

Preface	vii
About the Editors	xxi
Contributors	xxiii
1. Air Pollution and Its Control	1
<i>B. C. Meikap, Akhila Kumar Swar, Chittaranjan Mohanty, J. N. Sahu, and Yung-Tse Hung</i>	
1. Introduction	2
2. Air Pollution Control	8
3. Universal Air Pollution Control Measures for Industries	36
2. Air Quality Modeling and Prediction	41
<i>Taisa S. Lira, Marcos A. S. Barrozo, Adilson J. Assis, José R. Coury, and Yung-Tse Hung</i>	
1. Introduction to Air Quality Modeling and Prediction	42
2. Air Quality Monitoring	44
3. Meteorological Factors that Affects Air Quality	45
4. Statistical Analysis of Data	50
5. Modeling and Prediction	51
6. Study of Time Trend	58
7. Software Assessment	59
8. Air Pollution and Public Health	60
9. Application	61

3.	Air Pollution Problems and Control Measures in Steel Making through DRI Route	93
	<i>B. C. Meikap, Akhila Kumar Swar, Chittaranjan Mohanty, J. N. Sahu, and Yung-Tse Hung</i>	
1.	Introduction	94
2.	Rotary Kiln DRI Process	102
3.	Trend of Growth of Sponge Iron Plants	110
4.	Air Pollution Potential and its Control in Sponge Iron Plants	112
5.	Best Environmental Management Practice Recommended for Controlling Air Pollution in the Integrated DRI Steel Plant	123
6.	Operational Bottlenecks Causing Air Pollution	129
7.	Pollution Control in Sponge Iron Plants of Orissa — A Case Study	131
8.	Clean Technology Options for Integrated DRI Steel Plants	138
4.	Air Biofiltration Applied to Odor Treatment	149
	<i>Raquel Lebrero, Raúl Muñoz, Santiago Villaverde, and Yung-Tse Hung</i>	
1.	Introduction	150
2.	Physicochemical Techniques	152
3.	Biological Treatment	154
4.	Comparative Analysis of Treatment Technologies	166
5.	Legislation	168
5.	Drinking Water Associated Pathology	175
	<i>Sabu Thomas, Sankar Jagadeeshan, Praveen Kumar, Sathish Mundayoor, and Yung-Tse Hung</i>	
1.	Introduction	176
2.	Bacterial Pathogens	182
3.	Viral Pathogens	195
4.	Protozoan Pathogen	199
5.	Fungal Pathogens	204
6.	Helminth Parasites	207
7.	Other Pathogens	209
8.	Water Quality Assessment	210

9. Treatment	211
10. Conclusion	217
 6. Disinfection in Wastewater Treatment	 237
<i>Yung-Tse Hung, O. Sarafadeen Amuda, A. Olanrewaju Alade, and Abass A. Olajire</i>	
1. Introduction	238
2. Disinfection Segment in Wastewater Treatment Plant	240
3. Disinfection Treatment Processes	250
4. Summary	267
 7. Treatment of Commercial Surfactants with Chemical and Photochemical Advanced Oxidation Processes	 271
<i>Idil Arslan-Alaton, Tugba Olmez-Hanci, and Yung-Tse Hung</i>	
1. Introduction	272
2. Types and Uses of Surface Active Agents	273
3. Fate and Biodegradability of Surfactants in the Environment	276
4. Types of Chemical and Photochemical Advanced Oxidation Processes	283
5. Advanced Oxidation of Surfactants with Chemical and Photochemical Advanced Oxidation Processes	291
6. Concluding Remarks	303
 8. Membrane Separation for Water and Wastewater Treatment	 315
<i>Sirshendu De, Chandan Das, and Yung-Tse Hung</i>	
1. Introduction	316
2. Drinking Water Treatment	321
3. Industrial Wastewater	321
 9. Municipal Wastewater Treatment for Reuse in Agricultural Irrigation	 347
<i>Eliet Veliz Lorenzo, Mayra Bataller Venta, Lidia Asela Fernández García, Irán Fernández Tórrrez, and Yung-Tse Hung</i>	
1. Introduction	348
2. Wastewater Reuse — State of the Art	350

