viruses, bacteria, algae, protozoan, nematodes, insects, and their propagules.

Based on the source of pollution, wastewater is broadly classified as stormwater runoff, agricultural runoff, industrial wastewater, and domestic wastewater. Stormwater is a kind of raw water formed by natural contamination of pollutants in rain catchment areas like agricultural field, pond, and forest, etc. Other examples of raw water are groundwater abstracted through borehole, rivers, natural and man-made lakes, and reservoirs (Scholz, 2006). The raw water can be supplied for potable use after simple filtration steps and disinfection. After domestic or industrial usage, water is discharged in sewage system. This water, burdened with pollutants and pathogenic microbes, is called as wastewater. Domestic wastewater is categorized as greywater and blackwater. Former is generated from kitchen, laundry, and washrooms, while latter includes human excreta, i.e., feces and urine discharged from toilets. Well-engineered wastewater treatment plant and zero-energy constructed

Waterborne Pathogens. https://doi.org/10.1016/B978-0-12-818783-8.00007-4

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Chemical treatment for removal of waterborne pathogens

Sushil Kumar[1], Anup Kumar Gupta[2], Anurag Maurya[3], Manoj Kumar Singh[4]

[1]*Delhi College of Arts and Commerce, University of Delhi, New Delhi, India;* [2]*Indian Institute of Technology (Indian School of Mines) Dhanbad, Dhanbad, Jharkhand, India;* [3]*Department of Botany, Shivaji College, University of Delhi, New Delhi, India;* [4]*Department of Botany, Acharya Narendra Dev College, University of Delhi, New Delhi, India*

1. Introduction

Water is basic and mandatory need for the humans and the entire living creature on earth. Therefore, the consumption of water by human should be safe, easily accessible, adequate, and free from any kind of contamination (Winward et al., 2008; Cabral, 2010; Lopez-Galvez et al., 2017). The large scale of death approximately 1.7 billion has been reported in developing country due to lack of clean drinking water (Efstratiou et al., 2017). There are a variety of microorganisms such as protozoa (*Giardia* and *Cryptosporidium*), spore bacteria (*Escherichia coli*), and virus, which are responsible for large-scale death (Omarova et al., 2018). In our body, cellular structure is made in such a way that about 99% contribution is of water; it is so important because it carries nutrients, minerals, and vitamins and also removes toxins from body. Every cell in our body needs water because it not only carries nutrients, minerals, and vitamins but also removes toxins.

The chemical properties of surface or groundwater are largely influenced by the water and rock interaction. Based on the interaction between dissolved mineral and water, it may be either soft water or hard water. In some area, water is contaminated by toxic inorganic metal and nonmetal such as fluoride, chloride, iron, arsenic, etc. (Obijole et al., 2019). The surface and groundwater interaction also influences the chemistry of water. Through the process of interaction, surface water is highly influenced by the sewage, industrial discharge, human fecal contamination, and animal fecal contamination. The waterbody contaminated by industrial discharge has high load of toxic metal.

Waterborne Pathogens. https://doi.org/10.1016/B978-0-12-818783-6.00011-6

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Sustainable Solution for Future Energy Challenges Through Microbes

Sumit Sahni, Manoj Kumar Singh, Anita Narang

Book Editor(s):Pardeep Singh, Suruchi Singh, Gaurav Kumar, Pooja Baweja

First published: 10 September 2021
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Summary

Shrinking reserves, volatile prices and environmental concerns associated with use of non-renewable energy pose challenges not only to the global economy but also to environmental sustainability. Furthermore, the location of world's oil reserves, which is politically unstable, puts a question mark on the future of global energy security. High chemical similarity, carbon neutrality and comparable energy content made biofuels (bio-alcohol, biogas, biodiesel) as a sustainable energy source, and microbes played a pivotal role in their production. Biofuels have been classified into first, second, third and fourth generation depending on the evolutionary hierarchy of raw material and technology used for its production. With each generation, the production of biofuels is moving towards attaining sustainability and profitability in energy production. They are evolving to solve the problems of energy crisis, pollution, global warming and waste management in most efficient manner. Advancements in biotechnology, gene editing technology and synthetic biology converted the role of microbes from just decomposer of biomass to producers of biofuels, as bio-refineries, bioelectric cell to solar biofuels. This chapter elucidates the mechanisms and technologies through which microorganisms can pave the way towards a clean and alternative source of energy, which is viable too.

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Production of Liquid Biofuels from Lignocellulosic Biomass

Manoj Kumar Singh, Sumit Sahni, Anita Narang

Book Editor(s):Pardeep Singh, Suruchi Singh, Gaurav Kumar, Pooja Baweja

First published: 10 September 2021
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Summary

Due to rapid industrialization and population growth, the demand for existing non-renewable energy resource, especially fossil fuels, has been increasing in spite of their shrinking resources. Moreover, excessive use of fossil fuels poses environmental risks such as air pollution and global warming. The development of alternative energy resources is of utmost significance among ways to cope with these challenges. Lignocellulosic biomass (LCB), an agriculture and food industry by-product, is an important source for the production of different categories of liquid transport fuels. The most extensively used biofuel in today's world is bioethanol. Bioconversion of lignocellulose to ethanol usually requires multi-step processes, which include: selection of suitable biomass, effective pretreatment method, suitable enzyme cocktail for saccharification, fermentation of mixed sugars and ethanol purification. Due to multiple and complicated steps in conversion of bioethanol, production of liquid hydrocarbons (such as alkanes and aromatic hydrocarbons) from LCB is attracting more research interest. Therefore this article also reviews the recent advancements in catalytic conversion of LCB components (cellulose, hemicelluloses and lignin) into hydrocarbons. LCB can be considered as an effective bio-resource to satisfy the global energy crisis in a sustainable way. However, integrated studies are required for the commercial production of liquid transport fuels from LCB resources.

Page No. 209

Impact of Climate Change on Functional AM Fungi in Rhizosphere

Climate Change and the Microbiome pp 397-416 | Cite as

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Chapter
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Abstract

In the study of global changes and ecosystem impacts, it is very important to consider mycorrhiza, because they hold a critical position at the plant-soil interface. Human-induced environmental changes on earth depend on number of factors such as increasing atmospheric CO_2, nutrient enrichment by atmospheric deposition (N_2), altered precipitation and temperature. All these changes taking place in present and will surely increase in the future can impact the association of fungi with plant roots in a positive or negative direction. These factors are classified on the basis of their impact on colonization of mycorrhiza viz. factors affecting arbuscular mycorrhiza (AM) fungi indirectly by altered allocation of carbon from the host and factors that directly affect AM fungi i.e. altered precipitation, temperature and nitrogen deposition. For the study of global climate change and its impact on AM fungi, this distinction in responses to different factors is very important. These global change factors always occur in association, since experimental examination of a large number of scenarios would not be possible in-situ. Therefore for the study of global changes on AM fungi, large spatial and temporal scale assessments have been considered. The majority of experiments only permit to extract short-term responses, though long-term responses are more appropriate. For example, CO_2 springs, global distribution of plant communities and regional extinction because of climate change. AM fungal community may also be impacted according to host biodiversity at local scales. Further, changes in AM fungal community that are not affected by the changes in plant community should be studied to find precise response of mycorrhizas to global change.

Keywords

CHAPTER 22

Adjusted Bias and Risk for Estimating Treatment Effect after Selection with an Application in Idiopathic Osteoporosis

Omer Abdalghani,[1] *Mohd. Arshad,*[1,2,*] *K R Meena*[3] **and** *A K Pathak*[4]

1. Introduction

In clinical researches, when comparing the effects of different treatments (therapies or drugs), usually a physician would like to select the most effective treatment among k (≥ 2) active treatments. The classical statistical approach to such a problem are the statistical significance tests (such as the test of homogeneity), where we examine the hypothesis of equality of treatment effects. If this hypothesis is rejected, we have the information that the effects are not equal, but we do not have the information about the best (most effective) treatment. Therefore, statistical tests (whether or not they yield statistically significant results) do not supply the information about the selection of the most effective treatment. To this end, one statistical inference problem concerned with the correct selection objective is the ranking and selection problem which concentrates on selecting the most effective treatment among the k available treatments, using some selection rules. The quality of a treatment is assessed in terms of the characteristic (or parametric function) associated with it. Often, a primary characteristic of interest is the mean effect of a treatment. Moreover, the treatment that corresponds to the largest mean effect will be selected using some selection rule. Further, the problem of interest is the estimation of treatment mean effect after selection. Some relevant selection problems in medicine are represented in finding the optimal dose of treatment or identifying subgroups of patients that respond better to specific therapies than to populations at large.

In clinical trials, most of the work carried out for evaluation of new treatments mainly based on designs that compare a single or number of experimental treatments with a standard therapy or a placebo, then one or two treatments will be selected, based on their observed data, for further investigations. Such a design is called 'select and test' design due to Tall et al., 1998; Stallard and Todd, 2003. Most randomized comparative clinical trials including well-designed trials can produce bias in conventional treatment estimation. For example, in the process of randomization, if the allocation of patients is not completely blinded, so that, experimenters or patients have a preconceived idea about their allocation, then the process would be a form of selection bias (intervention allocation bias). If a physician has prior knowledge of how a new treatment might work, then, their evaluation of the patient's responses could be a source of bias. However, they are often potential sources of bias that might not be so apparent, for example follow-up bias, measurement bias, and exclusion bias.

The bias of estimators may occur when the maximum mean effect of several treatments has to be determined, or the mean effect of the selected treatment has to be estimated. It is so because these estimators may contribute to the decision as to whether to continue a drug development program or to select a specific treatment. Bias is likely to be high if the experimental treatments have similar mean effects. The risk of overestimating mean effect after selection may present in these situations as well. Some theoretical results were constructed for adjusting the selection bias that may arise in these situations as discussed in Shen, 2001; Stallard and Todd, 2005. In some situations, the experimenter may wish to estimate the treatment mean effect after selection. In the literature, the problem of estimating mean effect after selection has been studied by many authors. Most discussions focused on obtaining estimators of the parameters associated with the treatment (population) after selection and deriving various results using different loss functions. For some recent contributions on these problems, the reader may refer to Sackrowitz and Samuel-Cahn, 1986; Misra and Meulen, 2001;

