
IV Year B.Tech. Biotechnology I - Semester	L	T	P	To	C
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BT 405 DOWNSTREAM PROCESSING

Course Description & Objectives:

To make the student regarding role and importance of downstream processing in biotechnology and its problems associated with product purification. Also about the different separation, purification and new emerging methods and technologies for product recovery.

Course Outcomes:

1. Imparts an understanding of principles of major unit operations used in downstream processing of biopharmaceuticals (e.g., homogenization, centrifugation, chromatography, and ultra filtration).
2. Gives an insight focuses on designing processes for the recovery and subsequent purification of a target therapeutic protein.
3. Able to perform basic scale-up calculations for downstream unit operations
4. Able to describe and explain about process of recombinant proteins purification.

UNIT I: Role Of Downstream Processing In Biotechnology:

Role and importance of downstream processing in biotechnological processes. Problems and requirements of bioproduct purification. Economics of downstream processing in Biotechnology, characteristics of biological mixtures, process design criteria for various classes of bioproducts.

UNIT II: Physical Separation Methods:

Separation of intracellular, extra-cellular, heat and photosensitive materials. Cell disruption: chemical, mechanical and enzymatic methods Physicochemical basis of separation; Physical separation processes: solid and liquid system, flocculation, centrifugation, precipitation, filtration, settling.

UNIT III: Product Recovery Methods:

Extraction, liquid-liquid extraction, aqueous two-phase extraction, absorption, adsorption and leaching. Membrane-based separations (micro, ultrafiltration, reverse osmosis, dialysis), theory, design and configuration of membrane separation equipment applications.

UNIT IV: Product Purification:

Chromatographic techniques- Paper, TLC, Adsorption, Ion exchange, Gel filtration, affinity chromatographic separation processes, GC, HPLC, FPLC, Chromato focusing electrophoretic separations. Electrophoresis of proteins and nucleic acids, 1D-2D Gels, Types of Electrophoretic techniques (Capillary and Pulse field).

UNIT V: Product Finishing and Emerging Technologies:

Crystallization and drying. Pervaporation, super liquid extraction foam based separation case study with examples for processing of Two Industrial Products (Citric acid / Penicillin and Low volume high value product like recombinant proteins).

TEXT BOOKS:

1. BIOTOL.' Series - Product Recovery in Bioprocess Technology, 1st edition, Butterworth Publications, 2004.
2. B. Sivasankar - Bioseparations Principles and Techniques, 1st edition, PHI Publications, 2009.

REFERENCE BOOKS:

1. Wankat PC- Rate Controlled Separations, 1st edition, Spinger, 2005.
2. S.N. Mukhopadhyay - Process Biotechnology Fundamentals, 2nd edition, Viva Books Private Limited, 2005.
3. P F Stanbury, A Whitaker - Principles of Fermentation Technology, 2nd edition, Elsevier Publication, 2008.
4. Keith Wilson, John Walker, John M. Walker - Principles and Techniques of Practical Biochemistry, 7th edition, Camebridge Publication, 2010.