3.	Wastewater Treatment Technology Recommended for Reuse in Agricultural Irrigation	359
4.	Conclusions	375
5.	Technical Terminologies	376
10.	Combined Sewer Overflow Treatment	383
	<i>Yung-Tse Hung, Hamidi Abdul Aziz, and Muhd Harris Ramli</i>	
1.	Combined Sewer Overflow	384
2.	Conventional Disinfection Method	386
3.	Alternation Disinfection Methods	393
4.	Operation and Maintenance	399
11.	Stormwater Management Planning and Design	405
	<i>Yung-Tse Hung, Hamidi Abdul Aziz, and Mohamad Fared Murshed</i>	
1.	Introduction to Stormwater	406
2.	Importance of Stormwater Management	408
3.	Stormwater Management	409
12.	Biological Wastewater Treatment	431
	<i>Manoj N. Hedao, Anand G. Bhole, Nitin W. Ingole, and Yung-Tse Hung</i>	
1.	Introduction	432
2.	Biological Treatment Process	434
3.	Treatment Kinetics	465
13.	Aerobic Granulation Process for Waste Treatment	475
	<i>Mónica Figueroa, José Luis Campos, Anuska Mosquera-Corral, Ramón Méndez, and Yung-Tse Hung</i>	
1.	Introduction	476
2.	Characteristics of the Granular Biomass	477
3.	Factors Affecting the Formation of Aerobic Granules	480
4.	Biological Processes in Aerobic Granules	484
5.	Microbial Populations Inside the Granules	493
6.	Applications of Aerobic Granular Biomass	497

14. Sequencing Batch Reactors	511
<i>Sudhir Kumar Gupta, Anushuya Ramakrishnan, and Yung-Tse Hung</i>	
1. Background	512
2. SBR Process Configuration	516
3. Advantages of SBR Technology	524
4. Disadvantages of SBR Technology	524
5. SBR Design Criteria	524
6. Budget Estimate for SBR Operation	527
7. Biological Nitrogen Removal	528
8. SBR Nitrogen Removal	530
9. Biological Phosphorus Removal	533
10. Effect of Operational Parameters on the Performance of SBR	537
11. SBR Pilot-Scale Studies	543
12. Challenges of SBR Operation	548
13. Granulation in SBR	548
14. Recommendations	553
15. Summary and Conclusions	555
15. Impact Assessment on Aquatic Pollution	563
<i>C. H. Sujatha, V. B. Pratheesh, P. R. Anupama Nair, and Yung-Tse Hung</i>	
1. Introduction	564
2. Aquatic Pollution and Its Impacts	566
3. Environmental Impact Assessment	578
4. Scope of EIA	580
5. EIA Methodologies	587
6. Legislatures for EIA	594
7. Conclusion	597
16. Decentralized Sewage Treatment Technologies	603
<i>Jerry R. Taricska, Yung-Tse Hung, and Kathleen Hung Li</i>	
1. Introduction	603
2. Septic Tank	607
3. New Technology	615
4. Process Design Requirements for Aerobic Process	622

5.	Intermittent Sand Filters	630
6.	Alternative Types of Media for ISF	641
7.	Drain Field	643
17.	Wetland for Waste Treatment	647
	<i>Neelam Verma, and Yung-Tse Hung</i>	
1.	Wetland: An Overview	647
2.	Wetland Process	652
3.	Threats to Wetland	658
4.	Waste: A Major Problem of the Present Scenario	662
5.	Constructed Wetland: A System for Wastewater Treatment	669
6.	A Case Study of Bhoj Wetland, Bhopal, India	674
7.	Benefits of Wetland	679
18.	Land Treatment of Wastewater	687
	<i>Hamidi Abdul Aziz, Abu Ahmed Mokammel Haque, Molla Mohammad Ali, and Yung-Tse Hung</i>	
1.	Introduction	688
2.	Wastewater Constitutes and Removal Mechanisms	697
3.	Preapplication and Storage	731
4.	Process Design for Slow Rate Systems	752
5.	Process Design for Overland Flow Systems	778
6.	Process Design — Soil Aquifer Treatment Systems	795
19.	Physicochemical Treatment Processes of Landfill Leachate	819
	<i>Hamidi A. Aziz, Mohd. Shahrir Mohd. Zahari, Mohd. N. Adlan, and Yung-Tse Hung</i>	
1.	Introduction	820
2.	Coagulation and Flocculation	827
3.	Chemical Precipitation	835
4.	Chemical Oxidation	838
5.	Air Stripping	853
6.	Adsorption	854
7.	Membrane Processes	865
8.	Evaporation and Vaporation	872
9.	Combined Physicochemical Treatment	873
10.	Conclusion	878

