

UCH831 NOVEL SEPARATION PROCESSES

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| 3 | 1 | 0 | 3.5 |

Course Objectives:

To understand the underlying principles and modelling and design concepts of novel separation techniques and their applications.

Introduction: Fundamentals of separation processes and basic concepts.

Adsorptive Separation: Definition, Types of adsorption, Adsorbent types, Preparation and properties, Types of adsorption isotherms and their importance, Mathematical modeling under different conditions, Cases such as thermal swing, pressure swing, and moving bed adsorption, Desorption.

Membrane Separation: Synthesis and characterization of membranes, Transport processes in membrane, Modeling of reverse osmosis (RO), Ultrafiltration (UF) and gaseous separations, Supported liquid membrane and immobilization, Facilitated transport, Design, Operation, Maintenance and industrial applications of different membrane separation processes such as RO, UF, Nano-filtration (NF), Pervaporation through non-porous membranes, External field induced membrane separation processes for colloidal particles, Fundamentals of various colloid separation, Derivation of profile of electric field strength, Coupling with membrane separation and electrophoresis, electro dialysis.

Liquid Membranes: Fundamentals and modeling, Micellar enhanced separation processes, Cloud point extraction, Centrifugal Separation processes and their calculations, Ion exchange and chromatographic separation processes.

Surfactant Based Separation Processes: Concept, Modeling and design aspects and applications.

Supercritical Fluid Extraction: Concept, Modeling and design aspects and applications.

Biofiltration: Concept, Modeling and design aspects and applications.

Course Learning Outcomes (CLO):

The students will be able to:

1. develop models and the solutions for adsorptive separation processes.
2. characterize the membrane.
3. use the concepts of membrane separation techniques for industrial separations.
4. solve problems involving separation based on liquid membrane.
5. exposure to other new separation techniques - surfactant based, supercritical fluid extraction and bio-filtration.

Text Books:

1. *D. M. Ruthven, Principles of Adsorption and Adsorption Processes, John Wiley (1984).*
2. *M. Mulder, Basic Principles of membrane Technology, Springer (1996).*
3. *M. A. McHugh and V.J. Krukonis, Supercritical Fluid Extraction, Butterworth (1985).*

Reference Books:

1. *S. Sourirajan and T. Matsuura, Reverse Osmosis and Ultra-Filtration Process Principles, NRC Canada (1985).*
2. *C.J. King, Separation Processes, Tata McGraw Hill (1981).*
3. *D. M. Ruthven, S. Farooq and K. S. Knaebel, Pressure Swing Adsorption, Wiley-VCH (1994).*
4. *W. S. Ho and K. K. Sirkar, Membrane Handbook, Kluwer (2001).*
5. *R W Rousseau, Handbook of Separation Process Technology, John Wiley & Sons (2009).*

Evaluation Scheme:

| S. No. | Evaluation Elements | Weightage (%) |
|---------------|---|----------------------|
| 1 | MST | 30 |
| 2 | EST | 45 |
| 3 | Sessional (May includes tutorials/ assignments/ quiz's etc) | 25 |