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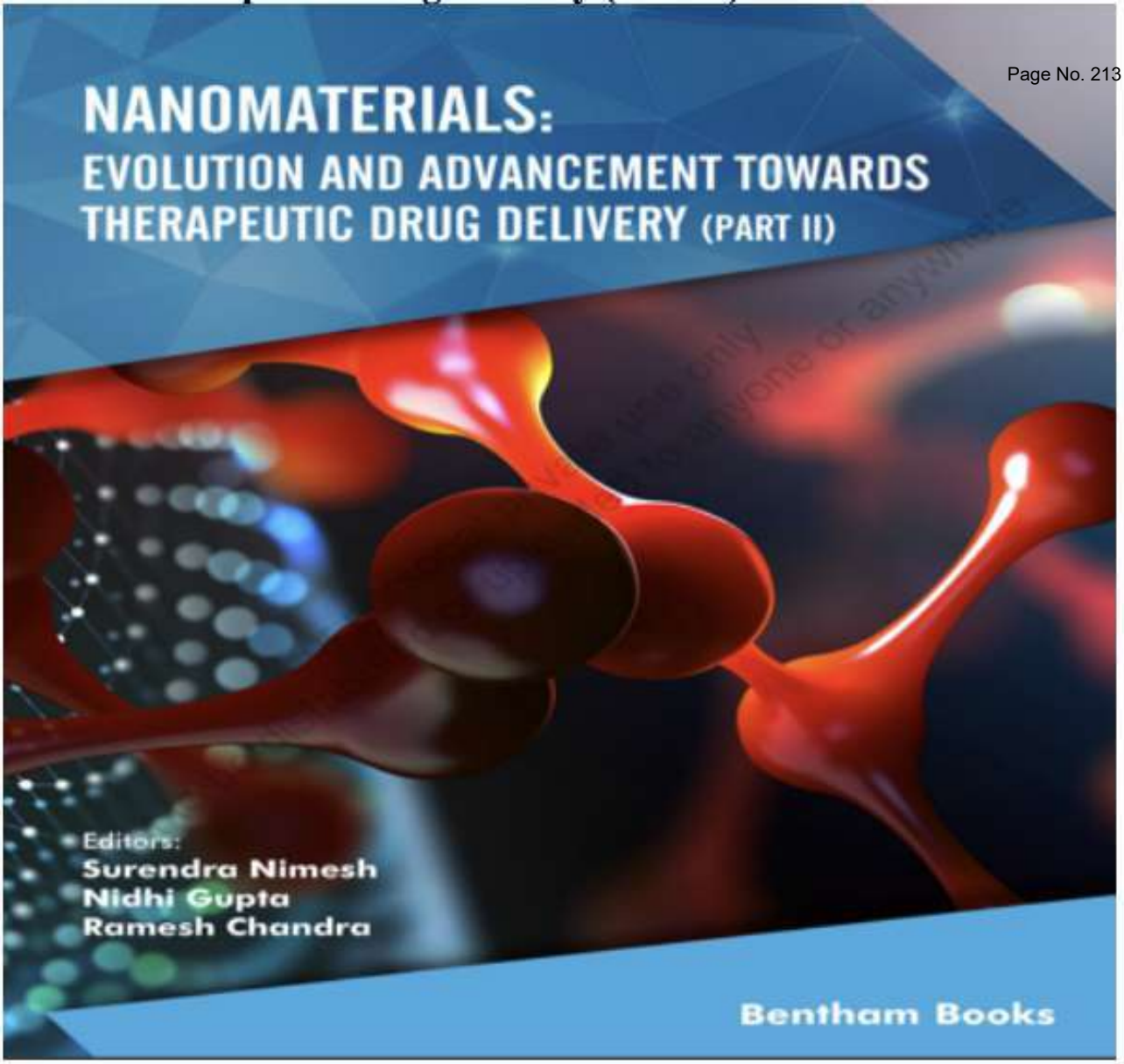

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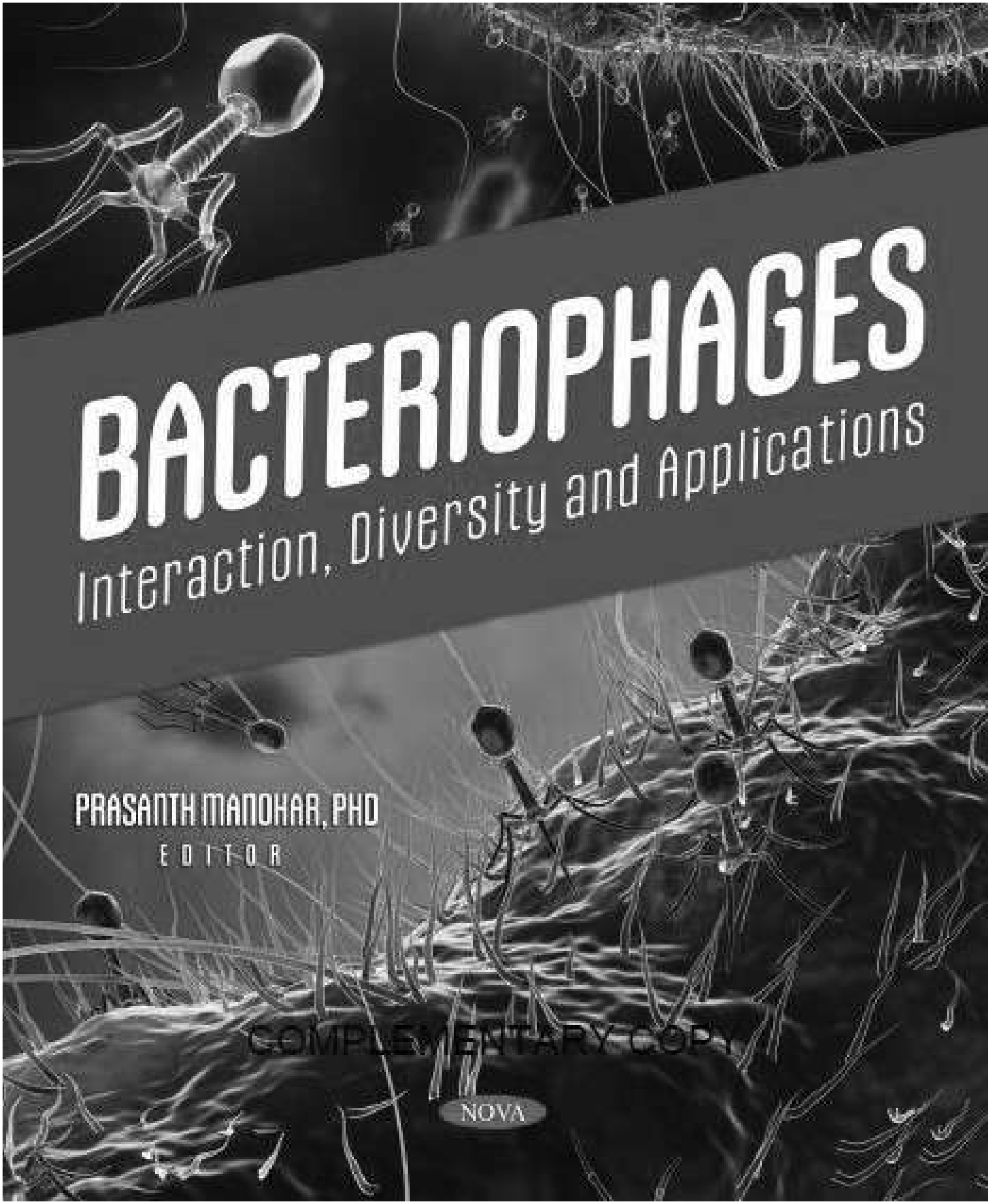
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Contents

Chapter 10

Bacteriophages in the Treatment of Biofilms

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Abstract

Antimicrobial resistance (AMR) is a growing crisis and only a few new antibiotics at various stages of development are in the pipeline. To fight AMR, discovery and development of novel antibacterial agents is urgently required and mining of novel antimicrobial leads from nature is fast emerging as a viable and promising option. Among the many variables that contribute to AMR, biofilm formation during bacterial growth has been identified as a critical contributor which protects sensitive bacteria from antibiotics. Biofilms are constituted of an assembled microbial population adhering to each other and to the solid surfaces, enveloped in an extracellular matrix that consists largely of polysaccharides, nucleic acids and proteins. Biofilms can be found on living tissue, wounds, and on the surfaces of medical and prosthetic devices. Given their refractory response to available antibiotic treatment, the potential of bacteriophages and their derived proteins as biofilm inhibitors/disruptors is reviewed in this chapter. Bacteriophages and the encoded enzymes such as endolysins, EPS depolymerase can be harnessed effectively to treat topical biofilms in wounds or those found internally such as in the infected lungs. Though phage therapy has been practised in Eastern Europe for about a century now, it is yet to be established through the rigours of western clinical medicine. In a few case studies in recent years, the Food and Drug Administration (FDA) approved phage therapy in the United States and in the United Kingdom as an Emergency Investigational New Drug (eNID). Several phages and phage products are currently in the pre-clinical stage or different phases of clinical trials. This chapter summarizes the current status and prospects of clinical uses of phage and phage-derived products alone or in combination with antibiotics.

Keywords: bacteriophage, antimicrobial resistance, biofilm, lysin, therapeutics

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Understanding the Pharmacology and Pharmacotherapeutics for Infectious Diseases

Nishtha Agrawal, Indu Singh, Madhu Khanna, Gagan Dhawan, Pradeep Kumar & Uma Dhawan

Chapter | First Online: 14 April 2022

Abstract

Infectious diseases are caused by living microorganisms such as bacteria, virus, parasite, and fungi that infect millions of people around the globe. These infectious diseases have been responsible for frequent outbreaks, sometimes culminating into epidemic or pandemic, the most recent one being the on-going COVID-19 pandemic caused by SARS-CoV-2. The major challenge posed by these infectious agents is the increasing cases of drug resistance and mutations (mainly in viruses). Another issue is the non-targeted approach of the conventional therapeutic agents which may lead to cytotoxic side-effects, low bioavailability, and the development of drug resistance. Hence, to overcome these shortcomings a target-based approach has been adopted in drug designing that would target the specific gene or protein involved in pathogenesis of above-mentioned microorganisms. In recent years, nanotechnology has gained great momentum in designing a

targeted drug delivery system, wherein the targeted drug molecule is encapsulated in the nano-carrier which can be programmed for sustained drug release and has higher efficacy against the pathogens. Some of the nanoparticle platforms like liposome, dendrimers, hydrogels, metal-based nanoparticles have recently proved their efficacy at the molecular site (like as reticuloendothelial system, macrophages) where native conventional drugs could not penetrate efficiently. The major advantages of using nano-formulations in drug delivery are low toxicity, sustained release of drugs, enhanced drug uptake, etc. The chapter is primarily focused on the use of nanomedicine in pharmacological intervention for improving treatment regimen and strategies against infectious organism and is concluded by discussing the alternative strategy of monoclonal antibody therapy.

