2.17 40138 UPSTREAM AND DOWNSTREAM PROCESS TECHNOLOGY

GENERAL EDUCATIONAL OBJECTIVES:

1. To study about the relationship between Upstream Process and downstream processing
2. To study about the Plant Cell Culture Techniques
3. To study about the Animal cell Culture techniques
4. To study about the microbial cell Culture techniques
5. To know the Steps in downstream processes
6. To know about types of Primary Separation techniques
7. To know about types of Product separation techniques and Product recovery

UNIT-1 INTRODUCTION

1.1 An overview of Upstream and downstream process
1.2 Relationship between Upstream Process and downstream process
1.3 The component parts of Upstream and downstream process
1.4 Bioreactor- Its role, basic design, types
1.5 Aseptic operation- raw materials, media, fermentor, working area
1.6 Scope of Upstream Process and downstream process

UNIT-2 PLANT CELL CULTURE TECHNIQUES

2.1 Introduction- Importance and Developments of Plant Tissue Culture
2.2 Principles of Tissue Culture- A brief account of Totipotency, Cytodifferentiation and Organogenesis
2.3 Culture media – Definition, Basic nutrients, growth regulators, types of media and preparation of MS media
2.4 Suspension Culture- Batch and Continuous Cell suspension culture, importance of suspension culture in production of secondary metabolites
2.5 Application - Plant Tissue Culture in Forestry, Agriculture, Horticulture and Medicine.

UNIT-3 ANIMAL CELL CULTURE TECHNIQUES

3.1 Introduction and scope of animal cell culture
3.2 Laboratory requirements for Animal cell culture media- Aseptic area, Incubation, preparation & sterilization, storage, laboratory backup, special equipment's, consumable items, substrates-attachment and growth, substrate materials and culture vessels- choice of culture vessel, treated surfaces
3.3 Culture Media- Physicochemical properties of the media- pH, CO2, bicarbonate, buffering, oxygen, osmolality, temperature, viscosity, surface tension and foaming. Natural media – example, advantage & disadvantages. Synthetic Media- BSS, Serum containing media, Serum free media, commercially important culture media. Advantage & disadvantages of synthetic media
3.4 Primary cell culture - Initiation of cell culture. Isolation of cells, Disaggregation of cells, Subculture, Secondary Culture, Established Cell Lines, Maintenance of cell lines

3.5 Bioreactors consideration for animal cell cultures- hollow fibre, fluidized bed reactor for suspension culture
3.6 Applications of animal cell culture

UNIT-4 MICROBIAL CELL CULTURE TECHNIQUES

4.1 Introduction and scope of microbial cell culture
4.2 Media for Microbial cell culture – Corn Steep Liquor, Saccharine Material, Cellulosic Material, Sulfur Waste Liquor, and Parma Media
4.3 Culture maintenance – Refrigeration, Paraffin Method, Cryopreservation, Lyophilization, mineral oil, sterile soil
4.4 Strain improvement- Introduction, types - mutant selection, recombination, and recombinant DNA technology
4.5 Bioreactor for microbial cells: batch and continuous

UNIT-5 AN OVERVIEW OF BIOSEPERATIONS

5.1 Introduction to Bioprocesses, range & characteristics of Byproducts
5.2 Need for Downstream processing and characteristics of fermentation broth
5.3 Steps in downstream processes

UNIT-6 PRIMARY SEPARATION TECHNIQUES

6.1 Cell Disruption
6.1.1 Intracellular and extra cellular products
6.1.2 Types of cell disruption,
6.1.3 Physical methods – Ultra sonication, diaaggregation,
6.1.4 Chemical methods- detergents and other reagents, enzymes
6.1.5 Mechanical methods- bead mill and Comparison of different methods
6.2 Flocculation and sedimentation
6.3 Filtration
6.3.1 Pretreatment of fermentation broths
6.3.2 Batch & Continuous filtration
6.3.3 Equipment's for filtration- Plate & Frame filter, Leaf filter, washing of filter cakes
6.4 Centrifuge
6.4.1 Introduction
6.4.2 Types of centrifuges& its working principle, Basket centrifuge, Disc bowl, Centrifuge decanter

UNIT-7 PRODUCT SEPARATION TECHNIQUES

7.1 Introduction, principle, process with an example and applications
7.2 Distillation
7.3 Extraction- Leaching, Liquid – liquid, Aqueous two phase extraction
7.4 Absorption & Adsorption
7.5 Evaporation

CHAPTER NO. 8 PRODUCT RECOVERY

8.1 Introduction, principle, process with an example and applications
8.2 Membrane Separations- Dialysis, Microfiltration, Ultrafiltration, Reverse osmosis
8.3 Crystallization
8.4 Electrophoresis
8.5 Chromatography
8.6 Drying

Reference Books:

1. Plant Tissue Culture: Theory and Practice by Bhojwani, S.S., Razdan, and M.K.
2. Plant Cell Culture – A Practical Approach Eds. R.A. Dixon and Gonzales, IRL Press
3. Industrial Microbiology br A. H. Patel
4. An Introduction to Plant Tissue Culture M.K. Razdan, Oxford and IBII Publishing Co. Pvt. Ltd., New Delhi
5. Animal Biotechnology by Murray Moo Young
6. Separation process principles by J.D. Seader and Ernest J. Henley, Second Edition by Wiley India Pvt Ltd