

Subject Index

a

AAO process 253
 absorption 90
 – equilibrium 297
 acenaphthene 209
 acetate 171ff.
 acetogenics, *see* bacteria
 acidogenic bacteria, *see* bacteria
Acinetobacter sp. 244
 activated sludge model (ASM) 275ff.
 activated sludge process 16, 119ff., 215,
 267ff.
 – model for optimizing 271
 – modelling 267ff.
 – reactor 138
 activated sludge reactor 138
 ADP 59
 aeration 90ff.
 – forced 153
 – natural 153
 – rate 158f.
 aerator 97, 108
 – aeration time 108
 – efficiency 97
 aerobic degradation 70
 – direct 215
 – metabolite 216
 – organic substance 70
 aerobic wastewater treatment 119ff.,
 151ff., 223ff., 367ff.
 air flow rate 101
 Akrofil PGM 217
 algae 224
 alkalinity 282
n-alkane 207ff.
 – chlorinated 196
 amino acids 45
 6-amino naphthalene 2-sulfonic acid
 (6-A 2-NSA) 213

amino-nitrotoluene 206
 ammonia 223ff., 242
 ammonium 229, 243f.
 – formation by anoxic hydrolysis of
 heterotrophs 281
 – nitrogen 281
 anabolismus 59ff., 69ff., 182, 279
 – nitrification 229
 anaerobic degradation 169ff.
 ANAMMOX process (anaerobic
 ammonium oxidation) 243
 anthracene 209
 anticodon 52
 AO Phoredox process 253
 AO process 253
 aromatic amine degradation 216
 Arrhenius equation 47, 236
 ASM, *see* activated sludge model
 asphalt 207
 ATP 59, 173
 – production 177, 237
 autotrophic bacteria, *see* bacteria
 azo dye 211ff.
 – anaerobic reduction 215
 – biodegradation 215

b

bacteria 43, 169
 – acetogenic 169ff.
 – acidogenic 169ff.
 – aerobic 281
 – anaerobic 169
 – anoxic 281
 – autotrophic 228, 280f.
 – chemolitho-autotrophic 175, 237ff.
 – denitrifying 237
 – dimensionless concentration 273
 – facultative aerobic 249
 – heterotrophic 281

- methanogenic 169ff., 249
- molecule 182
- morphology 43
- nitrifying 228ff., 280
- polyphosphate-accumulating 248
- sulfate-reducing 211
- sulfur-reducing 216
- bacterial balance 186
- bacterial decay 74, 269
- bacterial growth, oxygen consumption 267
- balance 272
 - real balance yield 336
- p-base 216
- batch reactor 119ff.
 - high initial concentration of bacteria 119
 - low initial concentration of bacteria 122
- bed reactor
 - anaerobic expanded and fluidized 191
 - fixed bed reactor 154ff.
- bicarbonate, sodium (NaHCO_3) 238
- 'Bio-Hochreaktor' 145
- biochemical oxygen demand (BOD_n) 34f.
 - BOD_5 (biochemical oxygen demand over 5 days without nitrification) 29, 157
- biocorrosion 151
- biodegradability 195, 203
- biofilm 151ff., 163, 189ff., 200, 237ff.
 - heterogeneous 151
 - reactor 152
 - resistance 164
 - surface 164
 - system 151ff.
- biological nutrient removal 223
- biological reaction 160
- biomass
 - autotrophic 279
 - decay 279
 - heterotrophic 279
- Biot number 163
- Bodenstein number 136
- brewing industry 29
- Brocadia* 243
- bubble 100, 154
 - column 98f.
 - butyrate 171ff.
- c**
- carbon
 - inorganic 37
 - organic 37
 - total (TC) 37
- carbon consumption for bacterial growth 267
- carbon dioxide production rate 76
- carbon removal 144, 267ff.
 - model 267ff.
 - modelling the influence of aeration 272
 - without bacterial decay 270
- carbonate
 - calcium (CaCO_3) 238
 - sodium (Na_2CO_3) 238
- carbohydrate 169ff.
- catabolismus 59f., 69ff., 169ff., 182, 279
 - aerobic 238
 - nitrification 229
- cellulose production 30
- chemical industry 30, 333ff.
- chemical oxygen demand (COD) 28ff., 157, 195, 278
- chemolitho-autotrophic bacteria 175, 237ff.
- chemoorgano-heterotrophic sulfate reducer 175
- chemostat 122, 187
- chlorine 196
- chlorobenzene 200
 - toxicity 200
 - wastewater 202
- chlorophenol 203
- cholera 11
 - epidemic 16
- citric acid cycle 62
- COD, *see* chemical oxygen demand
- codon 51
- coefficient 176
- coenzyme acetyl CoA 62
- colloid 32
 - oil-in-water emulsion 32
 - solid-in-water 33
- completely mixed activated sludge reactor 125
- completely mixed tank cascade 132, 140
- completely stirred tank reactor (CSTR) 90, 122, 230, 245ff.
 - aerobic 247
 - anaerobic 246
- concentration polarization model 303ff.
- concentration/mass flow rate diagram 340ff.
- consumption rate 159
- contact process 184
- convection 85ff.
- cross-flow configuration 314
- cross-flow mode 320