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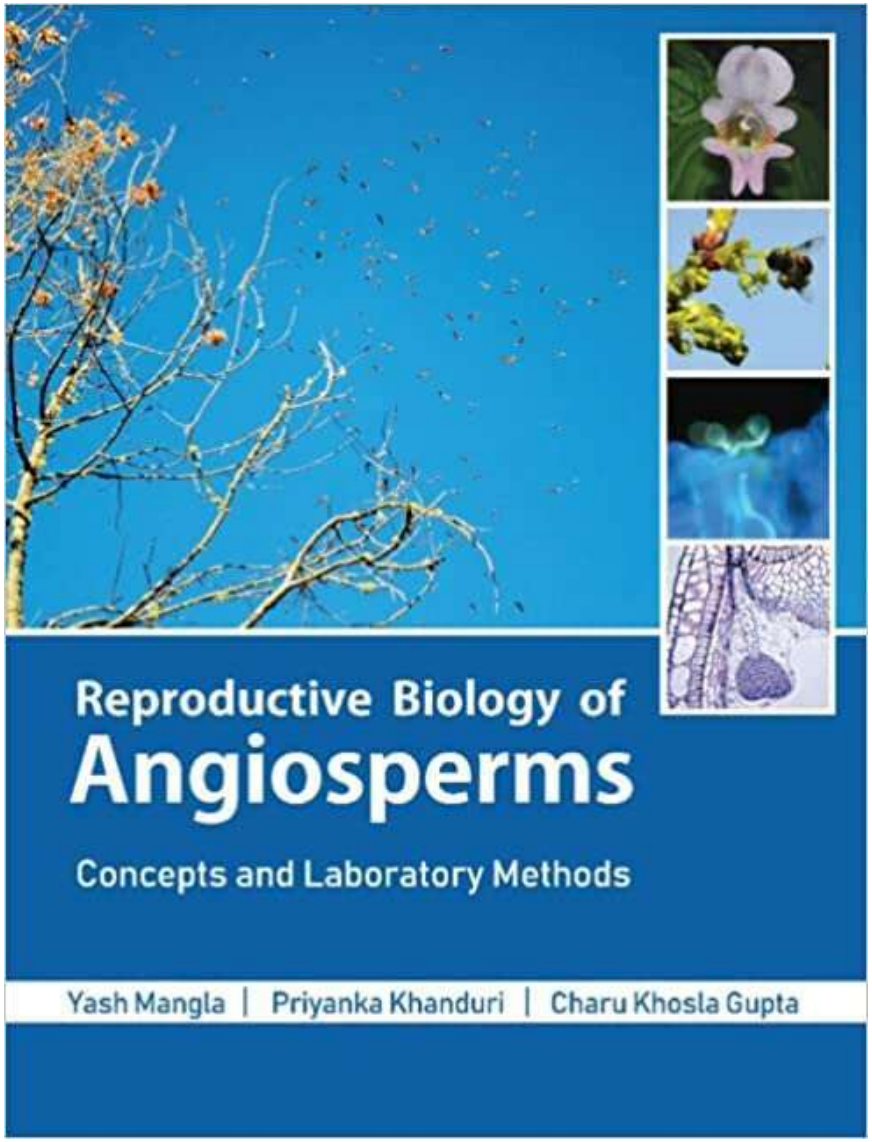
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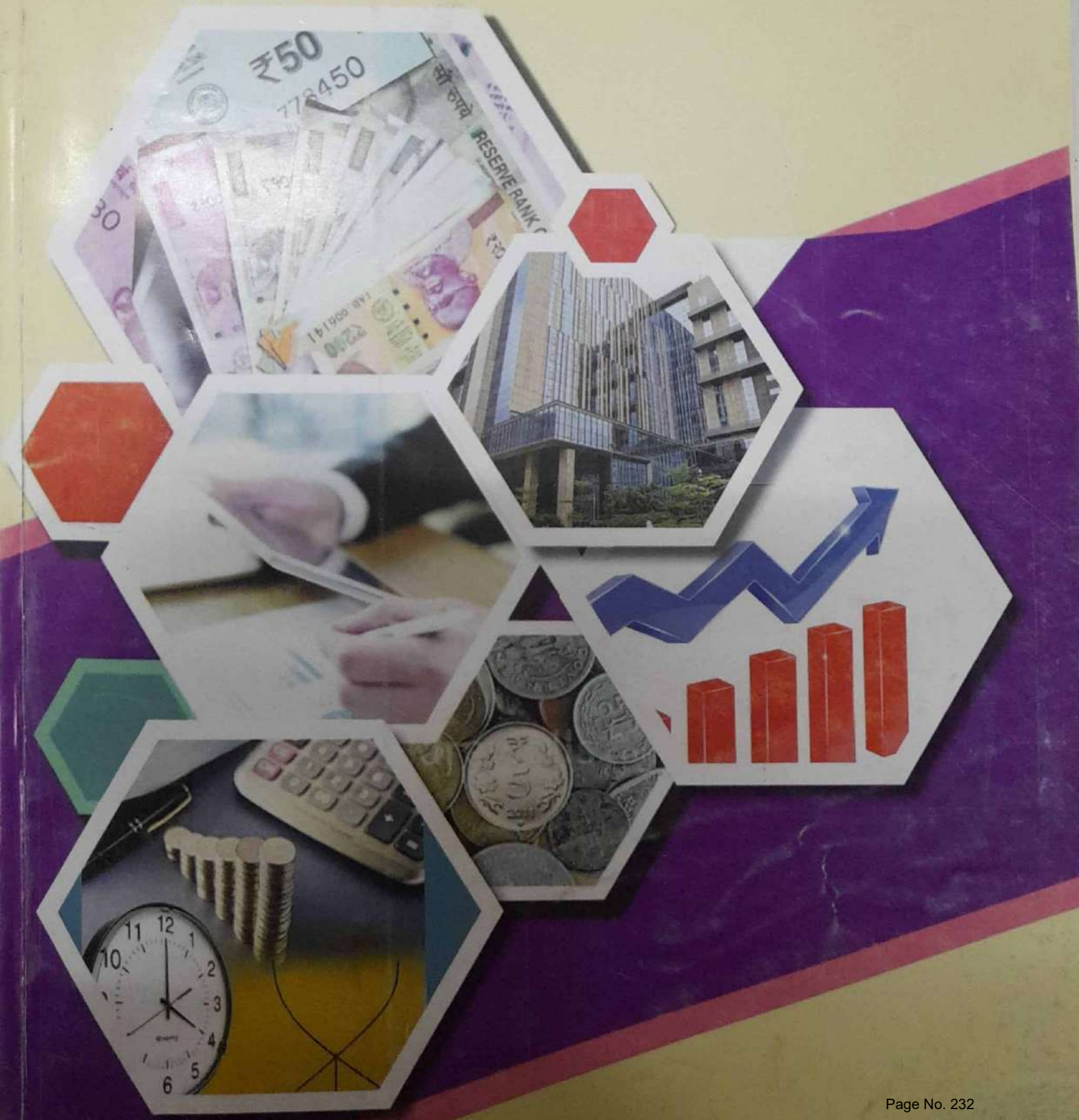

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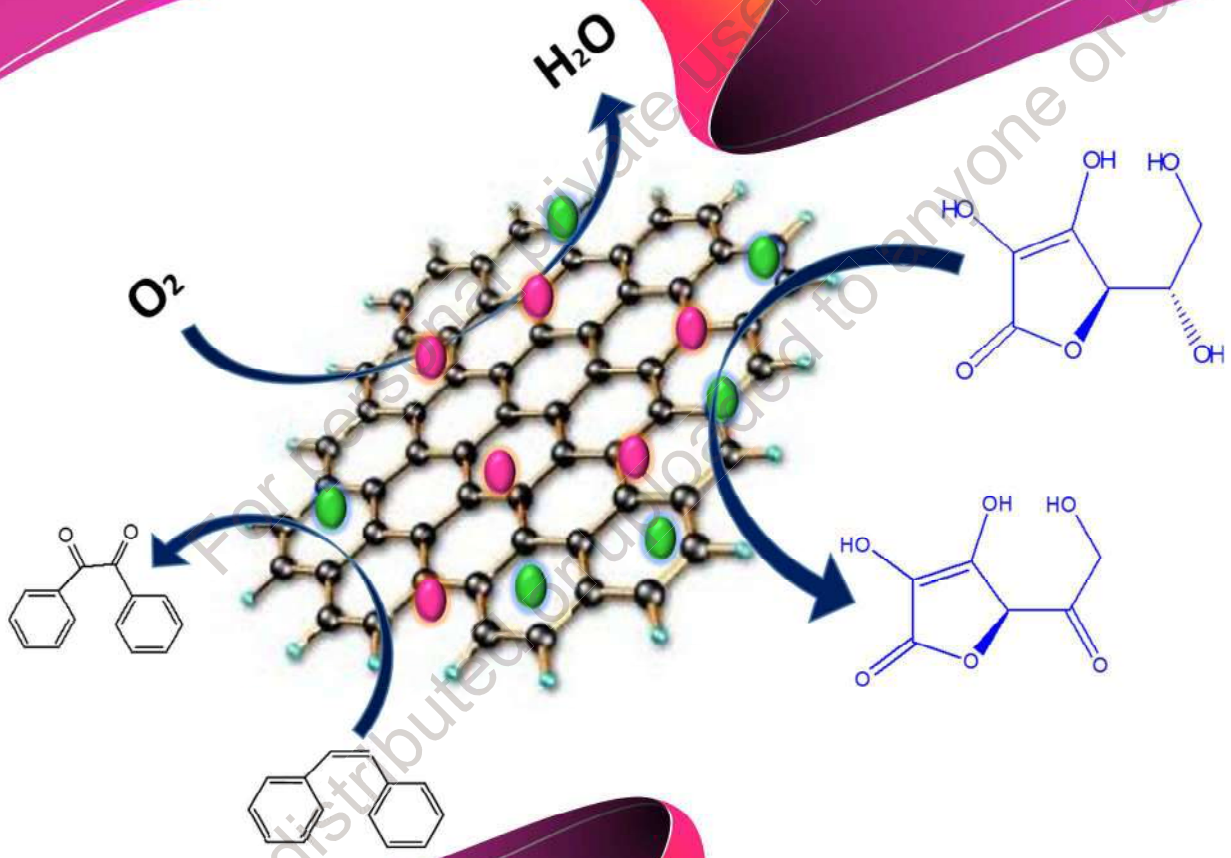

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CHAPTER 8

Graphene Based Nanomaterials as Catalyst in Reduction Reactions

Leena Khanna[1,*], **Mansi** [1] and **Pankaj Khanna**[2]

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Abstract: The exceptionally outstanding physical and chemical properties as well as unique morphology of graphene have led to the development of various graphene-based catalysts, which are highly effective and selective in the reduction and hydrogenation reactions of organic compounds. This chapter is dedicated to compilation of the versatile reactions of hydrogenation/reduction over graphene-based catalysts. The use of catalyst allows highly effective and selective reduction of substrates in an effortless, recyclable, constructible and environmentally benign system.

Keywords: Eco-friendly, Graphene, Hydrogenation, Nanocomposites, Reduction, Solid support.

INTRODUCTION

The chemistry of graphene has recently been explored and become an important part of material science just after a breakthrough work done by Geim and Novoselov in 2004 [1 - 3]. It has a 2D-sheet structure having conjugated carbon atoms with sp^2-hybridization and an extended honeycomb-like network structure. Various properties of graphene, like high surface area, fine size, chemical inertness, great mechanical strength, and conductivity make it an ideal material for catalysis, organic conversion energy storage, *etc*.

The 2-dimensional single-layer carbon sheet structure of graphene serves as a building unit for the synthesis of graphite, fullerenes and nanotubes with three-, one- and zero-dimensional structures, respectively. Graphene sheets with a large

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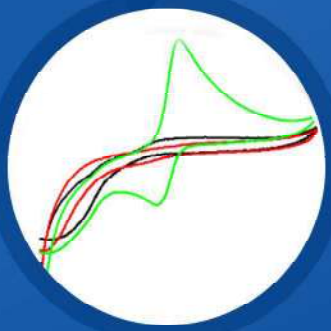

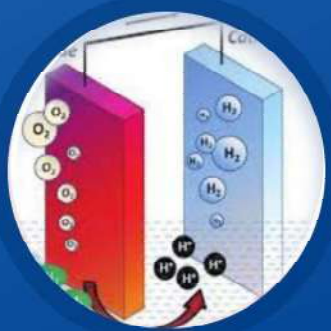

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CHAPTER 6

Nanocatalysis for Reduction/Hydrogenation Reactions

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Abstract: Heterogeneous nanocatalyst demonstrate excellent catalytic activity for the hydrogenation/reduction of nitro-aromatics, carbonyls, alkenes/alkynes in the presence of different reductants such as $NaBH_4$ and H_2 using various solvents such as ethanol, methanol, dioxane, THF, and water, as green solvents. Earth-abundant coordinating elements such as Pd, Pt, Fe, Cu, Co, Ag, Au, and Ni, elementary synthesis, short time reactions, high selectivity, mild reaction conditions, and reusability of nanocatalyst for at least 4-5 cycles without any loss in catalytic activity, are some priorities for the hydrogenation reactions using nanocatalyst.

Keywords: Alkenes, Alkynes, Bimetallic, Carbonyls, Hydrogenation, Nano-catalyst, Nitro aromatics, Reducing agents, Reduction.

INTRODUCTION

Hydrogenation and reduction of compounds are important chemical reactions in organic synthesis as well as industries. The use of heterogeneous metal catalysts has been the most versatile and dynamic process for these reactions. It was about 100 years ago when Paul Sabatier hydrogenated alkenes efficiently over Ni metal catalysts [1]. Since then, the use of these solid catalysts has multiplied thousand times. The heterogeneous metal catalysis owns a broad scope, besides Ni, Pd, and Pt, we now have several cheap metals to catalyse the hydrogen-ation/reduction reactions. A wide variety of multifunctional molecules are reduced by this method, and numerous value-added products can be obtained in high yield in a short time, with chemo and/or regioselective control.

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21 Chapter The Impact of Climate Change on Human Health in India: An Overview

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Introduction:

Climate change occurs over decades, and still now-a-day climate change have occurred naturally, because of continental drift, numerous astronomical cycles, variations in solar energy output, and volcanic activity. Over the past few decades, it has become increasingly apparent that human actions changes atmospheric composition causing global climate change [1]. The Ministry of Earth Science (MoES), Government of India have published a report in 2020, under titled "Assessment of Climate Change over the Indian Region" considering that the impact of climate change as one of the most significant and concerning issues of the India that is the second largest country in the world by population and is rapidly catching up to China. The lack of adaptive capacity coupled with limited resources to help bolster health infrastructure have made it extremely challenging for the India to cope with the spread of illness and disease. Due to diverse array of temperature zones, climate change in India is now making things far worse. From the Himalayas in the far north, to coastal megacities, to deserts where the 50° Celsius mark is usually breached, the nation is persistently ranked as one of the most sensitive to climate change [2, 3].

