

How and Why Soap Works

Thirty Home Experiments Exploring the Science of Surfactants

By

Julian R. Silverman

Fashion Institute of Technology, USA

Email: Julian_Silverman@fitnyc.edu



ROYAL SOCIETY
OF **CHEMISTRY**

Contents

Chapter 1	Background Knowledge, Skills, and Abilities	1
1.1	Background Knowledge, Skills, and Abilities	1
1.2	Basic Science Knowledge	2
1.3	Basic Laboratory Skills	14
1.4	Abilities Beyond Science	24
	Abbreviation	29
	References	30
Chapter 2	The Story of Soap	31
2.1	The Story of Soap	31
2.2	Primordial Soap	33
2.3	Myth and Mystery	38
2.4	History	41
2.5	Industry	49
2.6	Globalization	53
2.7	Making Soap	62
	References	67
Chapter 3	The Chemical Ingredients of Soaps, Surfaces, and Soils	73
3.1	The Chemical Ingredients of Soap, Surfaces, and Soils	73

How and Why Soap Works: Thirty Home Experiments Exploring the Science of Surfactants

By Julian R. Silverman

© Julian R. Silverman 2026

Published by the Royal Society of Chemistry, www.rsc.org

3.2	Cohesion	74
3.3	Adhesion	78
3.4	Surface Tension	82
3.5	Capillary Action	87
3.6	Density	91
3.7	Viscosity	94
3.8	Solubility	98
3.9	Hydrophobicity	102
3.10	Amphiphilicity	107
3.11	Polarity	111
3.12	Like Dissolves Like	114
3.13	Conclusion	117
	References	118
Chapter 4	The Structures of Suds	119
4.1	The Structures of Suds	119
4.2	Foams	120
4.3	Films	125
4.4	Bubbles	131
4.5	Lubrication	134
4.6	Color and Light	137
4.7	Like Assembles Like	142
4.8	Micelles	146
4.9	Suspensions	149
4.10	Conclusion	153
	Abbreviation	154
	References	154
Chapter 5	The Material Properties of Soap	156
5.1	The Material Properties of Soap	156
5.2	Solubility and Phase	157
5.3	Lathering and Suds	162
5.4	Conditioning and Irritation	168
5.5	Fragrance and Function	172
5.6	Detergency	181
5.7	Conclusion	188
	Abbreviations	189
	References	189

Chapter 6	The Three Uses of Soap	191
6.1	The Three Uses of Soap	191
6.2	Beauty	193
6.3	Versatility	201
6.4	Utility	207
6.5	Conclusion	215
	References	217
Chapter 7	Washing Our Hands of Soap	219
7.1	Washing Our Hands of Soap	219
7.2	Wetting the Skin	223
7.3	Adding Soap	224
7.4	Scrubbing and Lathering	225
7.5	Washing Away Germs	228
7.6	Drying Our Hands	230
7.7	Conditioning Our Skin	231
7.8	Conclusion	232
	References	237
Chapter 8	At Last, Sustainability	240
8.1	At Last, Sustainability	240
8.2	Collecting Atoms	245
8.3	Connecting Compounds	250
8.4	Cycling Cells	256
8.5	Contextualizing Skin	261
8.6	Changing Populations	264
8.7	Emerging Planetary Goals	269
8.8	Next Steps	273
	References	276
Chapter 9	Appendix	280
A.1	Appendix 1: Glossary	280
A.2	Appendix 2: Recipes	284
A.3	Appendix 3: List of Experimental Materials	289
	Subject Index	294