d

- Damköhler-II number 161
 Darcy's law 302
 dead-end configuration 313
 dechlorination 200ff.
 deep tank aeration 98
 degradation 70, 169ff.
 – aerobic 70, 216
 – anaerobic 169ff.
 – aromatic amine 216
 – metabolite 216
 denitrification 224ff., 237, 280
 – catabolism 238
 – endogenous 241
 – kinetics 239ff.
 – Monod kinetics 240
 – oxygen 241
 – parameter 240
 – post-denitrification 323
 – rate 240
 – stoichiometry 239
 – yield coefficient 240
 density distribution 138
 – retention time 139
 desorption 93, 200
 – capacity 94
 desoxyribonucleic acid (DNA) 50f.
 – replication 57
Desulfovobacter postgateii 175
Desulfotomaculum 175
Desulfovibrio 175
Desulfovibrio desulfuricans 175
 2,4-diaminotoluene 206
 dichlorobenzene (DCB) 200f.
 – 1,2-DCB 200ff.
 – 1,4-DCB 200
 1,2-dichloroethane (DCA) 196
 dichloromethane (DCM) 196
 diffusion 83ff., 159ff., 293
 – coefficient 83f.
 dimensional analysis 108
 dimethylsulfonoxide (DMSO) 209
 2,4-dinitrophenol (2,4-DNP) 71
 2,4-dinitrotoluene (2,4-DNT) 204ff.
 dissolved organic carbon (DOC) 28, 267
n-dodecane 208
 – standard emulsion 211
 dispersion, axial 134ff.
 dye liquor 215
 dynamic method 92

e

- Eadie-Hofstee plot 49
 efficiency 95ff., 112
 – coefficient 161
 effluent 195, 215
 – decentralized effluent treatment 331ff., 346ff.
 Einstein equation 83
 electron acceptor 237
 electron donor 243
 emulsifier 32, 207
 emulsion, oil-in-water 32
 endocrine-disrupting substance (EDS)
 195, 319
 energy 63
 – activation 47
 – consumption 95
 enzyme 47
 ethanol 65f., 175
 EU guideline 41
 eubacteria 43f.
Eumulgin (ET5) 208
 eutrophication 223f.
 exoenzyme 169f.
 extracellular polymeric substance (EPS)
 151, 316

f

- fatty acid 169ff.
 fermentation 65, 177, 249
 – carbonaceous 17
 fermenter 65
 Fick's law 83, 296
 filter 152
 – trickling 152ff.
 filtration 293ff.
 – microfiltration 296
 – nanofiltration 296
 – ultrafiltration 296
 fixed bed reactor 154ff.
 – aerated 154
 – anaerobic 188
 – submerged 154
 flavine adenine dinucleotide (FAD) 59
 flow rate 349
 – air flow rate 101
 – gas flow rate 100, 124
 – wastewater flow rate 349
 food industry 320
 formazine turbidity unit (FTU) 33
 fouling process 315
 Froude number 112