The key question is, how will the climate change affect human health? Climate impacts numerous key determinants of health on which we depends that leads to extremes and violent weather events; resurgence of disease organisms and vectors, food and water, affects the quantity of air and the stability of the ecosystems. Climate changes have both direct and indirect impact on human health. Indirect impacts emanate from changes in temperature patterns that can disturb natural ecosystems, change the ecology of infectious diseases, exacerbate air pollution levels, harm agriculture and fresh water supplies, and cause large-scale reorganization of plant and animal communities [4]. Climate change is a significant and emerging threat to public health. The effects of climate change on human health are influenced by a variety of pathways and there may be long delays between

20 Chapter Biological and Physical Applications of Silver Nanoparticles

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Introduction:

A nanotechnology process involves designing, fabricating and applying nanostructures or nanomaterials, and analyzing the relationship between physical properties and the dimensions of those materials. Materials or structures that have nanometer-scale dimensions are known as nanotechnology, which includes substances and systems in the nanometer range.

$$\mathbf{1\ nm = 10^{-9}\ meter}$$

The nanotechnology field deals with developing and utilizing nanostructures or nanoscales with individual atoms arranged at intermediate scales, providing new properties as compared to bulk materials [1]. Figure 1 illustrates a variety of nanomaterials.

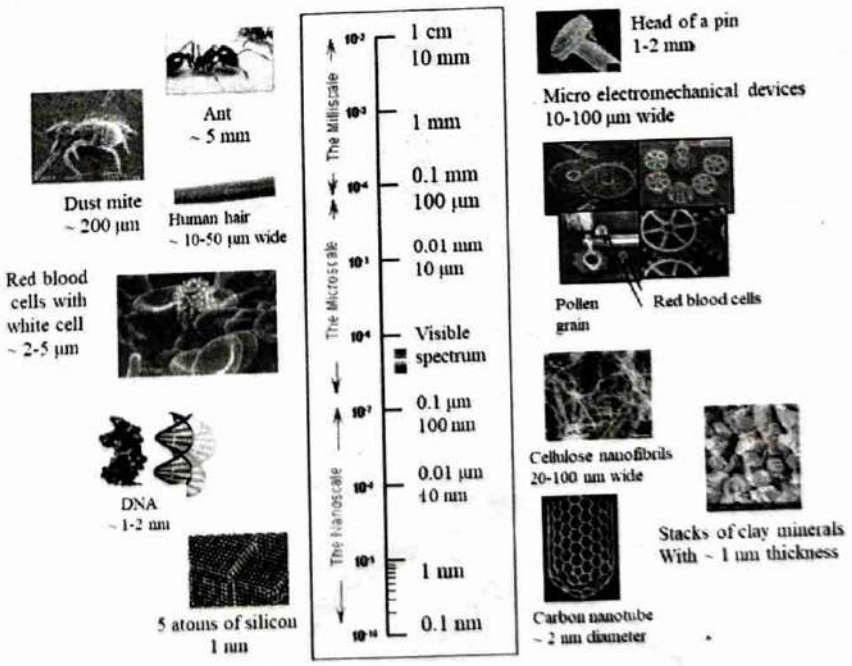

Figure 1 Visualization of Nanometer [2]

Metal-Organic Frameworks (MOFs) as Versatile Detoxifiers for Chemical Warfare Agents (CWAs)

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Contents

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Article

Fabrication of a Gold-Supported NiAlTi-Layered Double Hydroxide Nanocatalyst for Organic Transformations

Garima Rathee,[‖] Sahil Kohli,[‖] Sagar Panchal, Nidhi Singh, Amardeep Awasthi, Snigdha Singh, Aarushi Singh, Sunita Hooda,* and Ramesh Chandra*

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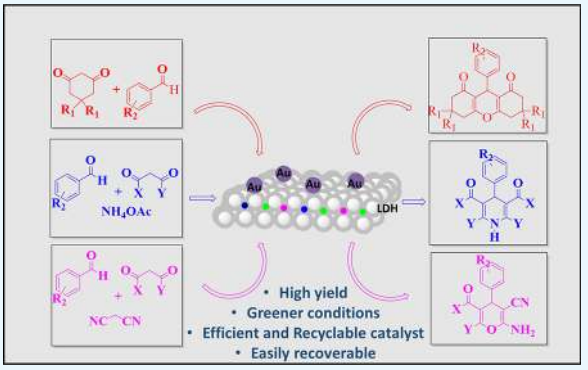
ABSTRACT: This work is mainly focused on the synthesis of an efficient and reusable heterogeneous Au/NiAlTi layered double hydroxide (LDH) nanocatalyst and its applications in the preparation of biologically important xanthene, 1,4-dihydropyridine, polyhydroquinoline, and 4*H*-pyran derivatives. NiAlTi LDH was designed hydrothermally and then gold was supported over the surface of LDH by using ion-exchange and $NaBH_4$ reduction methods. The synthesized nanocatalyst was physicochemically characterized by X-ray diffractrometry, Fourier-transform infrared spectroscopy, thermogravimetric analysis, scanning electron microscopy, and transmission electron microscopy (TEM). The TEM images confirmed the support of gold nanoparticles over the surface of LDH with a size distribution of 7−9 nm. The well-characterized nanocatalyst was tested for the synthesis of biologically important xanthene, 1,4-dihydropyridine, polyhydroquinoline, and 4*H*-pyran derivatives. The advantages obtained were excellent yields in a lesser reaction time. Stability and reusability were also accessed; the catalyst was stable even after five cycles. High catalytic efficiency, easy fabrication, and recycling ability of Au/NiAlTi LDH make it a potential catalyst for the synthesis of xanthene, 1,4-dihydropyridine, polyhydroquinoline, and 4*H*-pyran derivatives.



1. INTRODUCTION

Xanthene, 1,4-dihydropyridine, polyhydroquinoline, and 4*H*-pyran derivatives are famous structural architectures found in many synthetic drugs, biologically active natural products, and essential units for chemical intermediates.[1] Therefore, many methods have been reported for their catalytic synthesis with different advantages. Still, each of them offers various limitations such as hazardous and long catalyst preparation, harsh conditions, extended workup, and toxic and expensive solvents and reagents. Therefore, the fabrication of novel heterogeneous catalysts for such catalytic synthesis to replace toxic, polluting, and conventional catalysts has attracted the attention of many researchers because of their easy recovery, selectivity, reusability, enhanced reactivity, and convenient product isolation.[2]

Nanocatalysts have gained ample attention for various such transformations but suffer from disadvantages such as reusability and recovery. Therefore, designing heterogeneous nanocatalysts could be a better alternative as they can be separated easily by centrifugation or filtration methods and reused after catalyst washing.[3] Layered double hydroxides (LDHs), also named hydrotalcite-like compounds, are a branch of clay minerals having positively charged octahedral-type brucite-like sheets intercalated with anionic charges and H_2O molecules.[4,5] Because of their properties of high surface area and anion-exchange capacities, LDHs have emerged as eco-friendly materials in the fields of catalysis, drug carriers, adsorption, anion exchange, and precursors for magnetic materials.[4−9] As LDHs can be synthesized by economic and simple routes, they have gained considerable attraction in the field of catalytic synthesis of organic compounds.

To date, many metal nanoparticles and metal ions such as copper, cobalt, ruthenium, and palladium have been used catalytically for various reactions such as oxidation of alcohols and so forth. For the last few decades, gold catalysts have attracted attention because of their higher catalytic properties.[10] One of the essential applications of Au nanoparticles in organic synthesis is alcohol oxidation.[11] Nanocomposites fabricated by supporting Au on a support system (LDHs) could generate an active catalyst for various organic transformations with a greater efficiency.

Herein, we have fabricated a new nanocomposite material by supporting gold nanoparticles over hydrothermally generated

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ternary NiAlTi LDH.[5] This nanocomposite was used for the first time as a nanocatalyst for the synthesis of xanthene, 1,4-dihydropyridine, polyhydroquinoline, and 4*H*-pyran derivatives.

2. RESULTS AND DISCUSSION

2.1. Characterization of NiAlTi LDH and Au/NiAlTi LDH. Figure 1a illustrates the X-ray diffraction (XRD)

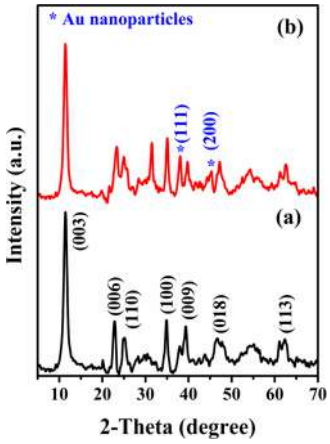

Figure 1. XRD patterns of (a) NiAlTi LDH and (b) Au/NiAlTi LDH.

spectrum of hydrothermally generated NiAlTi LDH, which could be correlated with the previously reported data.[4,5] The characteristic diffraction peaks of (00*L*) series [(003), (006), and (009)] detected at 11.43, 22.78, and 39.32°, respectively, illustrate the formation of the lamellar structure of LDH, intercalated with water and carbonate ions. The *d*-spacing for the (003) plane (0.866 nm) and the (110) plane (0.35 nm) could be easily linked with the reported Ti-assimilated LDHs. The TiO_2 anatase phase could be confirmed by the (110) diffraction plane located at 25.17°. The other XRD peaks illustrating (100), (018), and (113) represent the carbonate- and water-intercalated LDH material. Figure 1b depicts the XRD spectrum of Au-supported NiAlTi LDH. The presence of gold nanoparticles on the surface of NiAlTi LDH was confirmed by the obtained XRD spectrum. The two diffraction peaks other than the characteristic peaks of NiAlTi LDH present at 38.1 and 45.2° confirm the presence of Au nanoparticles as these peaks could be assigned to the (111) and (200) standard Braggs reflection planes of crystalline Au nanoparticles, respectively.[12]

Figure 2 depicts the Fourier-transform infrared (FTIR) spectra of NiAlTi LDH and Au/NiAlTi LDH. The FTIR spectrum of NiAlTi LDH illustrated in Figure 2a consists of a broad band located at 3406 cm^{-1} confirming the presence of intercalated water molecules and the −OH group of brucite layers. The existence of a shoulder band at 3120 cm^{-1} could prove the existence of H-bonding between carbonate ions and water molecules. Furthermore, an asymmetric band at 1363 cm^{-1} could confirm the presence of carbonate ions interlayered within the brucite sheets. When gold was supported over the surface of NiAlTi LDH, like the XRD spectrum, no changes were observed in the FTIR spectrum of Au/NiAlTi LDH, stating the existence of interlayered carbonate ions and water molecules (Figure 2a).[4,5]

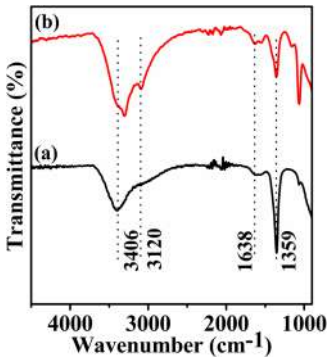

Figure 2. FTIR spectra of (a) NiAlTi LDH and (b) Au/NiAlTi LDH.

