

Index

A

ABE fermentation, 48, 49, 53
Acetate kinase (AK), 28, 29, 40, 258
Acetic acid, 12, 49, 85, 88, 90, 91, 98, 121, 151, 235, 253, 262
Acetoacetyl-CoA reductase, 213
Acetogenesis, 98, 119, 121, 241, 255, 263
Acetyl CoA, 28, 52, 56, 87, 90, 213, 282, 283
Acid hydrolysate, 85, 87
Acidogenesis, 98, 119, 121, 123, 128, 147
Acidophiles, 3, 9, 12, 16, 68, 69
Acid treatment, 83, 118
Activation energy, 2, 13
Adaptation strategies, 190
Agriculture, 2, 11, 25, 49, 115, 138, 146, 147, 163, 168, 215
Alcohol dehydrogenase, 28, 29, 53
Algae, 4, 8, 9, 12, 64–66, 68–76, 83, 98, 99, 169–171, 183, 184, 194, 240
Alkaliphile, 3, 12, 16, 68, 69
Alkalithermophiles, 3
Alkali treatment, 83
Alpecin, 218
Amino acids, 14, 98, 121, 149–150, 170, 176, 177, 232, 240
Ammonia, 11, 82, 100, 101, 105–107, 123, 125–127, 139, 147, 284
Ammonia fiber explosion, 82
Anabaena, 178–180
Anaerobes, 26, 28, 31, 38, 41, 42, 48, 88, 90, 120, 121
Anaerobic bacteria, 28–31, 87, 253, 255, 257

Anaerobic digestion (AD), 97, 98, 100–102, 104–106, 108, 109, 118–120, 122, 123, 125, 126, 129, 130, 136, 138, 139, 147, 236, 248, 263
Anode, 14, 233–235, 237–240, 259
Anti-inflammatory, ix, 196–197
Antioxidant, 11, 196
Antiviral, 12, 191, 196, 197, 203
Aquatic environments, 189, 191, 203
Application of bioproducts, 265
Archaea, 4, 5, 10, 164, 169, 171, 174, 191–195, 203, 207–213, 222
Aromatics, 87, 147, 232
Astaxanthin, 75, 151
Artemisinin, 182

B

Bacteria, 4, 27, 55, 81, 100, 147, 164, 190, 208, 231, 248, 277
Bagasses, 9, 49, 84, 87, 216, 219, 220, 277, 279, 291–294
Barophiles, 3, 5, 6
Bioactivity, 190, 208
Bio-based chemicals (Bio-GTC), 2, 150–151
BioBricks, 179
Biobutanol, 12, 47–57, 248, 250–252, 255, 256
Biocatalysis, 2
Biochemical processes, 2, 280–286
Biocompatibility, 196, 197, 208, 210, 214, 215, 221, 222, 261