g

- gas/liquid mass transfer 87
- gas/liquid oxygen transfer 83ff.
- gas bubble, *see* bubble
- gas film, resistance 164
- glucose 170
 - catabolismus 60
 - concentration 177
- glycogen 245
- glycolysis 61
- groundwater 15, 228

h

- Haber–Bosch synthesis 227
- Haldane kinetics 179, 197
- heavy metal 31
- Henry's law 76, 160
- Henry coefficient 76ff.
- heptamethylnonane 211
- hexachlorobenzene (HCB) 200ff.
- hexadecane 211
- high-rate process 184
- HNO_2 242
- hollow fine fiber 311
- hydrocarbon 70ff., 170, 207
 - degradation 70ff.
 - saturated 207
 - unsaturated 207
 - *see also* polycyclic aromatic hydrocarbon (PAH)
- hydrogen 171ff.
- hydrolysis 176
- hydroxide
 - calcium 238
 - sodium 238

i

- inhibition 180
 - non-competitive 180
- irrigation field 14

k

- kinetic coefficient 136, 176

l

- lactic acid 65
- Lactobacillus bulgaricus* 65
- large-scale plant 95
- Langmuir plot 49
- legislation 39ff.
 - EU Guidelines 41
 - German 38
- limiting composite curve 342

Lineweaver-Burk plot 49

liquid mass transfer 93

load equivalent (Schadeinheit) 20

m

- magnesium ammonium phosphate (MAP) 258
- mass balance 303
 - bacteria 169
 - oxygen 159
- mass flow rate
 - air 106
 - concentration/mass flow rate diagram 340ff.
 - overflow 186
 - recycled sludge 186
- mass transfer coefficient 86, 305
 - overall 103
 - specific 86
 - specific overall 90
- mass transfer gas/liquid 158f.
- mass transfer liquid/solid 158ff.
- mass transfer rate 164
- mass transfer resistance 163f., 302
 - mechanism 301
 - mass transport 293ff.
 - mechanism 293
 - model 296
 - transport 293ff.
 - material flow management 334
 - membrane 293ff., 311ff.
 - characteristics 293
 - cleaning management 315f.
 - constant 301
 - cushion 311
 - fouling 315
 - gradient of trans-membrane pressure 295
 - mass transport 293ff.
 - non-porous 296
 - porous 300
 - resistance 302
 - selectivity 294
 - technology in biological wastewater treatment 291ff.
 - tubular 312
 - membrane bioreactor (MBR) 200, 230, 257, 318
 - aerobic wastewater treatment 319
 - material 308
 - module 309
 - nutrient removal 323
 - process 257, 317
 - technology 296

- metabolism 43ff.
 - anaerobic 65
 - bacteria 39
 - microbial 43ff.
- metabolite degradation 216
- methane 175ff.
- methanization 187
- Methanobacterium* 179
- methanogens, *see* bacteria
- methanol 238
- Methanosarcina barkeri* 172ff.
- Methanothrix* 172ff., 182
- methemoglobinemia 224
- Michaelis-Menten equation 49
- mineral oil 206f.
 - biodegradability 207
- mineralization 12, 71
- modified Ludzak-Ettinger (MLE) process 250f.
- module
 - design 308
 - plate-and-frame 311
 - spiral-wound 311
- monochlorobenzene (MCB) 200f.
- Monod kinetics 132, 177, 197, 213
- Monod number 161
- mutation 58