Furthermore, Figure 3 represents the thermogravimetric analysis (TGA) of NiAlTi LDH and Au/NiAlTi LDH. The TG

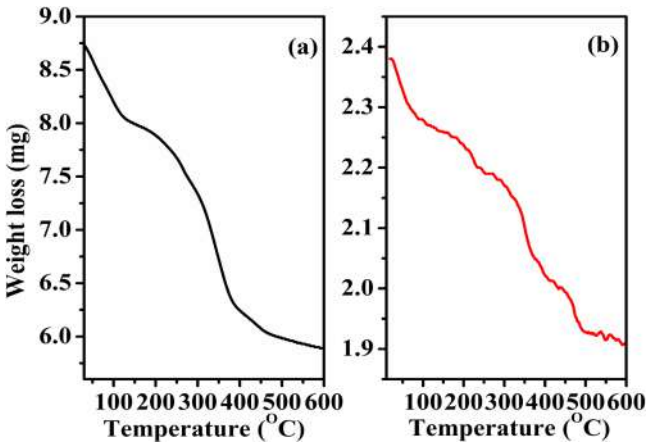

Figure 3. TGA spectra of (a) NiAlTi LDH and (b) Au/NiAlTi LDH.

curves of both NiAlTi LDH and Au/NiAlTi LDH show initial degradation in the range of 50−200 °C, which illustrates the elimination of water molecules from the interlayers of LDH and also physisorbed water molecules (in both the cases). Furthermore, the second degradation observed around 290 °C, might be attributed to the brucite layers' concomitant dehydration. Finally, the third degradation around 400 °C is due to carbonate anions' decomposition.[4,5]

Electron microscopy images are depicted in Figure 4. Figure 4a represents the scanning electron microscopy (SEM) image of NiAlTi LDH, clearly showing the platelet-like structure of NiAlTi LDH. The transmission electron microscopy (TEM) image of NiAlTi LDH, depicted in Figure 4b, confirms the formation of sheet-like formation in correlation with the previously reported work.[4,5] Figure 4c shows the SEM image of Au-supported NiAlTi LDH, which confirms that the platelet-like morphology was not distorted after the Au-supporting process. Figure 4d displays the TEM image of Au/NiAlTi LDH, confirming the formation of fringes (0.63 and 0.34 nm), which were found to be in excellent correlation with *d*-spacing obtained from XRD analysis. The support of Au nanoparticles on the layers of LDH was confirmed by the TEM images of Au/NiAlTi LDH (Figure 4e). The Au nanoparticles were slightly distributed at 7−9 nm.

2.2. Catalytic Activity of Au/NiAlTi LDH. *2.2.1. Synthesis of Xanthene Derivatives by Au/NiAlTi LDH.* The catalytic activity of Au/NiAlTi LDH was estimated for the synthesis of

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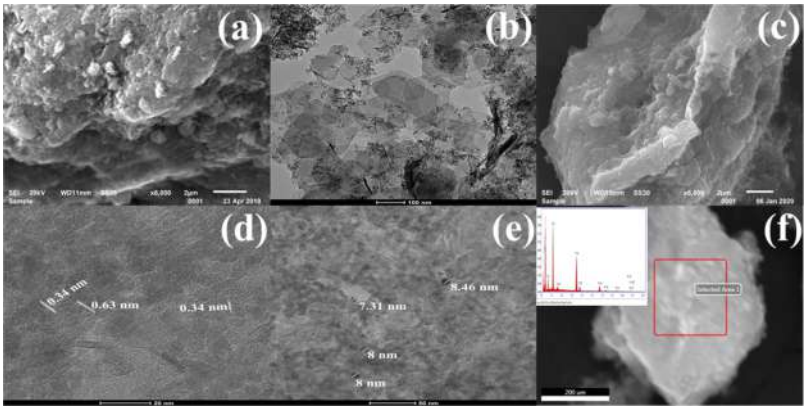


Figure 4. (a) SEM image of NiAlTi LDH, (b) HRTEM image of NiAlTi LDH, (c) SEM image of Au/NiAlTi LDH, (d) TEM image of Au/NiAlTi LDH, (e) TEM image of Au/NiAlTi LDH displaying Au nanoparticle sizes and (f) EDAX spectra of Au/NiAlTi LDH.

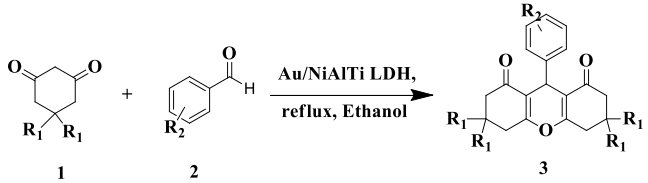
xanthene derivatives. The optimal conditions were obtained using 1 mmol of 4-nitrobenzaldehyde and 2 mmol of 5,5-dimethylcyclohexane-1,3-dione/1,3-cyclohexanedione as the model reaction for the synthesis of xanthene derivatives. Variation in various parameters such as the catalyst amount, temperature, and solvent was evaluated (Table 1). The results

Table 1. Optimization of Reaction Conditions for the Synthesis of Xanthene Derivatives

entry	catalyst and catalyst amount (mg)	solvent	temp (°C)	time (min)	yield (%)
1			rt	240	trace
2			80	240	trace
3		ethanol	rt	240	trace
4		ethanol	80	240	10
5	Au/NiAlTi LDH (5)	ethanol	rt	120	35
6	Au/NiAlTi LDH (5)	ethanol	50	90	75
7	Au/NiAlTi LDH (5)	ethanol	reflux	60	85
8	Au/NiAlTi LDH (5)	H_2O	rt	240	trace
9	Au/NiAlTi LDH (5)	H_2O	reflux	240	trace
10	Au/NiAlTi LDH (5)	acetonitrile	reflux	120	50
11	Au/NiAlTi LDH (5)	chloroform	reflux	120	49
12	Au/NiAlTi LDH (10)	ethanol	reflux	20	92
13	Au/NiAlTi LDH (15)	ethanol	reflux	20	93
14	NiAlTi LDH (20)	ethanol	reflux	120	60

combined in Table 1 state that when the optimization of the xanthene derivative was carried out in the absence of the catalyst, without or with ethanol as a solvent, at room temperature or reflux conditions with ethanol as a solvent, the obtained xanthene derivative yield was very low. When Au/NiAlTi LDH was added as a catalyst at room temperature with ethanol as a solvent, a moderate increase in the yield was observed, but favorable results were observed under reflux conditions. Furthermore, the reaction was tested for different solvents, but none of them responded as a better solvent than ethanol for this reaction. Finally, the amount of Au/NiAlTi LDH was optimized. The obtained optimized condition for the synthesis of xanthene derivatives was the use of 10 mg of Au/NiAlTi LDH in ethanol under reflux conditions. Furthermore, the designed gold catalyst was tested for the synthesis of other xanthene derivatives using different aromatic aldehydes (Table 2). NMR characterization technique was used for confirming the formation of desired xanthene products. Based on the NMR results, it might be stated that the product obtained after

Table 2. Synthesis of Xanthene Derivatives



1 2 3

entry	R_1	aldehyde	product	time (min)	yield (%)
1	CH_3	4-nitrobenzaldehyde	3a	20	92
2	CH_3	3-methoxybenzaldehyde	3b	30	85
3	CH_3	3-methylbenzaldehyde	3c	30	87
4	CH_3	3-chlorobenzaldehyde	3d	30	87
5	CH_3	4-cyanobenzaldehyde	3e	20	93
6	H	4-nitrobenzaldehyde	3f	20	90
7	H	3-bromobenzaldehyde	3g	30	87
8	H	3-methylbenzaldehyde	3h	30	86
9	H	4-methyoxybenzaldehyde	3i	30	88
10	H	4-hydroxybenzaldehyde	3j	25	90

crystallization was pure xanthene derivatives without any aldehyde impurities.

The proposed mechanism for the catalytic xanthene synthesis consists of a series of consecutive reactions illustrated in Figure 5. Initially, the carbonyl group of aldehyde gets activated by Au/NiAlTi LDH, followed by the formation of an intermediate (A) via the nucleophilic attack between dimedone and the activated carbonyl group. Furthermore, an intermediate (B) is formed by the Michael addition of the second dimedone molecule, resulting in the elimination of water after intramolecular cyclization. Finally, the desired xanthene product is obtained.[13,14]

2.2.2. Synthesis of 1,4- dihydropyridine and Polyhydroquinoline Derivatives using Au/NiAlTi LDH. Furthermore, the catalytic activity of Au/NiAlTi LDH was also tested for the synthesis of 1,4-dihydropyridine (1,4-DHP) and polyhydroquinoline derivatives as a pseudo-four-component reaction. The optimal conditions were obtained using 1 mmol of 4-nitrobenzaldehyde, 2 mmol of ethyl acetoacetate, and 1 mmol of ammonium acetate as the model reaction for the synthesis of 1-DHP and polyhydroquinoline derivatives. The effects of various parameters such as the catalyst amount, temperature, and solvent were evaluated (Table 3). The results combined in Table 3 were in great correlation with xanthene synthesis. The

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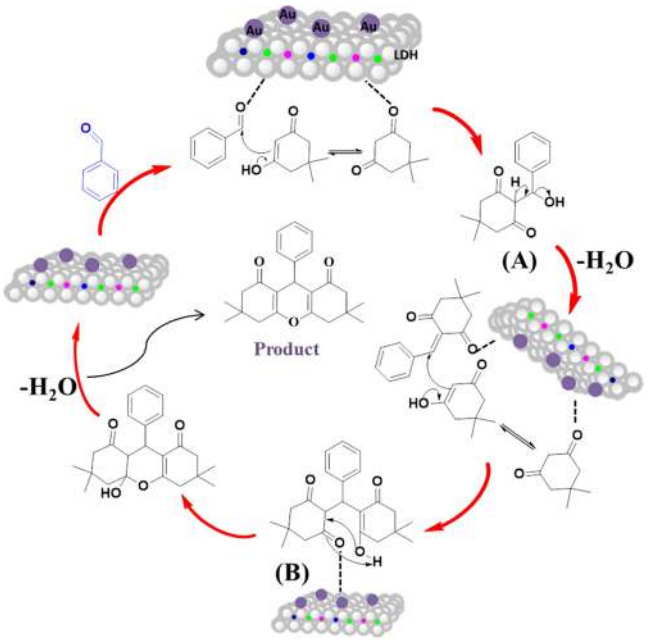


Figure 5. Plausible mechanism of xanthene derivative synthesis.

Table 3. Optimization of Reaction Conditions for the Synthesis of 1,4-DHP and Polyhydroquinoline Derivatives

entry	catalyst and catalyst amount (mg)	solvent	temp (°C)	time (min)	yield (%)
1			Rt	240	trace
2			80	240	trace
3		ethanol	rt	240	trace
4		ethanol	80	240	15
5	Au/NiAlTi LDH (5)	ethanol	rt	120	40
6	Au/NiAlTi LDH (5)	ethanol	50	90	78
7	Au/NiAlTi LDH (5)	ethanol	reflux	60	90
8	Au/NiAlTi LDH (5)	H_2O	rt	240	trace
9	Au/NiAlTi LDH (5)	H_2O	reflux	240	trace
10	Au/NiAlTi LDH (5)	acetonitrile	reflux	120	52
11	Au/NiAlTi LDH (5)	chloroform	reflux	120	50
12	Au/NiAlTi LDH (10)	ethanol	reflux	20	94
13	Au/NiAlTi LDH (15)	ethanol	reflux	20	94
14	NiAlTi LDH (20)	ethanol	reflux	120	55

optimization study states that when the optimization was carried in the absence of the catalyst, without or with ethanol as a solvent, at room temperature or under reflux conditions with ethanol as a solvent, the obtained xanthene derivative yield was meager. Furthermore, when Au/NiAlTi LDH was added as a catalyst at room temperature with ethanol as a solvent, a moderate increase in the yield was observed, but favorable results were observed when the pseudo-four-component reaction was refluxed.

Also, the reaction was tested for different solvents, but none of them responded as a better solvent than ethanol for this reaction. Finally, the amount of Au/NiAlTi LDH was optimized. The obtained optimized condition for the synthesis of xanthene derivatives was the use of 10 mg of Au/NiAlTi LDH in ethanol under reflux conditions. Furthermore, the designed gold catalyst was tested for the synthesis of other 1,4-DHP and polyhydroquinoline derivatives using different aromatic aldehydes (Table 4). The formation of desired pure 1,4-DHP products was confirmed by the NMR technique.