20.	River and Lake Pollution	889
	<i>C. H. Sujatha, V. B. Pratheesh, and Yung-Tse Hung</i>	
1.	Water	890
2.	Sources of Fresh Water	893
3.	Rivers and Lakes	895
4.	Pollution	901
5.	Water Quality Assessment	914
6.	Summary	921
21.	Removal of Dyes from Wastewaters by Low-Cost Adsorbents	929
	<i>Siew-Teng Ong, Sie-Tiong Ha, Pei-Sin Keng, Chnoong-Kheng Lee, and Yung-Tse Hung</i>	
1.	Dyes: General Survey	930
2.	Dye Removal: Conventional and Emerging Methods	933
3.	Application of Low-Cost Adsorbents for Dye Removal	940
4.	Experimental Methods and Modeling of Adsorption Studies	954
5.	Conclusions	970
22.	Treatment of Olive Oil Production Wastewaters	979
	<i>Taner Yonar, Berna Kiril Mert, Kadir Kestioglu, and Yung-Tse Hung</i>	
1.	Industry Description	980
2.	Production of Olive Oil	980
3.	Production Processes of Olive Oil	981
4.	Wastewater Characterization of Olive Oil Wastewater	984
5.	Olive Oil Mill Wastewaters Treatment Methods	985
6.	Pilot-Scale Treatability Studies on OOMW	1002
7.	Costs for Treatment of OOMW	1004
8.	OOMW Point Source Discharge Effluent Limitations, Performance Standards, and Pretreatment Standards	1007
23.	Medical Waste Management	1015
	<i>Luay A. Fraiwan, Khaldon Y. Lweesy, Rami J. Oweis, Osama Al-Bataineh, and Yung-Tse Hung</i>	
1.	Introduction	1016
2.	Medical Waste Characteristics and Production	1018
3.	Handling of Medical Waste	1035

4.	Treatment, Destruction, and Disposal of Medical Waste	1048
5.	Health and Environmental Hazards	1068
6.	Training	1080
24.	Enzyme Technology for Environmental Engineering	1089
	<i>Iran Alemzadeh, and Yung-Tse Hung</i>	
1.	Introduction	1090
2.	Enzyme in Food Industries	1097
3.	Textile Industries	1105
4.	Municipal Wastewater	1122
5.	Petrochemical Industrial Wastewater	1125
6.	Conclusion	1127
25.	Screening and Selection of Microorganisms for the Environmental Biotechnology Process	1137
	<i>Volodymyr Ivanov, Viktor Stabnikov, and Yung-Tse Hung</i>	
1.	Major Physiological Groups of Microorganisms	1137
2.	Periodic Table of Prokaryotes	1138
3.	Use of Periodic Table for Theoretical Selection of Prokaryotes in Environmental Engineering	1140
4.	Connection between Cell Shape and Physical Properties of Medium	1141
5.	rRNA-Based Phylogenetic Classification Cannot Be Used for Theoretical Selection in Environmental Engineering	1142
6.	Methods of Selection and Isolation of Microorganisms	1143
7.	Selection of Microbial Aggregates	1146
8.	Growth-Related and Survival-Related Selection of Microorganisms	1147
26.	Innovative and Cost-Effective Flotation Technologies for Municipal and Industrial Wastes Treatment	1151
	<i>Lawrence K. Wang, Mu-Hao S. Wang, Nazih K. Shammam, and Milos Krofta</i>	
1.	Introduction	1151
2.	Conventional Physicochemical Wastewater Treatment Systems	1153
3.	Innovative Physicochemical Wastewater Treatment Systems	1155

4.	Innovative Physicochemical Sludge Treatment System	1165
5.	Case History of Hoboken Project	1169
27.	Municipal Wastewater Treatment	1177
	<i>Kamel Al-Zboon, Jamal Radaideh, and Yung-Tse Hung</i>	
1.	Introduction	1178
2.	Municipal Wastewater Flow Rate	1178
3.	Characteristics of Wastewater	1183
4.	Municipal Sewage Treatment	1189
	Index	1223