- n**
- naphthalene 209ff., 337
- naphthalene disulfonic acid (NDSA) 337
 - 1,5-NDSA 214, 336
 - 4,8-NDSA 338
- naphthalene-2-sulfonic acid (2 NSA) 213
- naphthalene sulfonic acid (NSA) 212, 337
 - biodegradability 213
 - biodegradation 212
- Nernst-Einstein equation 83
- network design method 344
- Newton number 111
- nicotine amide adenine dinucleotide (NAD) 59
- nitrate 223f.
 - pathway 242
 - reductase 241
 - reduction 175
- nitratification 228f.
- nitric acid 232
- nitritification 14ff., 224ff., 242, 280
 - biofilm reactor 230
 - Haldane kinetics 234
 - kinetics 231
 - metabolism 229
 - soft water 238
 - without bacterial decay 270
- nitrifying bacteria, *see* bacteria
- nitrite 224, 243
 - accumulation 242
 - pathway 242
- nitroaromatics 204
- Nitrobacter* 228ff., 242
- nitrogen 243
 - cycle 227f.
 - degradable organic 282
 - dioxide (NO_2) accumulation 240
 - nitrogen-fixing organisms 227
- nitrogen removal 243, 253
 - model 267
 - process 250
 - recycling 257f.
- 4-nitrophenol (4-NP) 204ff.
- nitrosamine 224
- Nitrosomonas* 228ff., 242
- nutrient 30
 - biological removal 223, 250
- nucleic acid 45

- o**
- off-gas apparatus 107
- oil
 - biodegradation 208
 - oxygen transfer efficiency 102f.
 - oxygen transfer rate (OTR) 103
 - refinery 30
 - standardized oxygen transfer rate (SOTR) 108
- organic carbon 37
 - dissolved (DOC) 37
 - total (TOC) 37
- organic substance 195
 - particulate inert 278
 - soluble inert 278
- organics, anaerobic degradation 169ff.
- orthophosphate 224
- osmotic coefficient 298
- osmotic pressure 298
- β -oxidation 174
- oxygen 83ff., 237
 - absorption 90
 - concentration 100
 - concentration profile 162
 - consumption 160, 267
 - consumption rate 76, 159
 - dimensionless concentration 273
 - limitation 119, 130
 - mass transfer 85ff., 112, 158

- mass transfer rate 159
- transfer efficiency (OTE) 101
- transfer number 112
- transfer rate (OTR) 95ff.
- ozonation 214

- p**
- paper industry 30
- Peclet number 135ff.
- pentachlorophenol (PCB) 201ff.
- permeate 291ff.
 - flow rate 299ff.
 - flux 300
 - velocity 303
- pesticide 224
- pharmaceutical industry 30
- phenanthrene 209ff.
- Phoredox 253
- phosphate-accumulating organism (PAO) 244ff.
- phosphorus removal 253f., 323
 - biological 244ff.
 - chemical 252
 - enhanced biological 244
 - kinetic model 245
 - parameter 249
 - process 253
 - recycling 257
- pinch 343
- Pirellula* 243
- Planctomyces* 243
- plug flow reactor (PFR) 130
- Podura 153
- pollutant 27
 - colloid 27
 - dissolved substance 27
 - inorganic material 27f.
 - organic material 27f.
 - suspended solid 28
- polycyclic aromatic hydrocarbon (PAH) 206
 - biodegradation 209
 - dissolved in *n*-dodecane standard emulsion 211
 - dissolved in water 211
 - toxicity 206
- polyglucose (glycogen) 245
- poly- β -hydroxybutyrate (PHB) 244f.
- polyphosphate 224
- polyphosphate-accumulating bacteria, *see*
 - bacteria
- polyurethane 205
- pore model 296ff.
- potassium ammonium phosphate 258

- power consumption 96, 106ff.
- process improvement methodology 338
- process optimization 333
- production integrated water management 333
- prokaryotic cell
 - aerobic conversion 60
 - anaerobic conversion 64
 - propionate 171ff.
 - protein 45, 170_ structure 46
 - synthesis 46
 - proton transport 59
- Pseudomonas stutzeri* 211
- Psychoda 153
- 'Putox-Belebungsanlage' 145
- pyrene 211

- r**
- reaction enthalpy 174
- Reactive Black 5 (RB 5) 216f.
- reactive dye 211
- real balance yield 336
- recycle ratio 126
- recycling
 - nitrogen 257f.
 - phosphorus 257
 - water 331
- regeneration of water 331
- resistance 90, 164
- number 300
- overall mass transfer 94
- total resistance to mass transfer 164
- respiratory chain 64
- retention coefficient 295, 307
- retention time 126
 - critical mean 132
 - distribution 138
 - mean 126
- reverse osmosis 296
- Reynold's number 111, 300ff.
- Rhodococcus* sp. 211
- ribonucleic acid (RNA) 54
 - mRNA 55
 - rRNA 57
 - tRNA 55
- rotating disc reactor 156ff.
 - anaerobic 190

