

## Contents

### Preface *xi*

- 1      Metallosurfactants, a “Novel Portmanteau”: A Holistic Insight into the Structural–Physiognomies Relationships, Synthesis Stratagems, and Characterization    1**  
*Ankush Parmar, Shilpee Sachar, and Shweta Sharma*
  - 1.1      Introduction    1
  - 1.2      Intrinsic Physiognomies of Metallosurfactants    3
  - 1.3      Classification of Metallosurfactants    6
  - 1.4      Syntheses Stratagems and Characterization of Metallosurfactants    8
    - 1.4.1      Metathesis Reaction    8
    - 1.4.2      Ligand Substitution Reaction    9
    - 1.4.3      Ligand Insertion Reaction    10
  - 1.5      Conclusion    10
  - References    14
  
- 2      Metallosurfactants: A Surface and Interface Perspective    21**  
*Ravneet Kaur, Neena Mehta, and Surinder K. Mehta*
  - 2.1      Introduction    21
  - 2.2      Micellization and Surface Parameters    22
    - 2.2.1      Thermodynamics of Micellization    23
    - 2.2.2      Adsorption Parameters    24
  - 2.3      Adsorption of Surfactant Monolayers    34
  - 2.4      Conclusions    36
  - References    36
  
- 3      Metallosurfactant Self-Assembly: Structures and Chemistry of Interfacial, Biphasic, and Phase Transfer Catalysis    39**  
*Ravneet Kaur and Aashima Sharma*
  - 3.1      Introduction    39
  - 3.2      Self-Aggregation Behavior    40
    - 3.2.1      Micelles    40
    - 3.2.2      Inverted Micelles    44

3.2.3	Vesicles	46
3.2.4	Lamellar Phases	49
3.3	Chemistry of Catalysis	50
3.3.1	Micellar Catalysis	51
3.3.2	Vesicular Structures in Catalysis	53
3.3.3	Interfacial Catalysis	56
3.4	Conclusions	58
	Acknowledgment	58
	References	58
<b>4</b>	<b>Hydrolytic Metallosurfactants: Nanocatalysts for Esterolytic Reactions</b>	<b>63</b>
	<i>Bhanushree Gupta, Rahul Sharma, and Kallol K. Ghosh</i>	
4.1	Introduction	63
4.2	Metallosurfactants as Nanocatalyst for Esterolytic Reactions	64
4.3	Catalytic Hydrolysis of Carboxylate Esters	65
4.4	Catalytic Hydrolysis of Phosphate Esters	70
4.5	Quantitative Treatment of Observed Rates: Application of Kinetic Models	77
4.6	Conclusion	78
	References	79
<b>5</b>	<b>Metallosurfactants as Catalysts in Organic Reactions and Energy-Based Applications</b>	<b>83</b>
	<i>Sakshi Goel and Supriya Rana</i>	
5.1	Introduction	83
5.2	Metallosurfactants as Catalysts in Organic Reactions	85
5.2.1	Types of Reactions	85
5.2.2	NHC Metallosurfactant-Catalyzed Reactions	88
5.2.3	Stimuli-Responsive Metallosurfactant-Catalyzed Reactions	89
5.2.4	Miscellaneous Reactions	90
5.3	Metallosurfactants as Catalyst in Water Oxidation	91
5.4	Light-Driven Hydrogen Generation	95
5.5	Conclusions	97
	References	98
<b>6</b>	<b>Metallosurfactants as Drug-Delivery Vehicles</b>	<b>103</b>
	<i>Rohini Kanwar, Amit Kumar, Jyoti Rathee, and Surinder K. Mehta</i>	
6.1	Introduction	103
6.2	Distinct Assemblies of Metallosurfactants in Drug Delivery	105
6.2.1	Metallosomes as Drug-Delivery Agents	105
6.2.2	Metallosurfactants and Its Self-Assembled Structures as Nanovectors	107
6.2.3	Metallosurfactant Co-polymer-Based Micellar Systems for Drug Delivery	108

