

CH S 565: POLYMER CHEMISTRY

Course Outcome

- This is an introductory course on highly useful materials, namely the polymers.
- The course content is of interdisciplinary interest.
- It enables students to learn about general information about plastics, rubber and fibre materials.
- The applications of these materials in daily life, engineering and biomedical field have been emphasized.
- The students are made aware of the problems of polymer waste management and the strategies developed to minimize plastic pollution.

UNIT-I

[12 hours]

Terminology and basic concepts: General structure, naming, preparation, properties and uses of polymers (polyethylene, polypropylene, polystyrene, PVC, polyacrylics, polyesters, polyamides, and regenerated cellulose).

Classification based on various considerations: Source, preparation methods, thermal behaviour, chain structure etc.

Types: Homopolymers and copolymers; Linear, branched and network polymers.

Techniques of polymerization: Techniques of preparation of addition and condensation polymers.

Kinetics of polymerization: Kinetics of addition and condensation polymerization. Kinetics of copolymerization.

UNIT-II

[12 hours]

Stereochemistry of polymers: Geometric and optical isomerism in polymers. Structure, properties and preparation of stereoregular polymers. Expressions for average molecular weight. Molecular weight distribution and Polydispersity.

Determination of molecular weight: Osmometry, viscometry, ultracentrifugation, electrodialysis and GPC methods.

Thermal Characterization: Glass Transition and melting-correlation with structure-Factors affecting T_g and T_m . Techniques of thermal characterization: DSC, DTA, DTG and TGA techniques.

UNIT-III

[12 hours]

Structural features, properties and uses of commercial polymers: Polyurethanes, polycarbonates, formaldehyde based resins, epoxy resins and aromatic polyamides.

Properties and uses of Specialty polymers: Composites, Conducting polymers and Biomedical polymers.

Polymer degradation and stability: Thermal, oxidative, photo, chemical and radiation affected degradation. Plastic waste management-incineration, recycling and biodegradation.

Polymer processing Techniques: Compounding - role of additives. Casting, calendaring, moulding, foaming, reinforcing and spinning techniques.

References

1. Textbook of Polymers, 3rd edn., F. W. Billmeyer, Wiley (1984).
2. Contemporary Polymer Chemistry, 3rd edn., H. R. Allcock, J. E. Mark and F. W. Lampe Prentice Hall (2003).
3. Polymer Science and Technology, 3rd edn., J. R. Fried, Prentice Hall (2014).
4. Polymer Science, 4th edn., V. R. Gowariker, N. V. Viswanathan and J. Sreedhar, New Age International Pvt. Ltd. (2021).
5. Principles of Polymer Science, 2nd edn., P. Bahadur and N. V. Sastry, Narosa Publishers (2006).