- s**
- Saccharomyces cerevisiae* 65
- saturation coefficient 179
- Scalindua* 243
- Schmidt number 112, 305

sedimentation tank 184
 self-purification 12ff.
 Semenow number 273
 separation coefficient 186
 sequencing batch reactor (SBR) 137
 SHARON process (single reactor system for high activity ammonia removal over nitrite) 244
 SHARON-ANAMMOX system 244
 Sherwood number 305
 simple matrix 272
 simple plug flow model 99
 simplex aerator 96
 single-cell protein (SCP) 207
 sludge
 – activated sludge model (ASM) 275ff.
 – age 128, 285
 – critical sludge age 132f., 316
 – process, *see* activated sludge process
 – production rate 129
 – recycle 132
 – suspended 237
 small filter flies 153
 solution-diffusion model 296ff.
 sorption 293
 standard reaction enthalpy 174
 standardized oxygen transfer rate (SOTR) 95ff.
 stoichiometric yield coefficient 69ff., 136, 205, 231
 stoichiometric equation 69ff.
 stop-codon 52
 stripping 83
 struvite 257
 submerged configuration 314
 substrate
 – biodegradable 278
 – dimensionless concentration 273
 – limitation 121
 sulfate reduction 175
 sulfur-reducing bacteria (SRB) 216
 surface aeration 95, 113
 surface aerator 112
 surface renewal model 87
 surface tension 112
 – dimensionless 112
 surfactant 208, 217
 sustainable development 331
 synthrophic reaction 171
Synthrophobacter wolinii 171
Synthrophomonas wolfeii 171

t
 tank
 – cascade 140ff.
 – deep 105
 – monitoring 106
 – sedimentation 184
 – stirred, non-aerated 109
 tetrachlorobenzene (TeCB) 200
 – 1,2,3,4-TeCB 202
 – 1,2,4,5-TeCB 200
 Thiele modulus 161
 tortuosity 300
 total carbon TC 37
 total oxygen demand (TOD) 33
 tracer balance 142
 trichlorobenzene (TCB) 200ff.
 – 1,2,3-TCB 200ff.
 – 1,2,4-TCB 202
 – 1,3,4-TCB 200
 – 1,3,5-TCB 200
 2,4,6-trinitrotoluene (TNT) 204
 tube flow reactor 143
 – axial dispersion 141
 two film theory 87f.
 Tyndall effect 33

u
 upflow anaerobic sludge blanket (UASB) 187ff.
 urea 223

v
Vibrio fischeri 216
 volatile fatty acid (VFA) 244ff.
 volatile organic component (VOC) 93

w
 wastewater 1ff., 92ff.
 – ammonium 234
 – characterization 25ff.
 – history 1ff.
 – industrial 25, 86, 244
 – lowest wastewater flow rate 349
 – minimization of treated wastewater 346
 – nitrite-rich 234
 – regulation 25ff.
 wastewater management 331ff.
 – antiquity 1
 – medieval age 4
 – production integrated water management 331ff.

wastewater treatment 1ff., 119ff., 152,
196ff.
– aerobic 119ff., 319
– azo dye 216
– biological 14, 223ff.
– chlorobenzene 202
– chlorophenol 203
– dichloromethane (DCM) 198
– dichloroethene (DCA) 198
– final treatment 318
– membrane bioreactor in aerobic
wastewater treatment 319
– membrane technology in biological
wastewater treatment 291
– Waßmannsdorf wastewater treatment
plant (WWTP) 255

water
– minimization of fresh water use 339
– recycling 331
– regeneration 331
– surface 228
water springtails 153
water supply 1
– line 341
– limiting water supply line 341

y

yield
– real balance 336
– stoichiometric 335
– real 136

z

Zymomonas mobilis 65