

ENGINEERING CHEMISTRY FOR ENGINEERS

Dr. Kapil Tyagi

Dr. Shweta Tyagi

Dr. S. Ravichandran



Kripa Drishti Publications, Pune.

ENGINEERING CHEMISTRY FOR ENGINEERS

Editors

Dr. Kapil Tyagi

Associate Professor

Applied Science Department

Greater Noida Institute of Technology (Engg. Institute)

Greater Noida, UP (India).

Dr. Shweta Tyagi

Assistant Professor

Applied Science Department

Greater Noida Institute of Technology (Engg. Institute)

Greater Noida, UP (India).

Dr. S. Ravichandran

Professor,

Department of Chemistry,

Lovely Professional University,

Jalandhar, Punjab.

Kripa-Drishti Publications, Pune.

Book Title: **Engineering Chemistry for Engineers**

Edited By: **Dr. Kapil Tyagi, Dr. Shweta Tyagi,
Dr. S. Ravichandran**

Price: ₹675

1st Edition

ISBN: **978-81-971650-9-2**



9 788197 165092

Published: **July 2024**

Publisher:



Kripa-Drishti Publications

A/ 503, Poorva Height, SNO 148/1A/1/1A,
Sus Road, Pashan- 411021, Pune, Maharashtra, India.
Mob: +91-8007068686
Email: editor@kdppublications.in
Web: <https://www.kdppublications.in>

© Copyright Dr. Kapil Tyagi, Dr. Shweta Tyagi, Dr. S. Ravichandran

All Rights Reserved. No part of this publication can be stored in any retrieval system or reproduced in any form or by any means without the prior written permission of the publisher. Any person who does any unauthorized act in relation to this publication may be liable to criminal prosecution and civil claims for damages. [The responsibility for the facts stated, conclusions reached, etc., is entirely that of the author. The publisher is not responsible for them, whatsoever.]

PREFACE

The ever-expanding field of **Engineering Chemistry for Engineers** is concerned with changes in the surrounding conditions. Therefore, the purpose of teaching engineering chemistry in diploma programmes is to familiarise students with the fundamentals of the chemistry of various materials used in industry and to provide them with an understanding of the fundamentals of the chemical changes that occur in various aspects related to engineering fields. Additionally, they acquire the proper mindset to deal with the constant influx of new technology.

This book can also be viewed as a condensed introduction to the range of chemical engineering topics for undergraduate students studying chemistry and chemical engineering. To keep the content understandable to the widest audience, the book avoids discussing complicated mathematics and makes no assumptions about the reader's knowledge of chemistry or mathematics.

The entire spectrum of chemical engineering topics is covered in this book, ranging from phase behaviour and material and energy balances to more specialised subjects like operations, particle mechanics, and biochemical engineering. The structure of "Chemistry for Engineers" emphasises key subjects where the fields of chemistry and engineering overlap.

CONTENT

1. NMR and Mass Characterization of a Novel Oligosaccharide Isolated from Goat Milk - Dr. Pushpraj Singh1

1.1 Introduction:	1
1.2 Theoretical Study:	2
1.3 Experimental:	2
1.3.1 General Procedures:	2
1.3.2 Isolation of Goat Milk Oligosaccharides by Modified Method Kobata and Ginsburg.....	3
1.3.3 Sephadex G-25 Gel Filtration of Goat Milk Oligosaccharide Mixture: ...	3
1.3.4 Confirmation of Homogeneity of Goat Milk Oligosaccharides by Reverse Phase HPLC.....	4
1.3.5 Acetylation of Oligosaccharide Mixture:.....	6
1.3.6 Purification of Acetylated Milk Oligosaccharide on Silica Gel Column:.	6
1.3.7 Deacetylation of Compound 'a':	6
1.3.8 Methylglycosidation/Acid Hydrolysis of Compound 'A' Rasose:	6
1.3.9 Kiliani Hydrolysis of Compound 'A' Rasose:	6
1.3.10 Description of Compound 'A' Rasose:	7
1.4 Result and Discussion:	8
1.4.1 Stability of Molecular Geometry of Isolated Compound 'A' Rasose:	8
1.4.2 Structure Elucidation of Isolated Goat Milk Oligosaccharide Rasose 'A' 8	8
1.5 Conclusion:.....	12
1.6 Acknowledgments:	12
1.7 References:	12