A plausible mechanism comprising a sequence of consecutive reactions is depicted in Figure 6. The synthesis of 1,4-DHP and polyhydroquinoline derivatives follows two pathways [A] and [B], as illustrated in Figure 6. In route [A], the

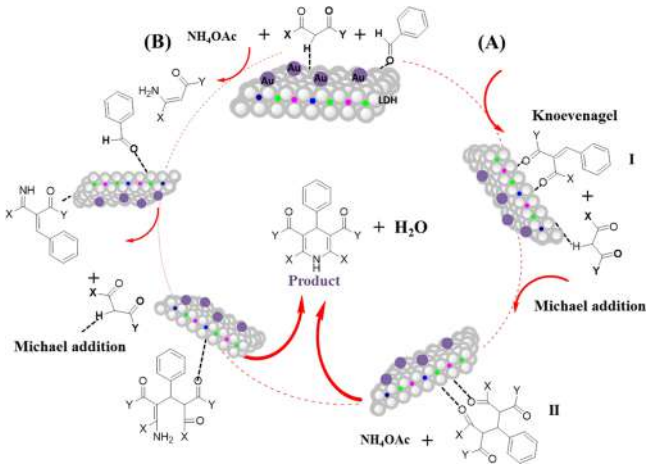
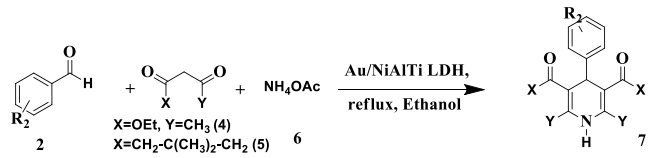


Figure 6. Plausible mechanism of 1,4-DHP and polyhydroquinoline derivative synthesis.

Table 4. Synthesis of 1,4-DHP and Polyhydroquinoline Derivatives



entry	1,3-carbonyl	aldehyde	product	time (min)	yield (%)
1	4	4-nitrobenzaldehyde	7a	20	94
2	4	4-methoxybenzaldehyde	7b	30	86
3	4	4-chlorobenzaldehyde	7c	30	88
4	4	4-hydroxybenzaldehyde	7d	30	86
5	4	4-cyanobenzaldehyde	7e	20	92
6	5	4-nitrobenzaldehyde	7f	20	95
7	5	3-bromobenzaldehyde	7g	30	88
8	5	2-methylbenzaldehyde	7h	30	85
9	5	4-dimethylaminobenzaldehyde	7i	30	94
10	5	4-hydroxybenzaldehyde	7j	25	87

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reaction gets initiated by the acid−base bifunctional LDH catalyst. The available acidic sites activate the aldehyde via protonation, whereas the acidic hydrogen of 1,3-dicarbonyl is simultaneously captured by the Au/NiAlTi LDH catalyst. These generated electrophiles and nucleophiles react together to generate a Knoevenagel intermediate [I], which further undergoes a Michael reaction with the second enolizable 1,3-dicarbonyl group to generate a second intermediate [II]. The so-formed second intermediate further reacts with ammonium acetate to form enamine, which further results in the desired product after intramolecular cyclization and dehydration steps.[13]

2.2.3. Synthesis of 2-Amino-4H-pyran Derivatives by Au/NiAlTi LDH. The catalytic activity of Au/NiAlTi LDH was also estimated for the synthesis of 2-amino-4*H*-pyran derivatives. The optimal conditions were obtained by using the three-component reaction between 1 mmol of 4-nitrobenzaldehyde, 1 mmol of dimedone, and 1 mmol of malononitrile. The effects of different parameters were investigated by the model reaction and are summarized in Table 5. As stated by the results, the optimal condition for the synthesis of 2-amino-4*H*-pyran derivatives was the use of 10 mg of Au/NiAlTi LDH under reflux conditions in ethanol. Furthermore, the scope of the designed gold nanocatalyst was investigated for the other aldehydes and 1,3-dicarbonyl compounds and the results are summarized in Table 6. The proposed mechanism for the catalytic synthesis of 4*H*-pyran derivatives is illustrated in Figure 7.

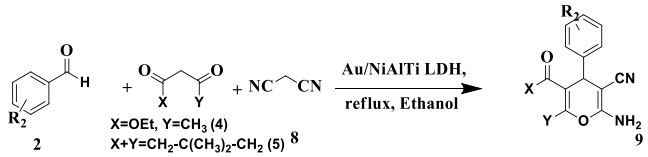
Table 5. Optimization of Reaction Conditions for the Synthesis of 2-Amino-4*H*-pyran Derivatives

entry	catalyst and catalyst amount (mg)	solvent	temp (°C)	time (min)	yield (%)
1			Rt	240	trace
2			80	240	trace
3		ethanol	Rt	240	trace
4		ethanol	80	240	17
5	Au/NiAlTi LDH (5)	ethanol	Rt	120	42
6	Au/NiAlTi LDH (5)	ethanol	50	90	75
7	Au/NiAlTi LDH (5)	ethanol	reflux	60	92
8	Au/NiAlTi LDH (5)	H_2O	Rt	240	trace
9	Au/NiAlTi LDH (5)	H_2O	reflux	240	trace
10	Au/NiAlTi LDH (5)	acetonitrile	reflux	120	50
11	Au/NiAlTi LDH (5)	chloroform	reflux	120	41
12	Au/NiAlTi LDH (10)	ethanol	reflux	20	93
13	Au/NiAlTi LDH (15)	ethanol	reflux	20	94
14	NiAlTi LDH (20)	ethanol	reflux	120	65

2.2.4. Recyclability of the Au/NiAlTi LDH Catalyst. Heterogeneous catalysis displays the advantages of easy separation and recyclability. Therefore, the reusability of the nanocatalyst was tested with the model reactions. After the completion of the reaction, Au/NiAlTi LDH was separated by using the filtration method. The recovered catalyst was washed with ethyl acetate, normal hexane, and ethanol and further oven-dried at 50 °C. Furthermore, the recycled nanocatalyst was employed for four consecutive cycles, and the results are depicted in Figure 8I. According to the results, no considerable reduction in the efficiency of Au/NiAlTi LDH was observed. The comparison of the FTIR spectra of the recycled nanocatalyst after four consecutive cycles with the fresh catalyst illustrates that the Au-supported LDH nanocatalyst does not undergo any structural change after the catalytic reaction (Figure 8II).

Furthermore, a comparative study of the catalytic efficiency of Au/NiAlTi LDH with previously reported catalysts is depicted in Table 7.

Table 6. Synthesis of 2-Amino-4*H*-pyran Derivatives



entry	1,3-carbonyl	aldehyde	product	time (min)	yield (%)
1	4	4-nitrobenzaldehyde	9a	20	93
2	4	4-methoxybenzaldehyde	9b	45	80
3	4	4-chlorobenzaldehyde	9c	30	90
4	4	4-hydroxybenzaldehyde	9d	40	87
5	4	4-cyanobenzaldehyde	9e	20	93
6	5	4-nitrobenzaldehyde	9f	20	94
7	5	3-nitrobenzaldehyde	9g	30	86
8	5	2-methylbenzaldehyde	9h	30	88
9	5	4-methylbenzaldehyde	9i	30	86
10	5	4-hydroxybenzaldehyde	9j	25	88

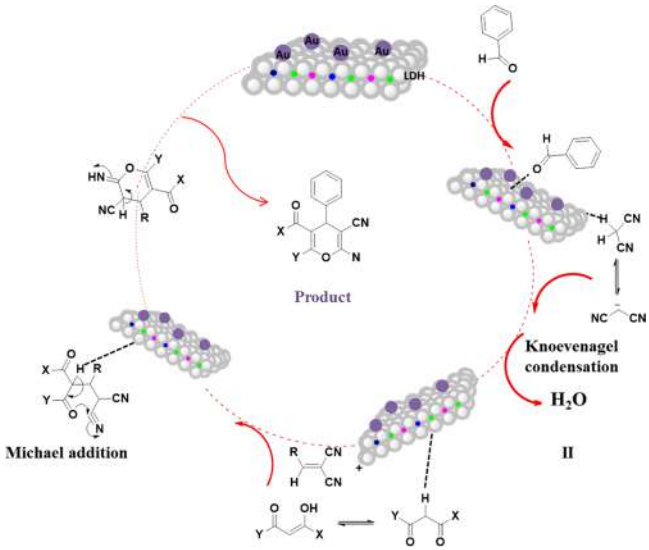


Figure 7. Plausible mechanism of 2-amino-4*H*-pyran derivative synthesis.

3. CONCLUSIONS

In summary, a novel, efficient, and recyclable heterogeneous nanocatalyst Au/NiAlTi LDH was developed. NiAlTi LDH was synthesized by using the hydrothermal route and gold nanoparticles were supported over the surface of the NiAlTi LDH by using ion-exchange and $NaBH_4$ reduction methods. The synthesized nanocatalyst was physicochemically characterized by XRD, FTIR spectroscopy, TGA, SEM, and TEM analyses. The TEM images confirmed the support of gold nanoparticles over the surface of LDH with a size distribution of 7−9 nm. This nanocatalyst was found to be an efficient catalyst for the synthesis of various biologically important xanthene, 1,4-dihydropyridine, polyhydroquinoline, and 4*H*-pyran derivatives under greener solvent conditions with

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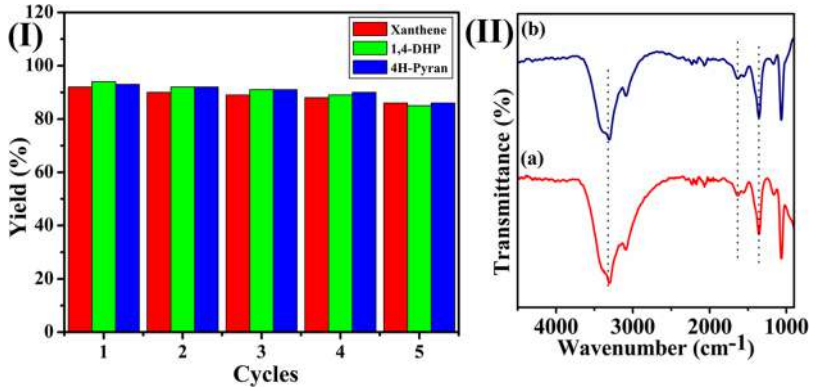

Figure 8. (I) Recyclability of the catalyst and (II) FTIR spectra of (a) fresh Au/NiAlTi LDH and (b) recovered catalyst after five cycles.

Table 7. Comparative Study of Catalytic Efficiency of Au/NiAlTi LDH

entry	catalyst and catalyst amount	derivative	solvent/condition	time	yield (%)	refs
1	Fe^{3+}-montmorillonite, 85 mg	xanthene	EtOH, 100 °C	6 h	94	15
2	$Zr(DP)_2$, 10 mol %	xanthene	EtOH/reflux	24 h	98	16
3	SO_4^{2-}/ZrO_2, 15 wt %	xanthene	EtOH/70 °C	8 h	95	17
4	Au/NiAlTi LDH	xanthene	EtOH/reflux	20	92	this study
5	$Al_2(SO_4)_3$, 10 mol %	1,4-DHP	EtOH/reflux	8 h	92	18
6	La_2O_3, 10 mol %	1,4-DHP	TFE	1−1.5 h	89	19
7	$BiBr_3$, 2 mol %	1,4-DHP	EtOH	2 h	86	20
8	Au/NiAlTi LDH	1,4-DHP	EtOH/reflux	20	94	this study
9	NH_4OAc (1.5 mol)	4*H*-pyran	rt	15 min	59	21
10	SBPPSP (50 mg)	4*H*-pyran	EtOH/H_2O (1:1), reflux	20 min	92	22
11	Au/NiAlTi LDH	4*H*-pyran	ethanol, reflux	20 min	93	this study

excellent yields. Moreover, the recyclability test indicated that it can be reused for four consecutive runs without appreciable loss in catalytic efficiency. This method provides several advantages, which include simplicity, yield, green solvent conditions, ambient reaction conditions, faster synthesis, inexpensive reactants, easy catalyst recovery, and recyclability of the catalyst.