- Bioelectrocatalysis, 230, 231, 235, 237, 240, 259
 Biodegradability, 82, 115, 118, 125, 126, 136, 147, 150, 196, 207, 208, 210, 214–216, 221, 222, 248, 261, 265
 Biodiesel, 12, 13, 63–76, 122, 164, 216–218, 230, 248, 250, 251, 260, 262, 264–266, 268, 276
 Bioelectrochemical Systems (BES), 14, 230–235, 240–242, 250
 Bioemulsifier, 15, 191, 203
 Bioenergy, 11–14, 16, 114
 Bioethanol, 248, 250–253, 256, 266
 Biofilm promoting proteins, 231
 Bioflocculating agents, 191, 194
 Biofuel, 2, 48, 64, 80, 115, 151, 168, 208, 230, 248, 276
 Biofuel potential (BP), 65
 Biofuel waste, 49, 92, 250, 268
 Biogas, 97, 102, 113, 147, 248
 Biogas production, 98–100, 102, 103, 113–115, 117, 119–127, 139
 Biohydrogen (BioH₂), 13, 14, 80–92, 122, 217, 230, 237, 248, 250, 252, 253, 255, 266, 267
 BioH₂ yield, 81, 90, 91
 Biomass, 13, 26, 47, 63, 80, 98, 114–115, 149, 163, 217, 230, 248, 276
 Biophotolysis, 80, 83
 Bioplastics, 75, 150, 215
 Biopolymer, 2, 15, 28, 150, 191, 194, 198, 202, 208, 212, 217, 219–221, 248, 250, 251, 260–262, 294, 298
 Bioprocessing, 2, 35, 37, 38, 42, 43, 81, 90, 92, 146, 153, 156, 159, 230, 240, 248–267, 279
 Bioprospecting, 1, 16, 69–71
 Bioreactor, 16, 51, 153, 155–159, 180, 183, 217, 218, 235, 252, 277, 279–281, 286–291, 293
 design, 156–158
 modelling, 277, 280, 286–291, 293
 Biorefineries, 71, 91, 151, 249, 276, 297
 Bioremediation, 2, 11, 12, 14, 15, 191, 203
 Biosensors, 230
 Bioseparations, 183, 293
 Biosurfactant, 191, 203
 Biosynthetic pathways, 168, 170, 177, 182, 191–195, 209
 Bleed, 51
 Blend, 48, 151, 214
 Blue-green algae, 83
 Bodipy, 70
 Bubble column bioreactors, 157, 158
 Building blocks, 208, 278, 282
 Butanol (C₄H₁₀), 48–57, 151, 170, 252, 253, 255, 265
 Butyric acid, 52, 55, 85, 88, 89, 91, 98, 121, 147
- C**
Caldanaerobacter, 13, 28, 85
 C3 and C4 pathways, 65, 66
 Capital costs, 105, 106, 293, 294
 Capital expenditures (CAPEX), 108
 Carbohydrate-active enzymes, 195
 Carbohydrates, 9, 13, 15, 26, 27, 33, 42, 48, 50, 53, 74, 81, 83, 98, 121, 125, 147, 195, 199, 202, 213, 232, 255, 260, 282
 Carbon, 5, 27, 63, 92, 98, 123, 146, 164, 209, 232, 249, 296
 Carbon concentrating mechanisms (CCM), 66
 Carbon dioxide (CO₂), 5, 9, 14, 15, 25, 52, 53, 64, 66, 67, 71, 72, 80, 82, 88, 97, 98, 100, 102, 104, 106, 107, 121–123, 126, 131–135, 137, 138, 146–148, 152, 154, 156, 164, 172, 183, 184, 208, 221, 222, 249, 259, 264, 265, 284, 292, 296, 297
 Carbon fixation, 10, 65, 164, 180
 Carboxylic acids, 9, 150
 β-Carotene, 75
 Carotenoids, 75, 169, 181, 279
 Catalysis, 1, 2, 10, 11, 13, 15, 16, 174, 175, 230, 249, 283
 Cathode, 14, 233, 235–237, 239–241, 259
 Cellulolytic enzymes, 90, 255
 Cellulose, 6, 13, 14, 26, 32–34, 36, 49, 50, 81–84, 86–88, 98, 115, 116, 118, 119, 125, 147, 219, 220, 232–236, 248, 249, 252–257
 Chemical treatment, 82–84
 Chipping, 82, 116
 Chlorophytes, 65
 Citramalate pathway, 57
 Clostridium, 53, 54
Clostridium, 13, 28, 31, 32, 38, 41, 48, 49, 53, 56, 57, 85, 88, 121, 170, 234, 236, 252–258
Clostridium thermocellum, 31, 32, 38, 41, 88, 252–256, 258
 Co-digestion, 98, 112, 126
 CO₂ explosion, 82, 152
 Co-fermentation, 27, 36, 262, 266
 Combined heat and power (CHP), 107, 293, 294, 296, 298
 Complexity, 230

