

Index

a

Acetobacter xylinum 22, 53, 213
 acetylation 335
 acrylamide (AAm) monomer 133
 acrylic acid (AA) 69
 active targeting 233
 aerogels 125
 freeze-drying method 10
 light weight materials 10
 agarose microparticles 25
 alginate based nanohydrogels 317
 alginate hydrogel, ionic interaction
 technique 127
 alkylated chitosan (ACS) 112
 5-Alkynylpyridine derivatives 279
 allicin–cellulose nanocrystal
 (ACNC) 152
 amino polysaccharide biopolymer 92
 ammonium persulphate (APS) 180
 amperometric responses 186
 amylopectin 126
 analyte concentration gradients 187
 anionic carboxymethylated NFC films 5
 annulusfibrosus (AF) 337
 antibacterial/antimicrobial studies 29
 anti-coagulation 99
 antimicrobial nanomaterials 151
 antiseptic drug octenidine 13
 artificial cerebrospinal fluid
 (ACSF) 149
 artificial cornea 32
 atomic force microscopy (AFM) 143
 atom transfer radical polymerization
 (ATRP) 235

b

bacterial cellulose (BC) 2, 21, 52, 333
 antibacterial/antimicrobial studies 29
 biomedicine 30
 biosynthesis of 23
 cardiovascular implant 30
 cartilage meniscus implant 31
 chemical structure 22
 drug delivery 29
 extracellular natural byproduct 22
 history 23
 mechanical properties 27, 54
 properties 23
 bacterial species 23
 bacteria-responsive multifunctional
 nanogels 232
Bacterium xylinum 53
 BC–acrylamide (BC–AM) 219
 superabsorbent hydrogels 219
 BC–silver sulfadiazine (BC–SSD) 25
 BH3-interacting domain death agonist
 (BID) 272
 binding affinity value 276
 bioadhesive cellulose gels 68
 biocellulose (BC) 212
 bioceramics 106
 biocompatibility
 of hydrogels 312
 in vitro 25
 in vivo 26
 material property 36
 and toxicology 223
 biodegradability 3, 28
 biodegradable nanoparticles 1

- biological membranes 1
- biomass recalcitrance 48
- biomedical applications 29, 59
- biomedical probes and devices,
 - chitosan-mediated
 - biopharmaceuticals 102
 - biosensors 100
 - implant materials 106
- biomedicine, CNC 30
 - drug loaded system 146
 - medical implants, cortical implants 148
- biomolecule recognition-responsive nanogels 231
- biomolecule sensitive hydrogels 300
- bio-polymeric aerogel
 - biocompatible and biodegradable 134
 - bone repair applications 134
- biotechnology, CNC 32
 - AFM 143
 - cellmilieu 143
 - electrospun
 - fibrous bio-nanocomposite 144
 - enzyme/protein immobilization and recognition 144
- blood brain barrier (BBB) 245
- blood vessel replacement 150
- bone tissue implant 31
- bovine serum albumine (BSA) 37, 220
- bulk polymerization 70
- C**
 - cancer targeting 150
 - carbon nanotubes (CNT) 211
 - carbonyldiimidazole (CDI) 215
 - carboxymethyl cellulose (CMC) 3, 27, 214
 - carboxymethyl chitosan (CMCS) 114, 316
 - carcinoembryonic antigen (CEA) 102
 - cardiovascular implant 30
 - carrageenan gel formation 128
 - cartilage meniscus implant 31
 - cartilage tissue engineering 340
 - cationic β -cyclodextrin (β -CD) 7
 - cellular internalization,
 - nanocellulose 3
 - cellulose 140
 - based nanohydrogels 319
 - biobased materials 48
 - chemical structure of 21
 - hydrogel, hydrogen bonding technique 129
 - linear homopolymer 48
 - microfibrils, biosynthesis of 24
 - nanowhiskers 2, 72, 73, 76, 78, 79, 154
 - types of 21
 - cellulose nanocrystals (CNC) 2, 50, 83, 153, 333
 - biocompatibility 142
 - extraction 141
 - in vivo* biodegradability 143
 - mechanical properties 142
 - nano-scale dimensions 141
 - surface chemistry 142
 - TEM 141
 - toxicity 143
 - cellulose nanofibrils (CNF) 52, 333
 - cetyltrimethylammonium bromide (CTAB) 146
 - chemical composition 23
 - chemical gel 132
 - chemical grafting 145
 - chemical hydrogels 301
 - chemical networks based
 - hydrogels 303
 - chitin 91
 - chitosan
 - active reactive sites 94
 - alkyl chain 111
 - based nanohydrogels 316–317
 - biofabrication 92
 - biopolymer 131
 - complex formation 94
 - DD 110
 - direct chemical modification 94
 - DQ 111
 - hybrid aerogels 133
 - hydroxyl groups 93
 - mediated biofabrication 96
 - reactive groups 92

