Contents

Chapter one  
1.1 Introduction to Surfactants 1
  1.1.1 Surfactants Categories 2
    (i) Cationic surfactants 2
    (ii) Anionic surfactants 2
    (iii) Zwitterionic surfactants 2
    (iv) Nonionic surfactants 3
  1.1.2 Critical micelle Concentration 3
    (i) Structure of the Surfactant 4
    (ii) Electrolyte 4
    (iii) Organic additive 4
    (iv) Temperature 6
  1.1.3 Micellar structure and Shape 6
  1.2 Polymers 9
  1.2.1 Polymer Formation 10
  1.3 Proteins 11
  1.4 Gelatin 14
  1.5 Binding of Surfactants to Proteins and gel 19
  1.6 References 21
## Chapter two

Theoretical Background of Light Scattering and Rheology

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>2.1 Introduction</td>
<td>24</td>
</tr>
<tr>
<td>2.2 Theoretical Background</td>
<td>24</td>
</tr>
<tr>
<td>2.3 Static Light Scattering (SLS)</td>
<td>25</td>
</tr>
<tr>
<td>2.4 Fluctuation Theory.</td>
<td>27</td>
</tr>
<tr>
<td>2.5 Size and Shape-effects</td>
<td>32</td>
</tr>
<tr>
<td>2.6 Zimm-Plot</td>
<td>35</td>
</tr>
<tr>
<td>2.7 Dynamic Light Scattering (DLS)</td>
<td>37</td>
</tr>
<tr>
<td>2.8 Fluctuations and Time-Correlation Functions</td>
<td>38</td>
</tr>
<tr>
<td>2.9 Theoretical Background of DLS</td>
<td>38</td>
</tr>
<tr>
<td>2.10 Rheology</td>
<td>40</td>
</tr>
<tr>
<td>2.10.1 Basic rheological ideas Viscosity</td>
<td>43</td>
</tr>
<tr>
<td>2.10.2 Basic rheological concept of Elasticity</td>
<td>44</td>
</tr>
<tr>
<td>2.10.3 Dynamic Mechanical Testing</td>
<td>45</td>
</tr>
<tr>
<td>2.10.4 Dynamic Mechanical Testing Response for Classical Extremes</td>
<td>46</td>
</tr>
<tr>
<td>2.10.5 Dynamic Mechanical Testing Viscoelastic Material Response</td>
<td>47</td>
</tr>
<tr>
<td>2.10.6 The complex stress</td>
<td>47</td>
</tr>
<tr>
<td>2.10.7 Creep measurement</td>
<td>48</td>
</tr>
<tr>
<td>2.10.8 Creep Recovery Experiment</td>
<td>48</td>
</tr>
<tr>
<td>2.10.9 The complex shear modulus G*</td>
<td>49</td>
</tr>
<tr>
<td>2.10.10 Complex viscosity</td>
<td>50</td>
</tr>
</tbody>
</table>
2.11 References

Chapter Three

Experimental Details

3.1 preparation of samples

(i) Surfactant preparation

(ii) Gelatin-surfactant preparation

(iii) Gel-surfactant preparation

3.2 DLS Setup

3.3 DLS data analysis

3.4 Rheology Measurements

(i) The single element Maxwell model

(ii) The Cross model

(iii) The Bingham model

(iv) The power-law liquid

(v) The Sisko model

3.5 References

Chapter Four

Micellization of Alpha-olefin Sulfonate in aqueous solutions

4.1 Abstract
4.2 Introduction 69
4.3 Tubidimetric Titration 72
4.4 Turbidity data analysis 73
4.5 Results and Discussions 77
4.6 Thermodynamics of micellization 77
4.7 Density of micellar solution 78
4.8 Intrinsic Viscosity and hydration 79
4.9 Aggregation Number, hydration and shape 81
4.10 Inter-micellar interactions 82
4.11 Effect of counter ion binding 83
4.12 Conclusion 85
4.13 References 86

Chapter Five 88
Gelatin-alpha olefin sulfonate interactions 88
5.1 Abstract 88
5.2 Introduction 89
5.3 Results and Discussions 92
5.4 Conclusion 99
5.5 References 100
Chapter Six 102

Surfactant induced softening in gelatin hydrogels 102

6.1 Abstract 102

6.2 Introduction 103

6.3 Results and Discussions 109

(i) Fast mode relaxation 110

(ii) Slow mode relaxations 114

(iii) Rheological studies 116

(iv) Structure of the micelle-bound gel phase 121

6.4 Conclusion 124

6.5 References 125

Chapter Seven 129

Effect of temperature on Surfactant induced softening in gelatin hydrogels 129

7.1 Abstract 129

7.2 Introduction 130

7.3 Results and Discussions 132

(i) DLS studies 132
(ii) Rheological studies

(iii) Free energy of gel surfactant interactions

7.4 Conclusion

7.5 References

Chapter Eight

8.1 Conclusion

8.2 References