- Consolidated bioprocessing (CBP), 35–38, 42, 90, 92, 248–267, 279
- Consortium, 14, 15, 119, 197, 235
- Continuous stirred tank bioreactors (CSTRs), 84–86, 102, 130, 156, 157, 159, 289–291
- Controlled drug release, 215
- Cooking, 97, 103, 107, 134, 138, 146, 217
- Corrosive, 48, 118, 137
- Cosmetics, 75, 167, 168, 216, 265
- Cost-effective, 57, 87, 90, 92, 112, 118, 127, 183, 208, 222
- Crude glycerol, 216, 217, 262
- Crystallinity, 50, 82, 116, 118, 214
- CSTR bioreactor, 290
- C-type cytochromes, 231
- Cupriavidus necator*, 210, 217–221
- Cyanobacteria, 5–8, 10, 69, 70, 80, 164, 165, 168, 170, 171, 173, 174, 177–184, 240
- D**
- Dark fermentation, 13, 81, 83, 87, 91
- Decarboxylation, 87, 172
- Degree of polymerization, 82, 195
- Determination of linkage positions, 199–200
- Detoxification, 87
- Diatoms, 65, 66, 68–71
- Digestate, 98, 103, 104, 106, 108, 109, 130–131, 136, 263
- Digester, 98–109, 114, 116, 121, 123–128, 130, 133, 136, 137, 139
- Digestion, 97, 98, 100–102, 104–106, 108, 109, 112, 118–120, 122–124, 126, 147, 236, 248, 250, 263
- Dilution rate, 51, 290, 291, 293
- Dimethylallyl pyrophosphate (DMAPP), 169, 172–174, 181
- Direct electron transfer, 231, 233, 234
- Distillation, 35, 51, 167
- Downtime, 50, 155
- Drawbacks, 34, 37, 38, 48, 55, 56, 117, 201, 255, 279
- Drug delivery, 189, 196–198, 208, 265
- Dry digestion, 105–106, 109
- Dunaliella salina*, 68, 69, 75
- E**
- East African soda lakes, 67
- Economics, 2, 30, 33, 48, 57, 72, 75, 87, 91–93, 98, 99, 105, 108–109, 112, 119, 127, 134, 146, 149–151, 157–159, 164, 183, 215, 219, 235, 249, 250, 259, 262, 263, 266, 267, 276, 277, 289, 292–294, 297
- Ectoine, 150, 151, 278
- Efflux pump, 55, 182
- Eicosapentaenoic acid, 76
- Electricity production, 97, 107, 109, 259
- Electrodes, 231–235, 237, 238, 240, 241, 259
- Electrogenic activity, 238
- Electron acceptor, 7, 11, 14, 122, 153, 231, 233, 235, 237, 240, 257, 259
- Electron donor, 7, 14, 83, 156, 231–233, 236, 237, 239, 240, 257, 259
- Electron shuttling compounds, 231, 232, 237
- Electron transfer characteristics, 14, 230
- Electron tunneling, 231
- Elongation at break, 214
- Embden-Meyerhof pathway (EMP), 28, 87, 89, 90
- Endo-xylanase, 257
- Energy, 1, 25, 47, 63, 80, 97, 113, 145, 163, 194, 209, 230, 248, 276
- Energy crops, 49, 84, 114, 250
- Environment, 2, 25, 48, 64, 80, 104, 112, 147, 164, 190, 208, 230, 248, 276
- Enzymatic hydrolysis, 33, 34, 36, 83, 87, 90, 252
- EPS biosynthesis, 190, 194, 195, 203, 261
- EPS chemical composition, 194, 198, 199, 203
- EPS structure, 201, 203
- Equipment's, 48, 108, 124, 134, 137, 155, 277, 278, 293
- Escherichia coli*, 5, 11, 56, 173, 209, 216
- Ethanol, 12, 25, 48, 74, 82, 148, 170, 219, 234, 252, 277
- Ethanol tolerance, 27, 28, 30, 38, 42
- Eukarya, 4, 8–10, 209
- Evolutionary adaptation, 37, 38, 41, 42
- Exopolysaccharide (EPS), 8, 15, 190–203, 250, 260, 261
- Explosive limits, 152–153
- Exponential phase, 194, 286, 287
- Extracellular minerals, 231
- Extreme environments, 4, 5, 10, 11, 16, 66–68, 122, 190, 202, 232, 236, 264
- Extremophile, 25, 29, 32, 35, 39, 42, 43, 48, 57, 68, 69, 89, 97–109, 112, 122, 134, 190, 208, 231–233, 236, 242, 249, 251, 252, 254, 259, 261, 267, 268, 276, 278, 279, 297
- Extremophile processing, 278–297
- Extremophiles, 1–16, 84
- Extremophiles genome, 4, 6, 15, 38, 41, 174, 177–179, 181, 195, 213, 232, 237, 255