4. EXPERIMENTAL SECTION

4.1. Materials. All the reagents and materials were acquired from commercial sources and were used as such without any further purification. XRD patterns were recorded on a X-ray diffractometer (model no. D8 DISCOVER). Morphological studies were evaluated on a TECNAI 200 kV transmission electron microscope (FEI, Electron Optics). FTIR spectra were obtained on an IRAffinity-1S FTIR spectrophotometer.

4.2. Preparation of Au/NiAlTi LDH. NiAlTi LDH was synthesized using a previously reported hydrothermal route.[5] 2.74 g of $Ni(NO_3)_2{\cdot}6H_2O$, 1.77 g of $Al(NO_3)_3{\cdot}9H_2O$, 0.3 mL of $TiCl_4$, and 1.5 g of urea were dissolved in distilled water. The mixture was aged for 48 h in a hydrothermal autoclave at 150 °C. The material so-obtained was filtered, washed with deionized water and ethanol, and dried at 60 °C. Furthermore, the gold was supported on synthesized NiAlTi LDH by using ion-exchange and $NaBH_4$ reduction methods. For a typical run, 0.025 g of hydrochloroauric acid was dissolved in 80 mL of water, followed by the addition of 700 mg of LDH, and stirring overnight. After filtering, washing, and drying, the sample was transferred to 50 mL of toluene, followed by the addition of $NaBH_4$. After stirring for 10 min, 15 mL of ethanol was added and the mixture was stirred for 6 h. Au/NiAlTi LDH with Au loading was collected by filtration and washed with ethanol and water.

4.3. General Route for the Synthesis of Xanthene Derivatives. A mixture of 1 mmol of aldehyde, 2 mmol of 5,5-dimethylcyclohexane-1,3-dione/1,3-cyclohexanedione, and 10 mg of Au/NiAlTi LDH in 10 mL of ethanol was refluxed for a suitable time period. The reaction progress was further monitored by thin-layer chromatography (TLC) with ethyl acetate/hexane as the eluent. On completion of the reaction, the catalyst was filtered out and the pure product was obtained by using the recrystallization method.

4.4. General Route for the Synthesis of 1,4-DHP and Polyhydroquinoline Derivatives. A mixture of 1 mmol of aldehyde, 2 mmol of 1,3-dicarbonyl, 1 mmol of ammonium acetate, and 10 mg of Au/NiAlTi LDH in 10 mL of ethanol was refluxed for a suitable time period. The reaction progress was further monitored by TLC with ethyl acetate/hexane as the eluent. On completion of the reaction, the catalyst was filtered out and the pure product was obtained by using the recrystallization method.

4.5. General Route for the Synthesis of 4*H*-Pyran Derivatives. A mixture of 1 mmol of aldehyde, 1 mmol of 1,3-dicarbonyl, 1 mmol of malononitrile, and 10 mg of Au/NiAlTi LDH in 10 mL of ethanol was refluxed for a suitable time period. The reaction progress was further monitored by TLC with ethyl acetate/hexane as the eluent. On completion of the reaction, the catalyst was filtered out and the pure product was obtained by using the recrystallization method.

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■ ASSOCIATED CONTENT

Supporting Information

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^{1}H NMR spectra of xanthene, 1,4-dihydropyridine, polyhydroquinoline, and 4*H*-pyran derivatives (**3d**, **3e**, **3i**, **7i**, **9a**, and **9g**) (PDF)

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Author Contributions

‖G.R. and S.K. contributed equally to the manuscript as equal first authors. G.R., S.K., S.H., and R.C. designed the schemes. G.R., S.K., and S.P. performed the experiments. G.R., S.K., N.S., A.A., and S.S. evaluated the data and prepared the figures and tables. G.R., S.K., S.H., and R.C. revised and reviewed the manuscript.

Notes

The authors declare no competing financial interest.

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■ REFERENCES

(1) Azzam, R. A.; Mohareb, R. M. Multicomponent reactions of acetoacetanilide derivatives with aromatic aldehydes and cyanomethylene reagents to produce 4H-pyran and 1, 4-dihydropyridine derivatives with antitumor activities. *Chem. Pharm. Bull.* **2015**, *63*, 1055−1064.

(2) Okuhara, T. Water-tolerant solid acid catalysts. *Chem. Rev.* **2002**, *102*, 3641−3666.

(3) Zhao, G.; Busser, G. W.; Froese, C.; Hu, B.; Bonke, S. A.; Schnegg, A.; Ai, Y.; Wei, D.; Wang, X.; Peng, B.; Muhler, M. Anaerobic alcohol conversion to carbonyl compounds over nanoscaled Rh-doped $SrTiO_3$ under visible light. *J. Phys. Chem. Lett.* **2019**, *10*, 2075−2080.

(4) Rathee, G.; Awasthi, A.; Sood, D.; Tomar, R.; Tomar, V.; Chandra, R. A new biocompatible ternary Layered Double Hydroxide Adsorbent for ultrafast removal of anionic organic dyes. *Sci. Rep.* **2019**, *9*, 16225.

(5) Rathee, G.; Singh, N.; Chandra, R. Simultaneous Elimination of Dyes and Antibiotic with a Hydrothermally Generated NiAlTi Layered Double Hydroxide Adsorbent. *ACS Omega* **2020**, *5*, 2368−2377.

(6) Rathee, G.; Kohli, S.; Awasthi, A.; Singh, N.; Chandra, R. MoS_4^{2-} intercalated NiFeTi LDH as an efficient and selective adsorbent for elimination of heavy metals. *RSC Adv.* **2020**, *10*, 19371−19381.

(7) Natarajan, S.; Anitha, V.; Gajula, G. P.; Thiagarajan, V. Synthesis and characterization of magnetic superadsorbent Fe_3O_4-PEG-Mg-Al-LDH nanocomposites for ultrahigh removal of organic dyes. *ACS omega* **2020**, *5*, 3181−3193.

(8) Bhojaraj; Arulraj, J.; Kolinjavadi, M. R.; Rajamathi, M. Solvent-mediated and mechanochemical methods for anion exchange of carbonate from layered double hydroxides using ammonium salts. *ACS Omega* **2019**, *4*, 20072−20079.

(9) Eniola, J. O.; Kumar, R.; Al-Rashdi, A. A.; Ansari, M. O.; Barakat, M. A. Fabrication of Novel $Al(OH)_3$/CuMnAl-Layered Double Hydroxide for Detoxification of Organic Contaminants from Aqueous Solution. *ACS omega* **2019**, *4*, 18268−18278.

(10) Haruta, M.; Kobayashi, T.; Sano, H.; Yamada, N. Novel gold catalysts for the oxidation of carbon monoxide at a temperature far below 0 C. *Chem. Lett.* **1987**, *16*, 405−408.

(11) Su, F.-Z.; Liu, Y.-M.; Wang, L.-C.; Cao, Y.; He, H.-Y.; Fan, K.-N. Ga−Al Mixed-Oxide-Supported Gold Nanoparticles with Enhanced Activity for Aerobic Alcohol Oxidation. *Angew. Chem., Int. Ed.* **2008**, *47*, 334−337.

(12) Ma, K.; Li, Y.; Wang, Z.; Chen, Y.; Zhang, X.; Chen, C.; Yu, H.; Huang, J.; Yang, Z.; Wang, X.; Wang, Z. Core−shell gold nanorod@layered double hydroxide nanomaterial with highly efficient photothermal conversion and its application in antibacterial and tumor therapy. *ACS Appl. Mater. Interfaces* **2019**, *11*, 29630−29640.

(13) Rathee, G.; Kohli, S.; Singh, N.; Awasthi, A.; Chandra, R. Calcined Layered Double Hydroxides: Catalysts for Xanthene, 1, 4-Dihydropyridine, and Polyhydroquinoline Derivative Synthesis. *ACS Omega* **2020**, *5*, 15673−15680.

(14) Pourian, E.; Javanshir, S.; Dolatkhah, Z.; Molaei, S.; Maleki, A. Ultrasonic-assisted preparation, characterization, and use of novel biocompatible core/shell Fe_3O_4@GA@ isinglass in the synthesis of 1, 4-dihydropyridine and 4 H-pyran derivatives. *ACS Omega* **2018**, *3*, 5012−5020.

(15) Song, G.; Wang, B.; Luo, H.; Yang, L. Fe3+-montmorillonite as a cost-effective and recyclable solid acidic catalyst for the synthesis of xanthenediones. *Catal. Commun.* **2007**, *8*, 673−676.

(16) Ghassamipour, S.; Ghashghaei, R. Zirconium dodecylphosphonate promoted synthesis of xanthene derivatives by condensation reaction of aldehydes and *β*-naphthol or dimedone in green media. *Monatsh. Chem.* **2015**, *146*, 159−163.

(17) Kahandal, S. S.; Burange, A. S.; Kale, S. R.; Prinsen, P.; Luque, R.; Jayaram, R. V. An Efficient Route to 1,8-Dioxo-Octahydroxanthenes and -Decahydroacridines Using a Sulfated Zirconia Catalyst. *Catal. Commun.* **2017**, *97*, 138−145.

(18) Kulkarni, P. $Al_2(SO_4)_3$ is an efficient and mild acid catalyst for the one-pot, four component synthesis of polyhydroquinoline. *J. Chil. Chem. Soc.* **2014**, *59*, 2319−2321.
(19) Tekale, S. U.; Pagore, V. P.; Kauthale, S. S.; Pawar, R. P. La_2O_3/TFE: An Efficient System for Room Temperature Synthesis of Hantzsch Polyhydroquinolines. *Chin. Chem. Lett.* **2014**, *25*, 1149−1152.
(20) Yoo, J. S.; Laughlin, T. J.; Krob, J. J.; Mohan, R. S. Bismuth(III) Bromide Catalyzed Synthesis of Polyhydroquinoline Derivatives via the Hantzsch Reaction. *Tetrahedron Lett.* **2015**, *56*, 4060−4062.
(21) Smits, R.; Belyakov, S.; Plotniece, A.; Dubur, G. Synthesis of 4H-Pyran Derivatives Under Solvent-Free and Grinding Conditions. *Synth. Commun.* **2013**, *43*, 465−475.
(22) Niknam, K.; Borazjani, N.; Rashidian, R.; Jamali, A. SilicaBonded N-Propylpiperazine Sodium N-Propionate as Recyclable Catalyst for Synthesis of 4H-Pyran Derivatives. *Chin. J. Catal.* **2013**, *34*, 2245.

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6 Nanostructured inorganic–organic silica as green material for sustainable development of catalysts

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6.1 Introduction

Due to the rising environmental cognizance across the globe, there has been an ever-increasing demand for clean and sustainable technologies. With "green chemistry" coming into the limelight, this dream to move towards a cleaner and greener world has been transformed into reality. Green chemistry works toward efficient utilization of raw materials and eradicating waste at the very beginning rather than employing end of the pipe solutions. It also primarily focusses on circumventing or minimizing the utilization of hazardous chemicals as solvents and reagents to carry out organic transformations [1]. Green chemistry opens up the doors to sustainability by providing more credible solutions to the existing perilous chemical methodologies employed in the industries [2]. It provides cleaner avenues for designing new products. In fact, it has earned its position as a dazzling star in the chemical industries by making a wide array of manufacturing processes economically viable. Various operating costs are reduced tremendously by employment of greener and sustainable methods. Treatment and disposal also become obsolete with minimal or zero waste generation. Moreover, steering clear of using stoichiometric reagents and other toxic solvents leads to massive cut in material and energy costs of the manufacturing protocols [3]. Essence of green chemistry can be consolidated by a cohesive set of 12 principles based on intelligently transforming the existing chemical processes into environmentally benign ones [4]. Catalysis is one such overarching principle encompassing the soul of green chemistry as it incorporates many underlying factors—milder reaction conditions, lesser by-products generation, and significantly lesser energy input.

