

Contents

Chapter 1 : Introduction	1-26
1.1: Block copolymers (BCs)	2
1.2: Self-assembly of BCs	4
1.3: Polyethylene oxide(PEO) - polypropylene oxide(PPO) block copolymers	8
1.4: PEO-PPO-PEO triblock copolymers (Ploxamers)	9
1.5: Self-assemblies/micelles of Pluronic block copolymers	13
1.6: Micelles of Pluronic block copolymers in drug delivery applications	15
1.7: References	22
Chapter 2 : Self-assembly of single PEO-PPO-PEO triblock copolymeric system for Curcumin drug	27-56
2.1: Introduction	29
2.2: Experimental Section	33
2.2.1: Materials	33
2.2.2: Determination of critical micelle concentration (cmc)	33
2.2.3: Phase-solubility experiments	34
2.2.3.1: Calibration of curcumin drug	34
2.2.3.2: Solubility of curcumin drug in Pluronic F127 micelles	35
2.2.4: Synthesis of curcumin-incorporated Pluronic F127 micelles (PMsCur)	36
2.2.5: Incorporation efficiency (IE) and drug loading(DL) of curcumin in PMsCur	37
2.2.6: Characterization of PMsCur	37
2.2.6.1: Dynamic light scattering (DLS)	37
2.2.6.2: Small-angle neutron scattering analysis (SANS)	37
2.2.6.3: UV-Visible spectroscopy (UV-VIS)	40
2.2.6.4: Fourier transform infrared spectroscopy (FTIR)	40
2.2.6.5: Powder X-ray diffraction spectroscopy (PXRD)	40
2.2.6.6: Differential scanning calorimetry (DSC)	41
2.2.7: In vitro release study of curcumin from PMsCur	41
2.2.8: Stability studies of PMsCur	41
2.3: Results and discussion	42

2.3.1: <i>cmc of Pluronic F127</i>	42
2.3.2: <i>Phase solubility of curcumin in Pluronic F127 solutions</i>	43
2.3.3: <i>Curcumin-incorporated Pluronic F127 micelles (PMsCur)</i>	44
2.3.4: <i>Characterization of PMsCur</i>	45
2.3.5: <i>In-vitro release and stability of PMsCur</i>	50
2.4: References	52
Chapter 3 : Self-assembly of single PEO-PPO-PEO triblock copolymeric system for Lamotrigine drug : Effect of hydrophiles	57-83
3.1: Introduction	59
3.2: Experimental Section	62
3.2.1: <i>Materials</i>	62
3.2.2: <i>Solubilization experiments</i>	63
3.2.2.1: <i>Calibration of lamotrigine (LTG) drug</i>	63
3.2.2.2: <i>Phase solubility study of LTG in Pluronic F127 solutions with and without hydrophiles</i>	64
3.2.3: <i>Dynamic light scattering (DLS) measurements</i>	64
3.2.4: <i>Small-angle neutron scattering (SANS) analysis</i>	64
3.3.5: <i>Preparation of LTG-incorporated Pluronic F127 micelles (LPMs)</i>	65
3.3.6: <i>Incorporation efficiency and drug loading of LTG in LPMs</i>	66
3.3.7: <i>Characterizations of Solid LPMs</i>	66
3.3.7.1: <i>UV-Visible spectroscopy (UV-VIS)</i>	66
3.3.7.2: <i>Fourier transform infrared spectroscopy (FTIR)</i>	66
3.3.7.3: <i>X-ray diffraction spectroscopy (XRD)</i>	66
3.3.7.4: <i>Thermogravimetric analysis (TGA)</i>	67
3.3.8: <i>In vitro release study of LTG from LPMs</i>	67
3.3.9: <i>Stability studies of LPMs</i>	67
3.4: Results and discussion	68
3.4.1. <i>Solubilization of LTG drug in Pluronic F127 solutions</i>	68
3.4.2. <i>Solubilization of LTG drug in Pluronic F127 i.p.of hydrophilic polymers</i>	70
3.4.3. <i>Characterization of LPMs</i>	73
3.4.4. <i>In-vitro release study of LPMs</i>	78