Extremophilic bioprocesses, 1, 250, 253
 Extremozymes, 2, 11, 15, 16, 236, 242

F

Fatty acid methyl ester (FAME), 74
 Fed-batch, 50, 54, 155, 159, 182, 289
 Fed-batch technique, 50
 Feedstock, 2, 13, 15, 25–43, 48, 49, 82, 88, 105, 106, 109, 115, 147, 151, 164, 167, 209, 216–218, 232, 248–267, 276, 277, 279
 Fe hydrogenase, 89
 Fermentation, 12, 26, 48, 74, 80, 97, 120, 164, 216, 235, 250, 278
 Ferredoxin, 28–30, 87, 88, 90, 173, 252
 Fertilizer, 75, 98, 104, 109, 134, 136, 138
 Filtration, 72, 74, 198, 240
 Fixed dome digester, 100, 102
 Flavin, 232
 Floating drum digester, 100, 103
 Flocculation, 72, 73
 Fluctuating, 121, 122, 208
 Food supplements, 75
 Fossil fuels, 57, 64, 80, 139, 145, 146, 248, 267
 Fouling, 51, 74, 102, 240, 259
 Fuel cell, 14, 112, 135, 230, 233, 236, 237, 250, 257–260
 Furfuraldehyde, 31, 34, 38

G

Gas grid, 107, 131, 134
 Gas stripping, 51, 180
 Gasoline, 47, 48, 135, 151
 G + C content, 4, 5, 234
 Genetic engineering, 15, 37, 38, 41–43, 164, 177, 179, 262, 267, 280
 Genetic manipulation, 27, 42, 57, 155, 164, 177, 189, 194, 203
Geobacillus thermoglucosidasius, 41, 253
 Geranylpyrophosphate (GPP), 169, 172–175, 179–181
 Glass-transition temperature (T_g), 214, 222
 Global Warming Potential (GWP), 135, 146, 296–298
 Glucose dehydrogenase, 91
 Glucuronic acid, 26, 91, 199
 Glyceraldehyde-3-P dehydrogenase (GAPDH), 88
 Glyceraldehyde-3-phosphate (GAP), 90, 172
 Glycogen, 164, 181
 Glycolysis, 29, 87, 282

Great Salt Lake, Utah, 67
 Green algae, 9, 65, 66, 68, 70, 83, 169–171
 Greenhouse gas emissions, 137, 221, 248
 Grinding, 82, 116

H

Haematococcus pluvialis, 75
Halomonas sp (Halomonas species), 193, 194, 277–279, 282, 287, 288, 291, 292
 Halophiles, 3, 10, 12, 15, 68, 69, 75, 193, 194, 217, 294
 Halophilic archaea, 4, 210–212, 222
 Halophilic bacteria, 13, 277, 279, 281, 282, 288, 292, 293
 Harvesting, 9, 50, 71–74, 163, 164, 167, 169, 183
 H₂-consuming bacteria, 84
 Hemicellulose, 26, 31, 34, 49, 50, 81–84, 87, 98, 115–119, 125, 147, 219, 220, 248, 249, 253, 256, 257
 Herbert-Pirt equation, 285
 Heterologous protein, 182, 257
 Heterotrophic conditions, 4, 83
 Hot springs, 4, 5, 7, 33, 64, 67, 68, 191, 197
 Hot water treatment, 82
 Household waste, 213
 Hydraulic retention time (HRT), 99, 100, 105, 124, 128, 130, 263
 Hydrogen (H₂), 5, 30, 80, 98, 147, 221, 236, 252, 278
 Hydrogenase, 84, 89, 90, 92, 236
 Hydrogen sulfide, 106, 107, 147
 Hydrolysis, 12, 13, 33–36, 50, 81, 83, 87, 90, 92, 98, 100, 104, 117–121, 123, 199, 200, 218, 234, 235, 249, 252, 253, 256, 257, 263, 266, 279
 Hydrothermal liquefaction, 74
 Hydroxyl methyl furfural (HMF), 31, 34, 38, 87
 5-Hydroxymethyl-furfuraldehyde (5-HMF), 31, 34, 38
 Hygroscopic, 48
 Hyperthermophiles, 3, 84