2. Complexes of Transition Metals with Schiff's Base - Dr. Neelu Basant.....14

2.1 Introduction:	14
2.2 Applications:	17
2.3 Biological Activities of Schiff Bases:	18
2.3.1 Antimicrobial Activities:	19
2.4 Synthesis Procedure of Transition Metal Complexes:	20
2.5 Conclusion:.....	23
2.6 References:	23

3. Polymer Science and Engineering - Ayilam Viswanathan Rajalakshmi24

3.1 Polymers:.....	24
3.2 Classification of Polymers:.....	24
3.2.1 Polymerisation:	25
3.2.2 Conducting Polymers:.....	26
3.2.3 Biodegradable Polymers:	26

3.3 References:	28
4. Enhancing Agricultural Sustainability: The Significance of Organic Farming and Its Diverse Practices - Bhagyashree Keshewani, Anil Kumar, S. Ravichandran.....	29
4.1 Organic Farming:.....	29
4.2 Trending Practices of Organic Farming:	30
4.2.1 Bulky Organic Farming:	30
4.2.2 Vermicomposting:	31
4.2.3 There are several practices that can be adopted to support agriculture:.	32
4.3 Traditional Farming Techniques: Modern Organic Methods:.....	34
4.4 Present Status of Organic Farming in India:.....	39
4.5 India's Certification Agencies:.....	40
4.6 Future Prospectuses:	41
4.7 References:	41
5. Green Chemistry Innovation and Technology - Vedant Patel, Kishor R. Desai, Bhavin R. Patel, S. Ravichandran	42
5.1 Introduction:	42
5.1.1 Biocatalysts:	42
5.1.2 Enzymes: The Key Elements for Biocatalysis:	43
5.2 Photocatalysis:	54
5.3 Photochemical Reactions:.....	58
5.4 Alternate Energy Processes in Chemical Synthesis:	59
5.5 References:	72
6. Water Technology and Fuels - Dr. Manish Kumar, Dr. Preetismita Borah, Ayush Kumar Singh, Kashyap Komal.....	78
6.1 Introduction:	78
6.2 Water Technology:	79
6.2.1 Water Electrolysis	79
6.2.2 Biomass Gasification:	80
6.2.3 Hydrogenation of CO ₂ :	81
6.3 Advantages of Applying Water Technology:	82
6.3.1 Decreasing the Amount of Water that does not Generate Revenue:	82
6.3.2 Maximizing the Longevity of Assets:	82
6.3.4 Reducing Expenses:	83
6.3.5 Enhanced Operations and Planning:	83
6.3.6 Enhanced Resilience to Extreme Events:	83
6.4 Fuels:	83
6.4.1 Hydrogen:.....	84
6.4.2 Biofuels:	84
6.4.3 Bioethanol	84
6.4.4 Biodiesel:.....	85
6.4.5 Methanol:	85
6.5 Advantages of water-based fuels over traditional fuel sources:	85

6.6 Conclusions:	86
6.7 References:	86

7. Biotechnology and Bioengineering - Dr. Manish Kumar, Dr. Preetismita Borah, Kashyap Komal, Ayush Kumar Singh88

7.1 Introduction:	88
7.2 Biotechnology:	89
7.3 Applications of Biotechnology:.....	90
7.3.1 Medicine:	90
7.3.2 Agriculture:.....	91
7.3.3 Industry:.....	92
7.3.4 Environment:.....	92
7.4 Bioengineering:	93
7.5 Applications of Bioengineering:.....	93
7.5.1 Medical Applications:	94
7.5.2 Bioprocess Engineering:	94
7.5.3 Biochemical Engineering:.....	94
7.5.4 Environmental Engineering:	95
7.5.5 Systems Biology:	95
7.5.6 Biomimicry:	95
7.6 Future Scopes of Biotechnology and Bioengineering:.....	95
7.7 Conclusions:	96
7.8 References:	96

