

Table of Contents

List of Abbreviations and Symbols	I–II
Chapter 1. General Introduction	1-27
Chapter 2. Materials and Methods	28-49
2.1. Materials	29
2.2. Synthesis of Gemini Surfactants	32
2.2.1. Cationic Gemini Surfactants	32
2.2.2. Anionic Gemini Surfactant	32
2.3 Synthesis and Modification of Adsorbents	33
2.3.1 Synthesis of GO and Gr@ZrO ₂ -NC	33
2.3.1.1. Preparation of GO	
2.3.1.2. Synthesis of Gr@ZrO ₂ -NC	
2.3.1.3. Surface Modification of Synthesized Gr@ZrO ₂ -NC	
2.3.2. Preparation and Surface Modification of Eggshell Powder	35
2.4. Structural Characterization of Bio/Nano-Adsorbents with and without Surfactants	35
2.4.1. Characterization of Gr@ZrO ₂ -NC based Adsorbents	35
2.4.2. Characterization of pure and Surfactant Modified Bio- adsorbent.	39
2.5 Methodology	41
2.5.1. Adsorption Study	41
2.5.2. UV-visible Spectroscopy	41
2.5.3. Electrical Conductivity Measurements	41
2.5.4. Surface Tension Measurements	42
2.5.5. NMR Measurements	42
2.5.6. Cloud Point (CP) Measurements	42
2.5.7. Polarising Optical Microscopy	43
2.5.8. Transmission Electron Microscopy	43
2.5.9. SANS Measurements	43
2.5.10. DLS/ Zeta ()-potential Measurements	46
2.5.11. Solubilization Experiment	46
Chapter 3. Adsorption of anionic azo-dyes using Surfactant Modified synthetic and natural adsorbents	50-73
3.1. Introduction	51
3.2. Results and Discussion	53
3.2.1. Adsorption of dyes on Surfactant Modified adsorbents	53
3.2.2. Effect of Adsorbent Doses/ [Dye] on Adsorption	55
3.2.3. Effect of Contact Time and Initial MO/CR Concentration	56

3.2.4. Effect Of pH	59
3.2.5. Adsorption Isotherms	60
3.2.6. Adsorption Kinetics	63
3.2.7. Desorption Studies	68
3.3. Conclusions	69
Chapter 4. Solution behavior of anionic Gemini modified Surface active ionic liquid: interaction; Clouding and solubilization	74-99
4.1. Introduction	75
4.2. Results and Discussion	77
4.2.1. Micellization of Single TPeAB and 12-4-12A	77
4.2.2. Mixed Micellization of TPeAB with 12-4-12A	78
4.3. Clouding Behaviour	82
4.3.1. Clouding Phenomenon in Aqueous TPeAB with 12-4-12A	82
4.3.2. Effect of Biocompatible additives on Clouding Behaviour	87
4.4. PAH Solubilization Studies in TPeAB + 12-4-12A with and without β -CD	88
4.4.1. Interplay of [12-4-12], [TPeAB] and CP on Single PAH Solubilization	88
4.4.2. Solubilization of PAHs in 12-4-12+ TPeAB+ β -cyclodextrin System	89
4.5. Co-solubilization of PAHs	92
4.6. Extraction/Adsorption of PAH	93
4.7. Conclusion	96
Chapter 5. Mixed Micellization and Interaction of Oppositely charged Gemini surfactants	100-112
5.1. Introduction	101
5.2. Results and Discussion	102
5.2.1. Micellization of Single Gemini Surfactant	102
5.2.2. Mixed Micellization of Gemini Surfactant Systems	104
5.2.3. Interaction of Oppositely Charged Gemini Surfactants	106
5.3. Conclusion	111
Chapter 6. Structural modification in Self-assembly of Aqueous oppositely charged Mixed Gemini Surfactants	113-142
6.1. Introduction	114
6.2. Results and Discussion	116
6.2.1. Structural Evaluation for Individual Aqueous Gemini Surfactants	116

6.2.2. Structural Evaluation for Mixed Oppositely Charged Gemini Surfactants	118
6.2.3. Temperature Influence on Aggregate Morphology	135
6.3. Conclusion	138
Chapter 7. Solubilization of Polyaromatic Hydrocarbons In Various Morphologies based on Mixed Gemini Surfactants	143-162
7.1. Introduction	144
7.2. Results and Discussion	146
7.2.1. Solubilization in Single Aqueous Gemini Surfactant	146
7.2.2. Solubilization in Oppositely Charged Mixed Aqueous Geminis	149
7.3. Co-solubilization of PAHs in the Mixed Gemini Surfactant System	157
7.4. Vesicle Size Variation after PAH Solubilization	158
7.5. Conclusion	161
Chapter 8. Overall Conclusion	163-166
List of Publications	167