I

Immunostimulating, 196
 Industrial waste, 194, 208, 213
 Inexpensive, 2, 27, 49, 81, 210, 217, 232, 260, 262, 279
 Inhibitory compounds, 27, 31, 34, 42, 87
 Integrated CBP, 248, 250, 251, 260–267

- Intrinsic viscosity η , 199–201
Ionic liquids (IL), 83, 118–119
Isopentenyl pyrophosphate (IPP), 169, 172–174, 181
Isoprene, 182, 183
Isoprenoids, 4, 164, 169–175, 180–183, 194
- K**
Keto acids, 150
 β -Ketothiolase, 213
- L**
Lacquer, 48
Lactate, 15, 28–30, 38, 41, 86, 87, 90, 121, 234, 252, 256, 258, 260, 278
Lactate dehydrogenase (LDH), 28, 29, 38, 41, 87, 90
Lactic acid, 12, 85, 90, 151, 208, 278, 279
Lag phase, 50, 155, 286
Life cycle assessment (LCA), 295–297
Lignin, 13, 26, 27, 31, 34, 49, 50, 81–83, 115, 117, 118, 219, 233, 248, 249, 256, 292, 296
Lignocellulolytic enzyme production, 87, 90
Lignocellulose, 26, 31–37, 47, 49, 50, 82, 87, 90–93, 115–117, 219, 232–234, 236, 238, 249, 252, 253, 255, 257, 261, 276, 279
Lignocellulosic, 9, 13, 14, 25, 29, 32, 35, 39, 42, 43, 47, 49, 50, 74, 81, 113–139, 216, 230–242, 248–267, 276
Lignocellulosic biomass (LCB), 13, 26, 27, 31–34, 36, 37, 42, 47, 74, 81–87, 90–93, 115, 116, 118, 119, 139, 230–242, 248–251, 253, 256, 257, 259, 276
Lignocellulosic wastes, 219–220, 250
Limonene, 165
Limonene synthase (LS), 172, 174–175, 179–182
Lineweaver-Burk equation, 288
 α -Linolenic acid, 13
Lipids, 4, 7, 9, 13, 15, 55, 64, 65, 68–71, 74, 151, 164, 177, 190, 194, 196, 215, 250, 251, 261, 264, 265, 282
Lithotrophic, 4
Loop and airlift bioreactors, 157
- M**
Manipulation, 27
Manure, 98, 99, 106, 113, 114, 117, 126–128, 134, 136, 138, 139
Mass transfer efficiency, 155–157, 159
Mechanical disruption, 82
Mechanical pretreatment, 82, 116–117
Mechanism of hydrogen production, 80
Mediator-less, 233, 236
Medium chain length PHAs, 208, 213, 214, 217
Melting temperature (T_m), 9, 214
Membrane, 4, 31, 51, 55, 66, 74, 84, 107, 120, 134, 135, 148, 158, 159, 169, 177, 178, 194, 231, 233, 234, 236, 239, 240, 259
Membrane biofilm bioreactor (MBfR), 158
MEP pathway, 170–174, 179, 181, 182, 253, 264
Metabolic engineering, 52, 92, 149, 253, 255–257, 262, 267, 276, 280
Metabolic flux, 92, 149
Metabolic flux analysis (MFA), 92, 149, 281
Metabolic modelling, 195, 277, 280–286, 290
Metabolic pathways, 42, 52, 56, 282
Metal-binding, 191, 203
Methane (CH_4), 5, 10, 12, 14, 15, 91, 97, 98, 102, 104–107, 113, 117–119, 121–127, 131, 137, 145–159, 248, 250, 251, 259, 260, 263–265
Methane gas, 91, 137
Methane monooxygenase (MMO), 148, 264
Methane oxidation, 149
Methanogens, 5, 14, 30, 84, 88, 91, 98, 100–102, 105, 106, 119, 121–125, 127, 131, 133, 147, 237, 239, 263
Methanol, 14, 148–150, 153, 217, 230, 248, 250, 251, 264, 265
Methanotrophic bacteria, 148–149, 153, 156, 158, 159, 248, 264
Methanotrophic cultivation, 154–157
Methanotrophs, 148–151, 153–156, 158, 248, 250, 251, 264, 265
Microalgae, 8–10, 63–76, 80, 91, 131, 164
Microbial biohydrogen production, 14
Microbial desalination cells (MDCs), 230, 239, 240
Microbial electrolytic cells (MECs), 14, 230, 237–239
Microbial electrosynthesis (MES), 230, 240
Microbial fuel cell (MFC), 14, 234–238, 240, 251, 257–259
Microbial growth kinetics, 286, 287
Microbial nanowires, 231
Microbial processes, 2, 3
Micro-bubble sparging CSTRs, 157
Milling, 49, 82, 116
Mitigate, 9, 35, 48, 150, 230
Modeling, 179, 183, 248, 266, 267
Molar mass, 82