- shapes and LBL assembly 96
 - solubility 112
 - substituent charge 114
 - chitosan–alginate–factor B 101
 - chitosan–genipin derivative 135
 - chitosan–glycerophosphate salt 105
 - chitosan-*g*-polyaniline copolymers 133
 - chitosan-PEG-based hydrogel 305
 - cholesterol modified pullulan nanogel (CHP) 228, 247
 - cholesteryl-group-bearing pullulan (cCHP) 248
 - conducting polymer based biosensors
 - fabricate conductive micropattern 185
 - FPP 185
 - intelligent materials 184
 - conducting polymer hydrogels (CPH) 176–177
 - conducting polymer based biosensors 184
 - conventional synthetic methods 177
 - functional and active biosensors 183
 - hydrogel-based biosensors 187
 - ionically crosslinked 189
 - preparation 179
 - sensing performances 183
 - conducting polymers (CP) 175
 - controlled drug delivery systems 1, 338
 - co-polymeric hydrogel 307
 - copolymerization 70, 303
 - crossing endothelium, brain 245
 - crossing skin barrier 246
 - cross-linked PAni-based redox hydrogel 190
 - cyclic voltammogram (CV) 192
 - cyclodextrin glycosyl transferase (CGTase) 145
 - cytotoxicity 3, 25
- d**
- degree of deacetylation (DD) 91, 110
 - degree of polymerization (DP) 213
 - degree of quaternization (DQ) 111
 - dendrimers 211
 - dermal tissue 59
 - dexamethasone (DEX) 249
 - dextran based nanohydrogels 317
 - dextrin nanogels 237
 - diabetic foot ulcers (DFU) 30
 - 3-diethylaminopropyl isothiocyanate (DEAP) 236
 - dimeric indoles 278, 279
 - dimeric peptidomimetics, IAP inhibitors 284
 - doping acid crosslinking, CPH
 - hydrophobic 192
 - multi-functional doping acid 194
 - 3D nanostructure matrix 195
 - doping processes 175–176
 - double-membrane hydrogels 11
 - doxorubicin hydrochloride 220
 - drug delivery systems (DDS), nanohydrogels 29, 31, 210
 - alginate based 317
 - cellulose based 317
 - chitosan based 316–317
 - dextran based 317
 - hyaluronic acid based 315
 - pectin based 317
 - drug loaded system 227
 - drug delivery 147
 - drug excipient 146
 - drug release mechanism 12, 229
- e**
- elastic moduli, cellulose fiber 81
 - electrostatic interaction 9
 - engineered nanosystem 91
 - enhanced permeability and retention (EPR) mechanism 232
 - environmental devastation 47
 - environmental stimuli 230
 - enzyme biological fuel cell (EBFC) 28, 32
 - enzyme-loaded biosensors 195
 - enzymes
 - based cross-linking hydrogels 304
 - protein immobilization and recognition 144
 - Escherichia coli* 103, 215
 - extracellular matrix (ECM) 68, 104, 183, 300
 - extraction, cellulose nanocrystals 51

f

- fibroin protein photoresist (FPP) film 185
- fluorescein isothiocyanate (FITC) 3, 153
- fluorescent signal capturing channel 101
- foreign body giant cell (FBGC) 160
- free radical photopolymerization (FRP) 235
- freeze-dried nanofiber network 53
- freeze-thaw method 32
- fused pyrazinone derivatives, structures 276

g

- gamma irradiation treatment 14
- gel drying
 - ambient pressure drying 129
 - freeze drying 129
 - supercritical drying 130
- GelrGONR-M, CLSM images of 189, 190
- generally recognized as safe (GRAS) 3
- genetically engineered fusion, NFC 339
- genotoxicity 25
- Gluconacetobacter* 22, 213, 214
- Gluconacetobacter xylinus* 3
- glucose oxidase (GOD/GOx) 28, 186
- glutaraldehyde (GA) 198
- glutathione (GSH) 196
- graphene nanosheets 27
- graphene-polymer composites 306

h

- haemo compatibility 26
- HemCon[®] 109
- heterocyclics IAP inhibitors
 - compounds 279
 - core scaffolds 280
 - diazepine and diazocine derivatives 281
 - isoquinoline, IAP antagonists 281
 - triazole containing macrocycles 281
- heterogeneous hydrogels 70
- heterostructure, PtNPs/PAni hydrogel 199