In the past few decades, green chemistry and catalysis have become an unstoppable juggernaut. Catalysis lies at the heart of chemistry due to its outstanding ability of altering the rate of chemical reactions. A catalyst has the magical ability to provide an alternate route to a reaction without getting spent itself. It can also change

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Varying sonication conditions to tailor surface morphology of GO thin films for enhanced gas sensing performance

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Vishal Dhingra, Shani Kumar, Arijit Chowdhuri, Amit Garg, et al.

CdS-SnO_2 Nanocomposite Sensor for Room Temperature Detection of NO_2 Gas

Ajay Kumar Sao, Jatinder Pal Singh, Babita Sharma, Sandeep Munjal, Anjali Sharma, Monika Tomar, and Arijit Chowdhuri

Abstract In the present work, an effort has been made to fabricate conductometric gas sensors based on thin films of Cadmium Sulphide (CdS) doped Tin Oxide (SnO_2), for detection of NO_2 gas at RT (room temperature) and the sensing response was studied at RT on 3% CdS nanoparticles doped SnO_2 thin film toward 10 ppm of NO_2 gas. The sensing response of CdS-SnO_2 nanocomposite was studied and compared with thin films of bare SnO_2, bare CdS. Incorporation of CdS in SnO_2 yielded the maximum sensing response of ~377 with faster response and recovery time of 8 s and 107 s respectively toward 10 ppm of NO_2 at RT. Bare SnO_2 and bare CdS thin films showed the sensing response of ~3.85 and ~89 respectively at RT.

Keywords CdS-SnO_2 · Conductometric sensors · Nanocomposites · NO_2 Sensing

1 Introduction

In the present scenario, gas sensing has become imperative in home safety, environmental monitoring and chemical control. Making efficient devices for continuous monitoring of gaseous air pollutants, presence of toxic and harmful gases in environment is still a challenging task. A good gas sensing device should have the

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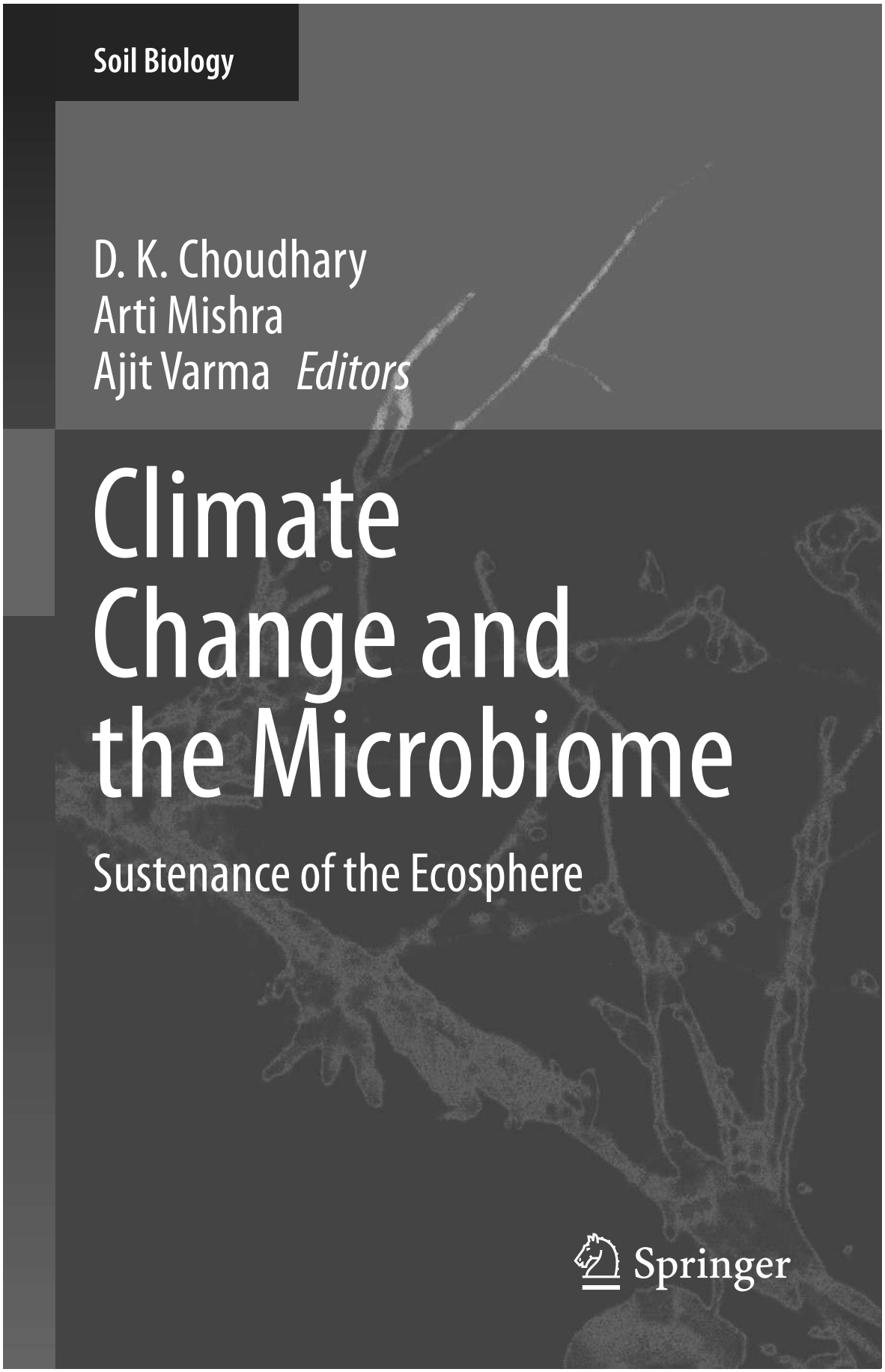
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Chapter 21
Impact of Climate Change on Functional AM Fungi in Rhizosphere

Manoj Kumar Singh, Sumit Sahni, and Anita Narang

Abstract In the study of global changes and ecosystem impacts, it is very important to consider mycorrhiza, because they hold a critical position at the plant-soil interface. Human-induced environmental changes on earth depend on number of factors such as increasing atmospheric CO_2, nutrient enrichment by atmospheric deposition (N_2), altered precipitation and temperature. All these changes taking place in present and will surely increase in the future can impact the association of fungi with plant roots in a positive or negative direction. These factors are classified on the basis of their impact on colonization of mycorrhiza viz. factors affecting arbuscular mycorrhiza (AM) fungi indirectly by altered allocation of carbon from the host and factors that directly affect AM fungi i.e. altered precipitation, temperature and nitrogen deposition. For the study of global climate change and its impact on AM fungi, this distinction in responses to different factors is very important. These global change factors always occur in association, since experimental examination of a large number of scenarios would not be possible in-situ. Therefore for the study of global changes on AM fungi, large spatial and temporal scale assessments have been considered. The majority of experiments only permit to extract short-term responses, though long-term responses are more appropriate. For example, CO_2 springs, global distribution of plant communities and regional extinction because of climate change. AM fungal community may also be impacted according to host biodiversity at local scales. Further, changes in AM fungal community that are not affected by the changes in plant community should be studied to find precise response of mycorrhizas to global change.

Keywords AM fungal community · Elevated CO_2 · Elevated temperature

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12

Production of Liquid Biofuels from Lignocellulosic Biomass

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12.1 Introduction

In the past two decades, gradually exhausting fossil fuel reserves and increasing environmental pollution due to excessive use of fossil energy forced many countries to put forward the 'energy strategy' for their sustainable development. This strategy promotes the use of renewable energy resources in place of fossil fuels (Han et al. 2019). According to the 2018 report of the US Energy Information Administration (USEIA), fossil fuels contribute 80% of the total energy consumed worldwide, and this share is going to reduce somewhat (70%) by 2050 (International Energy Outlook 2019), which is clearly unsustainable. Therefore, the production of renewable fuels is urgently required by using renewable resources to replace these non-renewable conventional fuels. At the present time, the main sources of renewable energy include solar energy, wind energy, biomass, hydrogen energy, geothermal energy and ocean energy. Among these renewable energy resources, biomass contributes 70%, the highest of all the available renewable energies (Panwar et al. 2011; Jurasz et al. 2020). The term biomass comprises any material coming from microbes, plants and animals which can be used as an energy source. In the perspective of biomass energy, it is generally called lignocellulosic biomass (LCB), which mainly consists of plant-based materials and plant dry matter. LCB consists of three structural components i.e. cellulose, hemicellulose and lignin with composition varying from 40 to 60, from 20 to 40 and from 10 to 25 wt%, respectively. Cellulose, a linear carbohydrate polymer, consists of 100 to over 10 000 of β-D-glucose units linked through glycosidic linkages. In contrast, hemicellulose is a branched copolymer of pentose and hexose monomer units situated in a plant cell wall along with lignin. Lignin is the most complex of all, is an amorphous polymer of phenolic compounds and has high energy density than cellulose and hemicellulose. After depolymerization of lignin, phenolic compounds such as phenol, guaiacol, syringol and other derivatives were obtained (Saidur et al. 2011; Schutyser et al. 2015; Nanda et al. 2016).

Transformation of LCB into liquid fuels can be achieved through many routes such as high-pressure liquefaction (Wang et al. 2008), fast pyrolysis (Wang et al. 2017), hydrolysis and fermentation (Lu et al. 2010) etc. as shown in Figure 12.1. Fast pyrolysis generates

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Sustainable Solution for Future Energy Challenges Through Microbes

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13.1 Introduction

Unprecedented growth in population and increase in the socio-economic stature of the middle class globally have created an incessant demand for energy. Today, most of the global energy demand is catered by fossil fuels which have limited reserves on earth and are rapidly depleting. Hence, these cannot sustain the burden of energy demands for more than two or three decades. This led the United Nations to add energy generation and distribution in its 17-point sustainable development goals (SDGs) in which it emphasized to increase the share of renewable energy progressively. Biofuels are an important one among the many available renewable energy sources which have the potential to satiate the ever-increasing energy demand and prove as a sustainable source of energy. Anything which can be used as fuel and has its origin from living organisms can be considered as biofuel. Biofuels in the form of wood, wood chips, charcoal etc. have been in use since time immemorial but cannot take centre stage due to their own limitations. Alternative biofuels include bioethanol, biodiesel, biogas, biohydrogen and bioelectricity which are more usage-ready and can be generated from the biomass available. Based on the resources used to produce them, biofuels have been classified into four generations i.e. first, second, third and fourth. Each generation has its own merits and demerits. Some are well studied, and technologies have been developed to produce them efficiently but are competing with food crops; others have no competition with food crops; however, the technologies involved in their generation are in infancy and need lots of research for their commercialization. There are some roadblocks which deter to prove them as sustainable energy sources which will be overcome in coming years. The major organisms involved in biofuel generation are not the higher organisms but microorganisms such as bacteria, fungi and algae which contribute at each step of biofuel production ranging from presenting themselves as biomass to treatment of biomass or as producers of catalysing enzymes in myriads of biochemical reactions involved.

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Facets of AM Fungi in Sequestering Soil Carbon and Improving Soil Health

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Abstract

Soils, particularly agricultural soils, are home to a plethora of microbial communities capable of sequestering soil carbon. In this framework, arbuscular mycorrhizal fungi (AMF) play a pivotal role. This universal group of fungi form an obligate symbiotic relationship with the roots of higher plants leading to improved nutrient uptake and abiotic and biotic stress resistance. In addition, these fungi secrete a group of glycoproteins called glomalin or glomalin-related soil protein (GRSP) that sustain soil health, cement soil aggregates, and sequester soil C in a stable form. AMF symbiosis and GRSP production are however influenced by numerous aspects, including crop and soil management practices. Besides plant and soil type, soil management practices also influence AMF diversity and abundance. The soil carbon sequestration via AMF and GRSP is achievable if AMF supporting agricultural practices are employed. This chapter summarizes the cumulative role of AMF and GRSP in forming and stabilizing soil aggregates for long-term C storage, the influence of AMF-mediated agricultural practices to sequester soil carbon and improve soil quality traits.

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