

CONTENTS

Preface(v)

Unit 1

Colloidal Dispersions

1.1	Introduction	1
1.1.1	Definition	1
1.2	Classification of Colloids	2
1.2.1	Lyophilic Colloids	3
1.2.2	Lyophobic Colloids.....	3
1.3	Dispersion Methods.....	3
1.4	Purification of Colloids	4
1.4.1	Dialysis	4
1.4.2	Electro Dialysis.....	4
1.4.3	Ultrafiltration	4
1.4.4	Association Colloids	5
1.5	Properties of Colloids	7
1.5.1	Optical Properties.....	7
1.5.2	Kinetic Properties of Colloids.....	10
1.5.3	Electrical Properties	16
1.6	Solubilisation.....	19
1.6.1	Factors Affecting Solubilization	20

Unit 2

Rheology

2.1	Introduction	22
2.1.1	Importance	22
2.1.2	Classification.....	23
2.2	Newtonian System/Fluids.....	23
2.2.1	Newton's Law of Flow	23
2.2.2	Temperature Dependence and Theory of Viscosity	26
2.3	Non–Newtonian Systems	27
2.3.1	Plastic Flow.....	27

2.3.2	Pseudo Plastic Flow	28
2.3.3	Dilatant Flow – Shear Thickening Systems	29
2.4	Thixotropy	30
2.4.1	Measurement of Thixotropy.....	31
2.4.2	Bulges and Spurs.....	33
2.4.3	Negative Thixotropy/Anti Thixotropy	33
2.5	Determination of Rheological Properties	36
2.5.1	Choice of Viscometer.....	36
2.5.2	Types of Rheological Instruments	36
2.5.3	Principle Methods for Measuring Viscosity	37
2.5.4	Capillary Viscometer/Ostwald's Viscometer.....	37
2.5.5	Falling Sphere Viscometer.....	40
2.5.6	Rotational Viscometers.....	41
2.5.7	Cop and Bob Viscometer	41
2.5.8	Cone and Plate Viscometer	44
2.5.9	Visco Elastic Materials	47
2.5.10	Pharmaceutical Areas in which Rheology is significant.....	47
2.6	Rheology of Suspensions	48
2.6.1	Deflocculated Particles in Newtonian Vehicles.....	49
2.6.2	Deflocculated Particles in Non-Newtonian Particles	49
2.6.3	Flocculated Particles in Newtonian Vehicles.....	49
2.6.4	Flocculated Particles in Non-Newtonian Vehicles	49
2.7	Rheology of Emulsions.....	49

Unit 3

Coarse Dispersions

3.1	Suspensions	53
3.2	Interfacial Properties of Suspended Particles	53
3.3	Theory of Sedimentation	55
3.3.1	Effect of Brownian Movement	56
3.3.2	Sedimentation Parameters.....	56
3.3.3	Sedimentation behaviour of Flocculated and Deflocculated Suspensions	58

3.4	Formulation of Suspension.....	60
3.4.1	Wetting Agents	60
3.4.2	Deflocculants and Dispersing Agents	61
3.4.3	Flocculating Agents	61
3.4.4	Thickness, Protective Colloids and Suspending Agents	61
3.5	Emulsions	62
3.5.1	Definition of Emulsions	62
3.6	Types of Emulsions	62
3.6.1	O/W Emulsions	63
3.6.2	W/O Emulsions	63
3.6.3	Multiple Emulsions.....	64
3.6.4	Micro Emulsions.....	64
3.7	Identification of Emulsions	64
3.8	Formulation of Emulsions	65
3.8.1	Raw Materials	66
3.8.2	Emulsifying Agents	66
3.8.3	Buffers.....	72
3.8.4	Density Modifiers	72
3.8.5	Humectants	73
3.8.6	Antioxidants.....	73
3.8.7	Preservatives	73
3.8.8	Flavours, Colours and Sweetening Agents	74
3.9	Physical Insolubility of Emulsions	74
3.9.1	Creaming.....	75
3.9.2	Flocculation.....	75
3.9.3	Coalescence.....	76
3.9.4	Breaking.....	76
3.9.5	Phase Inversion	77
3.10	Stress Conditions for Evaluating Stability of Emulsions	77
3.10.1	Aging and Temperature	77
3.10.2	Centrifugation	78
3.10.3	Agitation	78
3.10.4	Phase Separation	79

3.10.5	Electrophoretic Parameters/Properties	79
3.11	Evaluation and Testing for Emulsions.....	79
3.11.1	Methods of Assessing Stability.....	79
3.12	Theories of Emulsification	80
3.12.1	Droplet Stabilisation	81
3.13	Chemical Instability of Emulsions	84
3.14	Release of Drugs from Emulsion Formulations	85

Unit 4

Micromeritics

4.1	Introduction	87
4.1.1	Significance of Particle size in various Dosage Forms	87
4.1.2	Significance of Particle Surface Area	87
4.1.3	Particle and Size Distribution	88
4.1.4	Particle-Size Distribution.....	89
4.1.5	Number and Weight Distribution.....	89
4.2	Methods for Determining Particle Size	91
4.2.1	Optical Microscopy.....	91
4.2.2	Sieving	92
4.2.3	Sedimentation Method	92
4.2.4	Particle Volume Measurement.....	94
4.3	Particle Shape and Surface Area	95
4.3.1	Particle Shape.....	95
4.3.2	Methods for Determining Surface Area.....	96
4.4	Derived Properties of Powders	97
4.4.1	Porosity	97
4.4.2	Packing Arrangements	98
4.4.3	Bulkiness.....	99
4.4.4	Angle of Repose.....	99

Unit 5

Drugs Stability

5.1	Chemical Kinetics	100
-----	-------------------------	-----

5.1.1	Rates and Orders of Reactions	100
5.1.2	Molecularity	101
5.1.3	Specific Rate Constants	102
5.1.4	Units of Basic Rate Constant	102
5.2	Zero Order Reactions	103
5.2.1	Half Life.....	103
5.2.2	Shelf Life	104
5.2.3	Suspensions, Apparent Zero-Order Kinetics.....	104
5.3	First Order Reaction	105
5.3.1	Half Life.....	106
5.4	Second Order Reactions	106
5.5	Determination of Order	108
5.5.1	Substitution Method.....	108
5.5.2	Graphic Method	108
5.5.3	Half-Life Method	108
5.6	Complex Reactions.....	109
5.6.1	Reversible Reactions.....	109
5.6.2	Parallel or Side Reactions	110
5.6.3	Series or Consecutive Reactions	112
5.7	The Steady State Approximation.....	113
5.7.1	Michaelis – Menten Equation	113
5.8	Influence of Temperature and other Factors on Reaction Rates.....	115
5.8.1	Temperature	115
5.8.2	Classic Collision Theory of Reaction Rates.....	115
5.8.3	Transition State Theory.....	117
5.8.4	Effect of the Solvent	117
5.8.5	Influence of Dielectric Constant	117
5.8.6	Catalysis.....	117
5.9	Pseudo First Order Reaction.....	118
5.10	Decomposition and Stabilization of Medicinal Agents	119
5.10.1	Influence of Light in Photodegradation	121
5.11	Accelerated Stability Studies.....	122