- hexose monophosphate pathway (HMP) 23
- hierarchical porous nanostructure 189
- hollow-sphere structured PPy 181
- homo-polymeric hydrogel 307
- horseradish peroxidase (HRP) 192, 193, 305
- human adipose derived stem cell (hADSCs) 25
- human adipose mesenchymal stem cells (hASCs) 338–339
- human bone marrow-derived stem cells (hBMSC) 105
- human neutrophil elastase (HNE) 146
- hyaluronic acid (HA) based nanohydrogels 315–316
- hyaluronic acid-glycidyl methacrylate (HAGM) 235
- hydro apatite (HA) 79
- hydrogel-based biosensors 187
- hydrogels 297 *see also* nanohydrogels
 - amyloidogenicity code 346
 - antibodies 346
 - based ionic interaction 304
 - biocompatibility 312
 - biodegradability 35
 - biomedical application 344–346
 - characterization of 69, 71–76
 - chemical modification 34
 - chemical networks based 303–304
 - classification of 156, 305–307
 - cross-linked polymers 300
 - cross-link junctions 301–305
 - definition 298
 - elasticity 310–311
 - enzyme based 304–305
 - first generation 298
 - Fourier transforms infrared spectroscopy 71
 - genetic engineering 346
 - inhomogeneity 312–313
 - interpenetrating network 307–309
 - ionic interaction 304
 - mechanical 312
 - mechanical properties 80
 - networks, versatility 188
 - NMR 73

- photosensitive functional groups
 - based 305
 - physical network based 302–303
 - poly(amino acids) 342
 - polyester 33
 - polymer chains crosslinking 11
 - polymer network chain 155
 - porosity and permeation 311
 - rheological properties 79
 - second generation 298–300
 - SEM of 72
 - source types 309
 - swelling 34, 76, 309, 340–341
 - thermal properties 78
 - third generation 300
 - types of 34
 - XRD 75
 - hydrogen peroxide 180
 - hydrosol 298
 - hydroxybutyl chitosan 109
 - hydroxyethyl cellulose (HEC) 27
 - hydroxypropylmethyl cellulose (HPMC) 3, 249
 - hyperbranched polyester (HPE)
 - hydrogel 38
 - hyperthermia-based drug delivery system 103
- i**
- immobilization 100, 198
 - immobilizing enzymes, CPH 195
 - indium tin oxide 101 *see also*
 - fluorescent signal capturing channel
 - indoles and azaindoles 277
 - inhibitor of apoptosis proteins (IAP)
 - cIAPs 273
 - mechanism, Smac mimetics 273
 - regulating cell death 271
 - XIAP 273
 - inhomogeneity, of hydrogels 312–313
 - injectable polysaccharide
 - hydrogels 84
 - inter- and intra-hydrogen bonding,
 - BC 22
 - interpenetrating polymer networks (IPNs) 308, 340
 - intervertebral disc (IVD)
 - degeneration 337
 - in vitro* biocompatibility
 - hASC 25
 - outside living organism 25
 - RBC 25
 - in vitro* methyl thiazolyltetrazolium (MTT) 345
 - in vivo* biocompatibility 26
 - ionically crosslinked CPH
 - biosensors, redox hydrogels 189
 - HRP 192
 - tether binding redox centers 191
 - ionic hydrogels 306, 310
- k**
- Komagataeibacter
 - sucrofermentas 214
- l**
- Langmuir–Blodgett 99
 - layer-by-layer (LBL)
 - technique 96–100, 106, 107
 - lidocaine hydrochloride
 - (hydrophilic) 218
 - light/photo-responsive nanogels 231
 - lignin, chemical structures of 49
 - lignocellulosic natural fibers 48
 - linear homopolymer of glucose
 - (C₆H₁₀O₅)_n 67
 - lipo-polysaccharide 5
 - loading and delivery, siRNA 241
 - low ecological toxicity risk 2
 - lysozyme-CNC (LCNC) 152
- m**
- magnetic field responsive
 - nanogels 231
 - medical implants, cortical
 - implants 148
 - messenger RNAs (mRNA) 241
 - methoxy hydroquinone (MHC) 70
 - methylene bis-acrylamide (MBA) 69, 219, 237
 - methyltrimethoxysilane 101
 - microcrystalline cellulose (MCC) 10, 142

