

17BT002 UPSTREAM & DOWNSTREAM PROCESSING

Hours Per Week:	L	T	P	C
	3	-	2	5

Total Hours:	L	T	P
	45	-	2

BS	SA	CS	WA/RA	SSH	S
5	8	1-5	5	40	1-5

Course Description and Objectives:

This course helps to familiarize students with the downstream section of a bioprocess for the production of biotechnological products. To familiarize the student regarding removal of insoluble's, product isolation, high-resolution techniques and product polishing.

Course Outcomes:

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

- *Design the fermentation medium*
- *Operate the electrophoresis unit*
- *Use the chromatographic methods*
- *Understanding of current purification technologies*

SKILLS TO BE ACQUIRED:

- *Able to separate the product of interest*
- *Able to eliminate trace contaminants and impurities*
- *Able to operate sonicator*
- *Able to use the chromatography techniques*

ACTIVITIES:

- *Preparation fermentation medium*
- *Use of chromatography techniques for separation of bioproducts*
- *Use of Electrophoresis units and gel preparation*
- *Experiments on Cell disruption methods*

UNIT - I**L-9**

Upstream processing: Integrated bioprocessing, Inoculum media for industrial fermentation, Fermentation Media - Media composition, Media sterilization and contamination, Media economics, Screening for fermentation media.

UNIT - II**L-9**

Primary Separation and Recovery Processes: Cell disruption methods for intracellular products, removal of insolubles, Biomass (and particulate debris) separation techniques, flocculation and sedimentation, centrifugation and Filtration methods.

UNIT - III**L-9**

Enrichment Operations: Membrane based separations micro and ultra filtration theory, design and configuration of Membrane separation equipment, applications, Precipitation methods (with salts, organic solvents, and polymers) Extractive separations, aqueous two-phase extraction, Insitu product removal.

UNIT - IV**L-9**

Product Resolution / Fractionation and polishing: Adsorptive chromatographic separation processes, Electrophoretic separations (all electrophoresis techniques including capillary electrophoresis), Gel Permeation Chromatography, dialysis, Crystallization.

UNIT - V**L-9****New and Emerging Techniques:**

Pervaporation, Super critical extraction, foam based separation, Product recovery trains-few examples.

LABORATORY EXPERIMENTS

LIST OF EXPERIMENTS

Total hours: 30

1. Chromatography techniques - Paper, TLC, HPLC, Gel filtration & Ion exchange chromatography.
2. Electrophoresis & Blotting techniques - Native- PAGE, SDS-PAGE & Western Blot technique.
3. Solid separation methods - Filtration, Sedimentation, Centrifugation, Product enrichment operations – Liquid-Liquid extraction and Two-phase aqueous Extraction.
4. Protein precipitation and its recovery.
5. Product crystallization and drying.

TEXT BOOKS:

1. James E Bailey, David F., “Ollis, Biochemical Engineering Fundamentals”, 2nd Ed., Mc Graw Hill, 1993.
2. Asenjo J.M., “Separation Processes in Biotechnology”, Marcel Dekker Inc. 1993.
3. “Product Recovery in Bioprocess Technology”, BIOTOL Series, VCH, 1990.

REFERENCE BOOKS :

1. Wankat P.C, “ Rate Controlled Separations “, Elsevier, 1990.
2. Belter PA and Cussler E, “ Bioseparations “, Wiley , 1985
3. McCabe, Smith, Harriott, “Unit Operations of Chemical, Engineering”, 5th ed., Tata Mc Graw Hill.