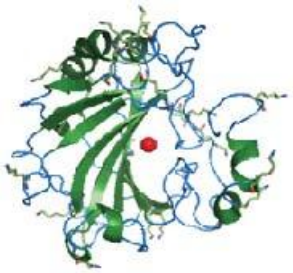
16BT303 ENZYME TECHNOLOGY



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Hours Per Week :

L	T	P	C
3	-	2	4

Course Description and Objectives:

This course offers an introduction to enzymes and their functions. The main purpose of this course is to explore various aspects of enzymes such as their classification, mechanism of action, isolation methods and kinetics.

Course Outcomes:

Upon completion of the course, the student will be able to

CO1: Understand the role of enzyme in cellular functioning.

CO2: Analyze structure, functions and the mechanisms of action of enzymes.

CO3: Model kinetics of enzyme catalyzed reactions and enzyme inhibitory and regulatory process.

CO4: Summarize current processes involved in industrial enzyme production from plants, animals and microorganisms.

CO5: Adapt different immobilization methods and analyze the bioconversions in immobilized reactors.

SKILLS:

- ✓ *Isolate commercially important enzymes.*
- ✓ *Estimate enzyme activity by colorimetric and spectroscopic methods.*
- ✓ *Immobilize enzymes for commercial applications.*

UNIT - 1 L-9

INTRODUCTION TO ENZYMES: Discovery of enzymes - a historical recall; Classification of enzymes; Applications of enzymes; Principles of catalysis - collision theory, transition state theory, role of entropy in catalysis; Comparison of chemical and enzyme catalysis; Stability, deactivation and catalytic activities; Mechanisms of enzyme action; Concept of active site and energetics of enzyme substrate complex formation; Specificity of enzyme reaction.

UNIT - 2 L-9

ISOLATION OF ENZYMES: Extraction and purification of crude enzyme extracts from plant, animal and microbial sources; Methods of characterization of enzymes; Development of enzymatic assays.

UNIT - 3 L-9

KINETICS OF ENZYME ACTION: Kinetics of single substrate reactions; Estimation of Michaelis - Menten parameters; Importance of K_m; Multi-substrate reaction mechanisms and kinetics; Turnover number; Types of Inhibition - kinetic models, substrate and product inhibition; Allosteric regulation of enzymes; Deactivation kinetics.

UNIT - 4 L-9

ENZYME IMMOBILIZATION: Physical and chemical techniques for enzyme immobilization - adsorption, matrix entrapment, encapsulation, cross-linking, covalent binding; Advantages and disadvantages of different immobilization techniques; Overview of applications of immobilized enzyme systems.

UNIT - 5 L-9

IMMOBILIZED ENZYME REACTORS: Design of immobilized enzyme reactors- packed bed, fluidized bed membrane reactors; Bioconversion calculations in free enzyme CSTRs and immobilized enzyme reactors; Stability, deactivation and catalytic activities.

ACTIVITIES:

- *Isolate peroxidase from horse radish.*
- *Purify and compare peroxidase by different methods.*
- *Estimate V_{max} of different enzyme reactions.*
- *Immobilize peroxidase on various substrates- cloth, fabric, glass bead and encapsulation.*

LABORATORY EXPERIMENTS

LIST OF EXPERIMENTS Total hours: 30

1. Extraction of enzymes- bacteria, plant and animal sources.
2. Purification of enzymes.
3. Development of enzyme assays and quantification of enzyme activity and specific activity.
4. Determination of enzyme kinetics- K_m and V_{max}.
5. Effect of temperature on enzyme activity.
6. Effect of pH on enzyme activity.
7. Techniques of enzyme immobilization - matrix entrapment, ionic and cross linking.

TEXT BOOKS:

1. T. Palmer, "Enzymes", 1st edition, East West Press, 2004.
2. N.K. Prasad, “Enzyme Technology - Pace Maker of Biotechnology”, 1st edition, PHI publishers, 2011.

REFERENCE BOOK:

1. Devasena, "Enzymology", 1st edition, PHI, 2011.