- microfibril cross-section 49
 - microfibrillated cellulose (MFC) 52, 141, 334
 - micropatterned PAni hydrogel
 - array 182
 - microporosity 27
 - miniature electrochemical
 - electrodes 175
 - miscellaneous structures, IAP
 - inhibitors 286
 - mixed field and fluorescence-
 - microscopy images 5
 - molecular cellulose chain 53
 - molecularly imprinted polymer (MIP)
 - composite 218
 - molecular weight (MW) 114
 - monocyte/macrophage (MM)
 - reaction 4
 - mononuclear phagocyte system (MPS)
 - organs 232
 - mucoadhesive DOX hydrochloride
 - loaded nanohydrogels 316
 - multidrug-resistant *Acinetobacter*
 - baumannii* (MDRAB) 152
 - multi-functional doping acid 194
 - multilayer thin films fabrication 99
 - multi-stimuli responsive nanogels 238
 - multi-walled carbon nanotubes (MWCNT) 196
 - myriad biotechnological and biomedical applications 153
- n**
- nanocellulose 333
 - CNC 50
 - CNF 52
 - drug formulations for topical
 - administration 215
 - implants, local therapy 222
 - types 50
 - nanocellulose drug delivery 224
 - biodegradability 3
 - microparticulate 8
 - nanoparticulate 5
 - poor bioavailability 1
 - tablet formulations 10
 - transdermal 13
 - nanocrystals 212, 213
 - nanofactories 103
 - nanofibrillar cellulose (NFC) 4, 21, 331, 333
 - cartilage tissue engineering 340
 - controlled drug delivery 338
 - coupling agent 334
 - crystalline and amorphous
 - regions 332
 - DP 213
 - electron micrographs, fibers 214
 - genetically engineered fusion 339
 - history and background 331
 - hydrogels 80
 - immobilization-stabilization 339
 - immunoassays and diagnostics 336
 - linked D-glucose units 212
 - nucleus pulposus replacement 337
 - surface modification 334
 - tablet compressing and coating 221
 - TDSS 217–218
 - TEMPO-mediated oxidation 335
 - 3D cell cultures 337
 - topical application
 - nanocomposites 215–216
 - wound healing 338
 - nanogels (NGs) 345
 - anti-inflammatory drug
 - delivery 248
 - autoimmune diseases treatment
 - of 249
 - BBB 245
 - biocompatibility and
 - biodegradability 227
 - bloodstream circulation 232
 - carriers, single drug 240
 - cationic type, cCHP 248
 - cellular immunity (T-cell
 - immunity) 247
 - CHP 247
 - crossing endothelium, brain 245
 - definition 223
 - DOX 236
 - easy synthesis, four methods 234
 - EPR 232
 - multi-stimuli responsive
 - nanogels 238

nanocarriers 232
 siRNA 236
 swelling 223
 toxicity 234
 nanohydrogels 69
 applications 313–319
 definition 297
 drug delivery 315–317
 first generation hydrogels 298
 polysaccharides based 314–319
 schematic representation 303
 second generation
 hydrogel 298–300
 third generation hydrogels 300–301
 tissue engineering 71
 nano hydroxyapatite (nano HA) 28
 nanomedicine 91, 209
 nanoparticles (NP), drug-delivery
 systems
 carbon NP 211
 liposomes 210
 magnetic NP 210
 mesoporous silica NP 210
 solid lipid NP 211
 nanoporous systems 10
 nano-sized hydrogels 314
 nanostructured materials 67
 nanostructured transdermal delivery
 system 29
 nanotechnology applications 1
 natural polymer complexes 97
 near-infrared fluorescence (NIRF)
 optical imaging 107
 neutralization process 96
 NFC *see* nanofibrillar cellulose (NFC)
N-isopropylacrylamide (NIPA) 188
N,N-dialkyl chitosan monolayers 99
 non-alcoholic steatohepatitis
 (NASH) 107
 non-biodegradable materials 47
 non-ionic hydrogels 306
 non-pathogenic bacteria 27
 non-renewable materials 47
 nuclear magnetic resonance
 (NMR) 73
 nucleus pulposus (NP)
 degeneration 337