- Molasses, 32, 50, 167, 216, 219, 234, 238, 261, 279
- Molecular-weight distribution, 199–201
- Monod equation, 287–290
- Mono Lake, California, 67
- Monolithic biofilm bioreactors, 158
- Monosaccharide composition, 199–200
- Monoterpene, 169, 174, 175
- Mutant strain, 31, 56
- MVA pathway, 170–172, 174, 181, 182
- N**
- Native strategy, 253–255
- NAD(P)H, 41, 88, 213, 283
- Nicotinamide Adenine Dinucleotide (NADH), 16, 29, 90, 213, 282, 283
- Ni-Fe hydrogenase, 89
- Nile red, 70, 71
- Nitrogenase, 11, 89, 90
- Non-renewable, 221
- Nutraceuticals, 75, 164, 276
- Nutrients, 9, 64, 66, 67, 69, 74, 98, 101, 125, 126, 138, 148, 149, 154, 155, 181, 183, 207–209, 213, 215, 216, 220, 222, 260, 279, 284, 289, 293
- O**
- Operating costs, 105, 106, 277, 294
- Operational expenditures (OPEX), 108–109
- Organic acids, 66, 87, 100, 147, 150, 181, 215, 240, 252, 257, 258, 260
- Organic loading rate (OLR), 99, 104, 124–125
- Organic wastes, 127, 128, 251, 260–265
- Organosolv, 83
- Oxidation, 4, 7, 13, 28, 30, 33, 82, 88, 118, 149, 170, 231–233, 237, 239, 240, 248, 259, 262, 264
- Ozonolysis, 83
- P**
- Partial pressure of hydrogen, 30, 42, 88, 121, 267
- Particle size, 82, 116
- Pathways, 15, 28, 29, 42, 56, 57, 66, 67, 72, 74, 87–92, 98, 112, 150, 151, 168–174, 177–182, 191–196, 209, 213, 222, 253, 257, 258, 262, 264, 267, 280, 282
- Pentocrobe 411, 40, 41
- Pervaporation, 51
- Petrochemical, 208, 215, 294
- pH, 2–5, 7, 9, 11, 13, 16, 27, 30, 31, 36, 49, 64, 67–70, 72, 83, 90, 100–101, 104, 118, 122, 123, 134, 148, 175, 190, 193, 194, 202, 214, 221, 230–232, 236, 237, 257, 261, 263, 266, 278
- PHA biosynthesis, 209, 213
- PHA synthase, 213, 218
- PHB recovery and purification, 277–279, 292
- Phaeodactylum tricornutum*, 66
- Phenazine, 232
- Phosphotransacetylase (PTA), 28, 29, 41, 256, 258
- Photobioreactor (PBR), 165
- Photo fermentation, 81, 83, 91, 217
- Photo heterotrophic bacteria, 83, 182
- Photosynthesis, 8, 65, 138, 163, 168, 169, 172, 180, 240, 241
- Physical pulverization, 87, 88
- Physical treatment, 82
- Physico-chemical treatment, 82–83
- Physiology, 26, 28–31
- Pili, 231, 232
- Pili-mediated electron transfer, 231
- Plug flow digesters, 102
- Pollutant bioadsorption, 191
- Poly(3-hydroxybutyrate) (PHB), 15, 150, 154, 157, 210–214, 216–222, 276, 292, 296–298
- Poly(3-hydroxybutyrate- 3-hydroxyvalerate) (PHBV), 210, 211, 213–215, 217–220
- Poly(3-hydroxypropionate)(PHP), 216
- Polyesters, 76, 150, 207, 208, 213, 217, 261, 262, 265
- Polyextremophiles, 3
- Polyhydroxyalkanoate (PHA), 15, 208–222, 250, 261, 262
- Pretreatment, 26, 27, 31, 33–35, 42, 81–84, 87, 90, 92, 112, 115–119, 235, 249, 266, 292, 297
- Process development, 145, 154, 156, 183, 276, 278, 280, 281
- Process integration, 296, 297
- Process modelling, 276, 295, 297
- Process optimization, 276, 278, 296, 297
- Process parameters, 98–101, 109
- Process simulation, 276, 277, 292–293, 295, 297
- Productivity, 5, 16, 27, 42, 50, 51, 64, 65, 72, 98, 123, 150, 151, 154–156, 159, 163–165, 168, 172, 180–183, 194, 217, 281, 287, 289, 291

