

CH-226 Principles of Polymer Chemistry

Credit Hours: 2-1

Pre-requisite: Nil

Course Objectives

1. This course aims to provide students with a foundational understanding of polymer chemistry, including polymer classification, synthesis methods, structure-property relationships, and characterization techniques. It emphasizes the practical significance of polymers in various industrial, biomedical, and environmental applications, fostering the ability to analyze and apply polymer concepts in real-world contexts.

Course Contents

2. Introduction to polymers, classification & nomenclature. Natural polymers, polymers synthesis by step-growth, chain growth, coordination and copolymerization. Molecular weight and distribution. Polymer structure and morphology, crosslinking, crystalline and amorphous polymers, Glass transition temperature (T_g) and melting temperature (T_m) of polymers. Polymer Characterization Techniques, spectroscopic methods (FTIR, NMR, UV-Vis), thermal analysis (DSC, TGA, DMA), molecular weight determination (GPC/SEC, viscometry). Polymer degradation and stability. Biodegradable polymers, recycling and sustainability, Commodity polymers (PE, PP, PVC, PS), polymers in engineering and biomedical applications (nylon, PET, PC, latex, polyurethanes, PLA, PLGA) and conjugated polymers for use in organic and bioelectronics.

Course Outcomes

By the end of this course, the students will be able to:

3. Explain the chemistry of polymerization and the properties of synthetic and natural polymers.
4. Analyze the molecular structure of polymers and their mechanical, thermal, and chemical behaviors.
5. Evaluate applications of polymers in biomedical devices, packaging,

and electronics etc.

Relevant Experiments:

1. Synthesis of polymers by step-growth polymerization.
2. Synthesis of polymers by step-growth polymerization.
3. Synthesis of conjugated polymers.
4. Characterization and optical properties of polymers.

Recommended Books

1. Burton, B. (Ed.). (2022). Textbook of Polymer Chemistry, Willford Press. ISBN: 9781647280154.
2. Koltzenburg, S., Maskos, M. & Nuyken, O. (2023) Polymer Chemistry (2nd ed.). Springer Berlin, Heidelberg. ISBN: 978-3-662-64928-2.
3. Forrest, S. R. (2020). Organic Electronics: Foundations to Applications. Oxford University Press. ISBN: 978-0198529729
4. Dusselier, M. & Lange, J-P. (Eds.). (2022), Biodegradable Polymers in the Circular Plastics Economy. Wiley-VCH GmbH. ISBN: 9783527347612.
5. T. Lodge, T. P. & Hiemenz, P.C. (2020) Polymer Chemistry (3rd ed.). Taylor & Francis Group. ISBN: 978-1466581647.
6. Chujo, Y. (Ed.) (2010). Conjugated Polymer Synthesis: Methods and Reactions. Wiley. ISBN: 9783527322671.
7. Carrahar, C. E. (2017). Carrahar's Polymer Chemistry (10th ed.). CRC press Taylor & Francis Group. ISBN: 9781498737388.
8. Current Literature and Reviews.