3.3 Pharmaceutical Engineering (Unit Operations)

1. Particle size Reduction: Objectives, factors affecting size reduction and mechanism of size reduction, Equipments involved in size reduction: Cutter mill, Roller mill, Hammer mill, Ball mill, Fluid energy mill, colloid mill and edge and runner mill. Selection of equipments and degree of size reduction.
2. Size separation: Particle size distribution and standards for powders, sieving, sedimentation, microscopy and electrical methods.
3. Mixing: Objectives and strategies for mixing of powder, semi-solid and liquid components, mixing equipments-shaker mixers, propeller mixers, agitators mixer, tumbling mixers, shear mixers, ultrasonic mixers etc.
4. Filtration: Definition, mechanism and factors affecting filtration, Filter media and filter aids. Types of filtering devices used in pharmaceutical industries, such as filter leaf, filter press, rotary filter, edge filters, membrane filters, HEPA filter etc.
5. Crystallization: Importance of size and shape, crystal geometry, forms, types, principles of crystallization, purity equilibria and yield enthalpy balance, supersaturation, nucleation, mechanism, factors influencing homogenous and hetrogenous solubility curve crystal growth, crystallizers types, tank- evaporator, adiabatic, vacuum draft circulators, magma Swenson walker crystals etc.
6. Extraction: Definitions and theories of liquid-liquid and solid-liquid extraction, small and large scale extraction procedures, continuous and counter-current extraction, factors altering choice of extraction process, recovery of solvent from marc.
7. Distillation: Physical concept, vapour liquid equilibrium relationship, volatility and relative volatility, simple batch distillation, continuous distillation, rectification, distillation column and their efficiency, azeotropes, molecular distillation, steam distillation and vacuum distillation.
8. Drying: Drying of dilute solutions and suspensions, drum dryer and spray dryer. Drying of solid materials, general principles, types of dryer, tray, tunnel, rotary, fluidized bed, vacuum and freeze dryer, lyophilization.
9. Evaporation: Factors affecting evaporation and efficiency of evaporators, natural circulation, types, evaporating pans and stills, short tube evaporators, forced circulation type-long tube evaporators, wiped film evaporators, evaporation under reduced pressure.
10. Centrifugation: Basic principles and equipments used in pharmaceutical industries.

PRACTICALS

Experiments based on theory.

Books recommended:

1. Copper and Gunn's Tutorial Pharmacy,CBS, Delhi
2. Bentley's Textbook of pharmaceutics- ER Rawlins ELBS.
3. The theory and practice of industrial pharmacy- Lachman et al., Varghese publishing house.
4. Unit operations of chemical engineering, McCabe & Smith, MeGraw Hill.
5. Hand book of chemical engineering- Perry- Mecurron hill.
6. Introduction to chemical engineering- Badger et al., McGraw Hill.