- Profitability, 215, 276, 277, 293, 297
 Promoter, 149, 179, 180
 1,3-Propanediol (1,3-PDO), 208, 248, 250, 260, 262, 265, 278
 Proton, 87, 121, 135, 202, 233, 236–238, 259
Pseudomonas aeruginosa, 190, 209, 210, 213
Pseudomonas putida, 55–57, 210, 218, 220
 Psychrophiles, 3–6, 8, 9, 12, 13, 16, 69, 98–100, 104, 109, 122, 235, 236, 238
 Psychrophilic digestion, 99, 100, 104
 Puruvate oxidoreductase, 28–30, 87, 90
 Pyrolysis, 74, 75, 80, 249
 Pyruvate, 7, 28–30, 38, 41, 42, 57, 66, 87–90, 172, 181, 200, 251, 257, 258
 Pyruvate ferredoxin oxidoreductase (PFOR), 28–30, 88
- Q**
 Quinones, 7, 169, 232
- R**
 Recombinant DNA, 164, 177, 183
 Recombinant strategy, 255–257
Reduction, 7, 11, 14, 28, 50, 51, 82, 104, 134, 135, 137, 170, 200, 213, 221, 222, 231–233, 237–240, 260, 293, 296, 297
 Redox proteins, 231
 Renewable, 25, 27, 47, 63, 67, 80, 81, 92, 113, 115, 136, 139, 151, 163, 165, 208, 209, 215–222, 230, 248, 261, 262, 264–266
 Renewable materials, 25, 49, 81, 109, 147, 151, 208
 Retention time, 100, 102, 104, 105, 123, 124, 128, 157, 263
 Revenue, 108, 109
 Ribosomal binding site (RBS), 179
 Ribulose-1,5-bisphosphate carboxylase/oxygenase (Rubisco), 65
 Ribulose monophosphate (RuMP) cycle, 148, 149
- S**
Saccharomyces cerevisiae, 26, 56, 170, 182
 Salt resistance, 4
 Saturation constant, 288
 Scaling-up, 57
 Separate hydrolysis and fermentation (SHF), 35, 36
 Short chain length PHAs, 208
 Shuttle vector, 41, 178, 179
 Simultaneous saccharification and co-fermentation (SSCF), 35–37, 65, 66, 266
 Simultaneous saccharification and fermentation (SSF), 35–37, 42, 91, 279
 Single-cell protein (Amino acids), 149–150
 Soap Lake, WA, 9, 66, 67
 Sodium bicarbonate (NaHCO₃), 67
 Sodium carbonate, 67
 Specific growth constant, 287–289
 Steam explosion, 82, 117
 Substrate concentration, 30, 33, 38, 42, 50, 287, 288
 Substrates, 13, 25, 48, 81, 98, 113, 146, 170, 209, 231, 249, 282
 Sugarcane bagasse, 9, 84, 87, 277, 279, 291, 292
 Sulfate-reducing bacteria, 11, 84, 88
 Surface area, 81, 82, 116
 Sustainable, 64, 75, 92, 108, 112, 115, 127, 130, 131, 138, 156, 164, 168, 208, 209, 215, 221, 248, 276, 277, 297
Synechocystis, 7, 178, 180, 181
 Synthetic biology, 151, 163–184, 267
- T**
 Techno-economics, 71, 146, 151, 183
 Techno-economic analysis (TEA), 71, 146, 151
 Temperature, 2–5, 7–11, 13, 16, 27, 30, 31, 34–36, 42, 64, 67–71, 74, 75, 81–84, 86–88, 90, 92, 98, 100–105, 117, 122–124, 126, 128, 130, 133, 134, 148, 155, 158, 183, 190, 191, 193, 200–202, 214, 219, 221, 230–232, 236–238, 241, 249, 252, 257, 264, 265, 267, 277, 278, 287
 Tensile strength, 214, 222
 Terrestrial environments, 189, 191, 203
Thalassiosira pseudonana, 65, 66
Thermoanaerobacter, 13, 14, 28, 31–33, 38, 40–42, 85, 253, 278
Thermoanaerobacter ethanolicus, 28, 31, 32, 38, 253
Thermoanaerobacter mathranii, 32, 38, 41, 85
Thermoanaerobacter pentosauceus, 28
Thermoanaerobacter strain AK5, 28, 30
Thermoanaerobacter strain J1, 28, 30, 31