8. Learning of Corrosion Chemistry - S. Suresh, Shubham Avinash Deshmukh, S. Ravichandran100

8.1 Two Types of Corrosion:	101
8.1.1 Dry or Chemical Corrosion:.....	101
8.1.2 Wet or Electrochemical Corrosion:.....	102
8.2 Factors Affecting the Corrosion:	104
8.2.1 Nature of Metal:.....	104
8.2.2 Nature of the Corroding Environment:	104
8.3 Corrosion Control by Cathodic Protection Method:.....	105
8.3.1 Cathodic protection:	105
8.3.2 Impressed Current Cathodic Protection:	105
8.3.3 Electroplating:.....	106
8.4 Corrosion Control by using Corrosion Inhibitors:.....	106

9. Understanding of Polymer Chemistry - S. Suresh, Shubham Avinash Deshmukh, S. Ravichandran.....107

9.1 Introduction:	107
9.2 Types of Polymerizations:	108
9.2.1 Addition Polymerization:.....	108
9.2.2 Condensation Polymerization:	108
9.3 Classification of Polymers:.....	109

10. Surface Chemistry and Catalysis - Dr. Neetu Kumari..... 116

10.1 Introduction:	116
10.1.1 Surface Chemistry:.....	116
10.1.2 Applications of Surface Chemistry:	117
10.2 Types of Absorption:	117
10.2.1 Physical Adsorption or Physisorption:.....	117
10.2.2 Chemical Adsorption or Chemisorption:	118
10.3 Factors Affecting Adsorption:	119
10.3.1 Effect of Temperature:	119
10.3.2 Effect of Pressure:	119
10.4 Catalysis:	122
10.4.1 Types of Catalysis:.....	122
10.4.2 Properties of a Catalyst:	123
10.4.3 Enzyme Catalysis:	124
10.5 Conclusion:.....	124
10.6 References:	125

11. QSAR Analysis Of 1, 3, 4, - Thiadiazole And 1,3,4 - Triazole Derivatives as CA (IX) Carbonic Anhydrase Inhibitors - Madhu Gupta, Sangeeta Agarwal, S. Ravichandran..... 126

11.1 Introduction:	126
11.2 Materials and Methods:	127
11.2.1 Data Set:	127
11.2.2 Molecular Descriptor Generation:.....	127
11.3 Results and Discussion:	128
11.4 Conclusion:.....	128
11.5 References:	129

12. Chemistry: Playing a Major Part in Our Everyday Life - S. Ravichandran, R. M. Aadarsh Vel..... 140

12.1 Introduction:	140
12.2 Brushing Teeth:	142
12.3 Drugs Are Essential Chemistry in Daily Life:.....	142
12.4 Waste Management:	144
12.5 Conclusion:.....	144
12.6 References:	145

About The Editors



Dr. Kapil Tyagi

(M.Sc. and Ph.D. in Chemistry)

Associate Professor,
Applied Science Department,
Greater Noida Institute of Technology(Engg. Institute),
Greater Noida, UP (India)



Dr. Shweta Tyagi

(M.Sc. and Ph.D. in Chemistry)

Assistant Professor,
Applied Science Department,
Greater Noida Institute of Technology (Engg. Institute),
Greater Noida, UP (India)



Dr. S. Ravichandran

(M.Sc. and Ph.D. in Chemistry)

Professor,
Department of Chemistry,
Lovely Professional University,
Jalandhar, Punjab.



Kripa-Drishti Publications

A-503 Poorva Heights, Pashan-Sus Road, Near Sai Chowk,
Pune – 411021, Maharashtra, India.

Mob: +91 8007068686

Email: editor@kdpublications.in

Web: <https://www.kdpublications.in>

Price: ₹ 675

ISBN: 978-81-971650-9-2



9 788197 165092