3.4.5. Stability of LPMs	79
3.5: References	80
Chapter 4 : Self-assembly of PEO-PPO-PEO triblock copolymeric systems for hydrophobic drugs of different polarity	84-115
4.1: Introduction	86
4.2: Experimental Section	89
4.2.1: Materials	89
4.2.2: Methods	90
4.2.2.1: Drug solubilization experiments for the ratiocination of Pluronics	90
4.2.2.2: Preparation of drug-loaded Pluronic P123 micelles	90
4.2.3: Characterization of drug-loaded Pluronic P123 micelles	91
4.2.3.1: UV–VIS Spectroscopy (UV-VIS)	91
4.2.3.2: Dynamic light scattering (DLS)	91
4.2.3.3: Small-angle neutron scattering (SANS)	92
4.2.3.4: Cloud point temperature (CPT)	92
4.2.3.5: Transmission electron microscopy (TEM)	92
4.2.4: In-vitro release study of drug-loaded Pluronic P123 micelles	93
4.2.5: Stability study of drug-loaded Pluronic P123 micelles	94
4.2.6: Antioxidant activity of drug-loaded Pluronic P123 micelles	95
4.3: Results and discussion	96
4.3.1: Evaluation of solubility of CUR, QCN, and LTG drug	96
4.3.2: Thermodynamics of solubility of CUR, QCN, and LTG in Pluronics P123 micelles	99
4.3.3: Characterization of drug-loaded Pluronics P123 micelles	100
4.3.4: In-vitro release study of drug-loaded Pluronics P123 micelles	104
4.3.5: Stability study of PLC, PLQ, and PLL	106
4.3.6: Anti-oxidant study of drug-loaded Pluronics P123 micelles	106
4.4: References	108
Chapter 5 : Self-assemblies of mixed PEO-PPO-PEO triblock copolymeric systems for Lamotrigine drug	116-143
5.1: Introduction	118
5.2: Experimental Section	121

5.2.1: Materials	121
5.2.2: Preparation of binary Pluronic mixtures	121
5.2.3: Determination of critical micelle concentrations	122
5.2.4: Solubilization experiments	122
5.2.5: Micelle characterization	123
5.2.5.1: Dynamic light scattering (DLS) analysis	123
5.2.5.2: Small angle neutron scattering (SANS) measurements	123
5.3: Results and Discussion	124
5.3.1. cmc_s of binary Pluronic mixtures	124
5.3.2. Micellar characterization	126
5.3.3: Solubilization of LTG in binary Pluronic mixtures	133
5.4: References	137
Chapter 6 : Self-assemblies of mixed PEO-PPO-PEO triblock copolymeric systems for Lamotrigine drug at body temperature	144-173
6.1: Introduction	146
6.2: Experimental Section	149
6.2.1: Materials	149
6.2.2: Preparation of single and mixed Pluronic micellar solutions	149
6.2.3: Solubilization experiments	150
6.2.3.1: Solubility for a screening of Pluronic systems for LTG	150
6.2.3.2: Solubility of LTG in mixed Pluronic micelle at body temperature	150
6.2.4: Characterization of Pluronic micellar systems	151
6.2.4.1: Dynamic light scattering (DLS)	151
6.2.4.2: Small-angle neutron scattering (SANS)	151
6.2.4.3: Transmission electron microscopy(TEM)	151
6.2.5: In vitro release study of LTG drug	152
6.2.6: Stability study of mixed Pluronic micelle for LTG	152
6.3: Results and Discussion	153
6.3.1: Solubilization	154
6.3.1.1: Pluronic polymers for LTG solubilization for screening	154

6.3.1.2: Solubilization of LTG in mixed Pluronic micelles	155
6.3.1.3: Thermodynamic parameters of LTG solubilization in mixed Pluronic micellar systems	156
6.3.2: Micelle characterization	158
6.3.2.1: Dynamic light scattering (DLS)	158
6.3.2.2: Small-angle neutron scattering (SANS)	160
6.3.2.3: Transmission electron microscopy (TEM)	163
6.3.3: In-vitro release study	164
6.3.4: Stability study of mixed Pluronic micelles	165
6.4: References	167
Chapter 7 : Self-assemblies of mixed PEO-PPO-PEO triblock copolymers-Phosphatidylcholine(PC) systems for Curcumin drug	174-196
7.1: Introduction	175
7.2: Experimental Section	178
7.2.1: Materials	178
7.2.2: Preparation of mixed PC-Pluronic solutions	178
7.2.3: Preparation of curcumin-loaded mixed PC-Pluronic solutions	178
7.2.4: Characterizations of mixed PC-Pluronic solutions	179
7.2.4.1: Dynamic light scattering (DLS))	179
7.2.4.2: Small-angle neutron scattering (SANS)	179
7.2.4.3: Transmission electron microscopy (TEM)	180
7.2.5: Phase-solubility of curcumin in mixed PC-Pluronic solutions	180
7.2.6: In- vitro release study	180
7.2.7: Stability study	181
7.2.8: Antioxidant activity	181
7.3: Results and discussion	182
7.3.1: Aggregation behavior of mixed PC-Pluronic solutions	182
7.3.2: Solubilization of curcumin in mixed PC-Pluronic solutions	187
7.3.3: In vitro release study of curcumin from mixed PC- Pluronic solutions	189
7.3.4: Stability study	190

7.3.5: Antioxidant activity analysis	190
7.4: References	192
Chapter 8: Summary and Conclusions	197-208
<i>List of Publications</i>	209-210
<i>List of Presentations</i>	211-213
<i>Awards/Achievements</i>	214-215