6.3	Metallosurfactants as MRI Contrast Agents	109
6.4	Conclusion	112
	Acknowledgments	112
	References	112
<b>7</b>	<b>Metallosurfactants as Molecular Machines for the Preparation of Hybrid Silica-Based Porous Material</b>	<b>117</b>
	<i>Rekha Bhar and Surinder K. Mehta</i>	
7.1	Introduction	117
7.2	Porous Silica-Based Materials	118
7.2.1	Molecular Machine	119
7.2.2	General Synthesis Procedure of Porous Silica Material	120
7.3	Different Types of Porous Silica-Based Material	121
7.3.1	Copper@Surfactants-Based Porous Material	121
7.3.2	Ruthenium@Surfactants-Based Porous Material	124
7.3.3	Cobalt@Surfactants-Based Porous Material	125
7.3.4	Iron@Surfactants-Based Porous Material	126
7.3.5	Other Metallosurfactant-Based Porous Material	128
7.4	Future Perspectives	129
7.5	Conclusion	130
	References	130
<b>8</b>	<b>Metallosurfactants as Non-viral Vectors in Transfection</b>	<b>135</b>
	<i>Pilar López-Cornejo, José A. Lebrón, Francisco J. Ostos, Manuel López-López, María L. Moyá, Eva Bernal, and Carmen Martín</i>	
8.1	Introduction	135
8.2	Metallosurfactant Monomers	137
8.3	Metallomicelles	145
8.4	Metalloliposomes (Metallosomes)	147
8.5	Future Perspectives	151
	Acknowledgments	151
	References	151
<b>9</b>	<b>Metallosurfactants as Nanoreactors for Nanoparticle Synthesis</b>	<b>159</b>
	<i>Jaspreet Kaur, Rekha Bhar, Khushwinder Kaur, and Surinder K. Mehta</i>	
9.1	Introduction	159
9.2	Metallosurfactants as Reactors for Nanoparticle Synthesis	161
9.2.1	Colloidal Synthesis	161
9.2.2	Thermal Decomposition	168
9.2.3	Biphasic Redox Reaction	169
9.3	Future Perspective	173
9.4	Conclusion	174
	Acknowledgments	174
	References	174

<b>10</b>	<b>Metallosurfactants and Their Biological Attributes: Anticancer and Antimicrobial Properties</b>	<b>179</b>
	<i>Neha Jindal and Shivani Uppal</i>	
10.1	Introduction	179
10.2	Antimicrobial Activity	180
10.2.1	Metallosurfactants Effective against Bacteria	181
10.2.2	Metallosurfactants Effective Against Fungus	182
10.3	Anticancer Activity	185
10.3.1	Metallosurfactants Effective Against Breast Cancer	186
10.3.2	Metallosurfactants Effective Against Lung Cancer	189
10.4	Conclusion and Future Challenges	189
	References	190
<b>11</b>	<b>Metallosurfactants as Carbon Monoxide-Releasing Molecules</b>	<b>195</b>
	<i>Maribel Marín-García, Núria Benseny-Cases, Mercedes Camacho, and Ramon Barnadas-Rodríguez</i>	
11.1	Why CO?	195
11.2	How to Deliver CO?	198
11.3	CO-releasing Metallosurfactants	202
11.3.1	Synthesis of Molybdenum-Based CORMs	204
11.3.2	Properties of Mixed CORAs Constituted by Molybdenum-Based Metallosurfactants and Phospholipids	205
11.4	Conclusions	208
	Acknowledgments	208
	References	208
<b>12</b>	<b>Supramolecular Metal-Modified Nanocontainers Based on Amphiphilic and Hybrid Matrix: Self-Assembling Behavior and Practical Applications</b>	<b>223</b>
	<i>Elena P. Zhiltsova, Marina R. Ibatullina, Ruslan R. Kashapov, Nadezda E. Kashapova, Albina Y. Ziganshina, Lucia Y. Zakharova, and Oleg G. Sinyashin</i>	
12.1	Introduction	223
12.2	Structure, Properties, and Biomedical Application of Metallosurfactants	224
12.3	Amphiphilic System Based on Metallosurfactants and Macrocycles	227
12.4	Nanocomposites Based on Amphiphilic Resorcinarenes and Metal Nanoparticles	235
12.5	Conclusions	239
	Acknowledgments	240
	References	241

<b>13</b>	<b>Metallosurfactants in Nanoscale Molecular Containers as Sensors</b>	<b>249</b>
	<i>Devika Vashisht and Nicole Pamme</i>	
13.1	Introduction	249
13.1.1	Metallosurfactants	249
13.2	Metallosurfactants as Nanosized Containers for Self-assembled Molecular Devices	251
13.3	Surfactant Aggregates in Chemical Detection	252
13.4	Self-Assembled Moieties as Fluorescent Sensors	253
13.5	Metallosurfactants and Detection Protocol	255
13.6	Conclusions	262
	Acknowledgments	262
	References	262
	<b>Index</b>	<b>265</b>