- Thermoanaerobacterium*, 31, 38, 42, 87, 236, 253, 254, 258
- Thermoanaerobacterium saccharolyticum*, 31, 36, 38, 41, 86, 253, 258
- Thermoanaerobacterium* strain AK17, 28, 32, 33
- Thermochemical conversion, 74, 75
- Thermodegradation temperature, 214, 222
- Thermophile, 3, 5, 6, 9, 11, 13–16, 26–28, 30, 34–38, 41, 42, 74, 75, 81, 84–87, 92, 122, 192, 195
- Thermophilic, 5, 26, 68, 81, 98, 119, 191, 235, 248, 278
- Thermophilic anaerobic digestion (TAD), 98, 104, 105, 248, 250, 251, 260, 263–264
- Thermophilic digestion, 100, 104–105, 109, 123
- Thickening agents, 191
- Titer, 26–28, 37, 38, 41, 42, 55, 56, 150, 156, 157, 170, 180, 182
- Tolerance, 8, 27, 28, 30, 31, 38, 42, 53, 55–57, 255, 262, 279
- Total carbohydrate content, 198, 199
- Total protein content, 199
- Toxic metals, 3
- Toxicity, 2, 3, 7, 14, 15, 50, 55, 56, 83, 101, 105, 106, 118, 123–125, 130, 131, 133, 136, 168, 177, 182, 183, 193, 198, 214, 240, 248, 249, 255, 296, 298
- Transcriptional terminator sites (TTS), 179
- Transesterification, 13, 74, 216, 251, 264, 265
- Triacylglycerol (TAG), 64–67, 70, 74, 76
- Trickle-bed bioreactor, 158
- U**
- Untreated lignocellulosic biomass, 84–87, 93
- Up flow anaerobic sludge blanket (UASB), 85, 102, 129–130
- V**
- Vaccine adjuvants, 191, 203
- Valeric acid, 98
- Value-added biofuels, 91
- Value-added bioproducts, 247–267
- Value added products, 2, 14, 15, 115, 131, 151, 241, 250, 251, 253, 255, 260, 265, 276–297
- Vehicle fuel, 107, 131, 134
- Viable, 7, 25, 75, 80, 81, 87, 92, 134, 149, 164, 168, 183, 215
- Viscosifying agents, 191
- Vitamins, 31, 150, 151, 240
- Volatile acids, 91
- Volatile fatty acids (VFA), 101, 105, 121, 123, 147, 218, 221
- W**
- Wastewater, 14, 52, 64, 76, 97, 102, 106, 128, 164, 183, 194, 218, 234, 238, 240, 249, 259
- Wet digestion, 105
- Wet oxidation (WO), 33, 82, 118
- Whey, 54, 114, 210, 216, 218–220, 279
- X**
- β -Xylosidase, 232, 257
- Y**
- Yellowstone National Park, 7, 11, 65, 67, 68
- Yield coefficients, 285, 286, 290
- Young's modulus, 214
- Z**
- Zyomonas mobilis*, 30, 34, 57