PLPE3008 BIOGRADABLE PLASTICS (3-0-0)

Course Objective:

This course aims to introduce students to the fundamentals of biodegradable polymers, covering their definition, classification, and degradation mechanisms. Students will explore the structure, properties, and applications of biodegradable polymers derived from renewable and non-renewable resources, and gain an understanding of their environmental impact, advantages, and limitations compared to conventional plastics. Additionally, modules aim to equip students with the knowledge to evaluate biodegradable plastics for various applications and their role in promoting sustainable development.

Syllabus

Module - I: (14 Hours)

Introduction, classification, and sources of biodegradable polymers

Biodegradable Polymers; Introduction, Definition, Defining biodegradability, Importance, Classification.

Degradation mechanism; hydrolytic scission, enzymatic hydrolysis.

Properties; Environmental Impact of bioplastics, advantages and disadvantages bioplastics/ biopolymers

Module - II: (14 Hours)

Structure, derivatives, and properties of Biodegradable & Compostable polymers from renewable and non-renewable resources;

Derived from renewable resources; cellulose acetate, Oils and fats of plant, Hydroxylation (ring opening) of vegetable oil, vegetable oil as feedstock for Polyurethane polymers, Lignin and hemicellulose, natural rubber, thermoplastic starch.

Animal origin; Chitosan, silk, Collagen, & elastin

Bacterial Origin: Bacterial cellulose, Poly (Hydroxyalkanoates), Alginates, Carrageenan

Derived from non-renewable resources; PVA, Aliphatic & aromatic co polyesters.

Module - III: (08 Hours)

Applications and testing of biodegradable plastics

Criteria used in the evaluation of biodegradable plastics; choosing the most appropriate methodology, description of current standards and test methods.

Bioplastics applications: Food packaging, edible films, coatings, automotive, Agricultural, membranes, tissue engineering & biomedical applications, composite applications, role in sustainable development and miscellaneous applications.

Current market of biodegradable plastics.

Course outcomes:

After the completion of this course, students will be able to:

CO1: Recognize the definition, importance, and classification of biodegradable polymers, along with their degradation mechanisms.

CO2: Describe the structure, properties, and examples of biodegradable polymers derived from both renewable and non-renewable resources.

CO3: Explain the environmental impact of bioplastics and analyze their advantages and disadvantages compared to conventional plastics.

CO4: Apply knowledge of biodegradable plastics to assess their suitability for various applications, considering factors like biodegradability and mechanical properties.

CO5: Analyze the role of biodegradable plastics in sustainable development and evaluate current standards and test methods used for their evaluation.

Books:

1. Biodegradable Polymers for Industrial Applications : Ray Smith, Woodhead Publications., England, 2005
2. Renewable Resources for Functional Polymers and Biomaterials: Park, RSC, Cambridge, 2011
3. Biopolymers : R.M. Johnson, L.Y. Mwaikambo and N. Tucker, RAPRA, UK, 2003
4. Green Composites: Polymer Composites & the environment: Caroline Bathe, CRC Press, Boca Raton, 2004
5. Biodegradable Polymers and Plastics; Emo Chiellini and Roberto Solaro University / Pisa Pisa, Italy. (Originally published by Kluwer Academic I Plenum Publishers, New York in 2003 Softcover reprint ofthe hardcover 1st edition 2003)