

Applied Science Publ.
Singhal OP & Samuel DVK. 2003. *Engineering Properties of Biological Materials*. Saroj Prakasan.

PFE503

ADVANCED FOODPROCESSENGINEERING

2+1

Objective

To acquaint and equip the students with different unit operations of food industries and their design features.

Theory

UNIT I

Thermal processing: Death rate kinetics, thermal process calculations, methods of sterilization and equipments involved, latest trends in thermal processing. Evaporation: Properties of liquids, heat and mass balance in single effect and multiple effect evaporator, aroma recovery, equipments and applications. Drying: Rates, equipments for solid, liquid and semi-solid material and their applications, theories of drying, novel dehydration techniques.

UNIT II

Non-thermal processing: Microwave, irradiation, ohmic heating, pulsed electric field preservation, hydrostatic pressure technique etc.

UNIT III

Freezing: Freezing curves, thermodynamics, freezing time calculations, equipments, freeze drying, principle, equipments. Separation: Mechanical filtration, membrane separation, centrifugation, principles, equipments and applications, latest developments in separation and novel separation techniques.

UNIT IV

Extrusion: Theory, equipments, applications. Distillation and leaching: Phase equilibria, multistage calculations, equipments, solvent extraction.

Practical

Solving problems on single and multiple effect evaporator, distillation, crystallisation, extraction, leaching, membrane separation and mixing, experiments on rotary flash evaporator, humidifiers, reverse osmosis and ultra filtration - design of plate and packed tower, visit to related food industry.

Suggested Readings

- Brennan JG, Butters JR, Cowell ND & Lilly AEI. 1990. *Food Engineering Operations*. Elsevier.
- Coulson JM & Richardson JF. 1999. *Chemical Engineering*. VolS. II, IV. The Pergamon Press.
- Earle RL. 1985. *Unit Operations in Food Processing*. Pergamon Press. Fellows P. 1988. *Food Processing Technology: Principle and Practice*. VCH Publ.
- Geankoplis J Christie. 1999. *Transport Process and Unit Operations*. Allyn & Bacon.
- Henderson S & Perry SM. 1976. *Agricultural Process Engineering*. 5th Ed. AVI Publ.
- McCabe WL & Smith JC. 1999. *Unit Operations of Chemical Engineering*. McGraw Hill.