o

optoelectronic application 29

p

PAni hydrogels 179, 180, 182, 197, 199
 patent assessments
 fused pyrazinone derivatives 276
 fused pyrrolidine, IAP
 inhibitors 275
 indoles and azaindoles 277
 pectin based nanohydrogels 317
 PEGylated nanogels 239
 PEO/PET hydrogel 157
 drug delivery 159
 medical devices and biosensors 158
 medical implants 159
 tissue engineering 157
 wound dressing 162
 Peppas's group 187
 peptidic imidazopyrazinone
 derivatives 276
 pH 113
 pharmacodynamics (dose-effect) 217
 pharmacokinetics over time (drug
 release rate) 217
 photo-cross-linked chitosan
 hydrogel 305
 photosensitive functional groups 305
 pH-responsive nanogels 230
 pH sensitive hydrogel 298
 physical gel
 acetylate polymer 131
 ionically cross-linked chitosan
 hydrogel 131
 polyelectrolyte complexed chitosan
 hydrogels 132
 physical hydrogels 301, 302
 physical network based hydrogels 302
 plant cell wall structure 49
 platinum nanoparticles (PtNPs) 196
 poly(3,4-ethylenedioxythiophene)
 (PEDOT) 185
 poly(dimethyl siloxane) (PDMS) 160
 poly(phenylenevinylene) (PPV) 175
 poly(tetramethylene oxide)
 (PTMO) 160
 polyacrylic acid (PAA) 36

- poly-anions 96
 - poly (vinyl alcohol)-chitosan-bacterial cellulose (PVA/chitosan/BC) 221
 - poly-disperse linear homo-polymer material 21
 - polyelectrolyte complex (PEC) formation 94
 - polyelectrolytes 100
 - polyester hydrogels 33
 - applications 38
 - development of 37
 - polyethylene glycol (PEG) 27, 210
 - polyethylene glycol diacrylate (PEGDA) 27
 - polyethylene glycol maleate citrate (PEGMC) 79
 - polyethylene oxide (PEO) 156
 - polyethylene terephthalate (PET) 37, 156
 - poly(vinyl pyrrolidone) (PVP) hydrogel 158
 - polyhydroxyethyl methacrelayte (pHEMA) 36, 297
 - poly-(lactide-co-glycolide) (PLGA) nanoscale fibers 178
 - polymer-based drug delivery systems 103
 - polymer 2-hydroxyethyl methacrylate (polyHEMA) 36
 - polymeric NP 211
 - polymerization 302
 - ATRP 235
 - bulk 70
 - conductive polymers 175
 - degree of 213
 - FRP 235
 - polyphosphoester-grafted CNC 7
 - polypyrrole-[poly(2-hydroxyethyl methacrylate)] (PPy-pHEMA) 178
 - poly(amino acids) preparation 342–343
 - polysaccharide hydrophobication 316
 - polysaccharide nanocrystals (PN) 9, 11
 - polysaccharides based nanohydrogels 314–319
 - polystyrene sulfonate (PSS) 177, 185, 192
 - polyvinyl alcohol (PVA) 30
 - poor bioavailability, drugs 1
 - programmed cell death (PCD) 271
 - proinflammatory activity, IAP antagonists 274
 - pro-inflammatory phenotype 5
 - pseudodimeric peptidomimetics, IAP inhibitors 284
 - pyrrolidine, IAP antagonists 285
- q**
- quince seed (QC) 11
- r**
- recycling superabsorbent 77
 - regenerated bacterial cellulose (RBC) 25
 - regenerated BC-TiO₂ nanocomposite (RBC-TiO₂) film 25
 - renal parenchymal haemorrhage 109
 - reversible addition fragmentation chain transfer polymerization (RAFT) 235
 - rhodamine B isothiocyanate (RBITC) 3
 - Ritgers–Peppas equation 11
- s**
- scanning electron microscopy (SEM) 6, 32
 - second generation hydrogels 298
 - pH sensitive hydrogels 298–300
 - temperature responsive hydrogels 300
 - self-assembling domains (SAD) 146
 - semi-interpenetrating hydrogels 308
 - shape-memorized bacterial nanocellulose hydrogels 11
 - simulated gastric fluid(SGF) 219
 - simulated intestinal fluids (SIF) 219
 - skin permeating nanogel system (SPN) 249
 - Smac mimetics and survivin transcriptional inhibitors 289
 - Smac mimetics targeting BIR3 273

- small angle X-ray study (SAX) 75
 small interfering RNA (siRNA) 236
 sol-gel process
 alginate hydrogel, ionic interaction technique 127
 κ-Carrageenan hydrogel, heating/cooling technique 127
 starch gel, chemical cross-linking technique 126
 sol-gel transition, hydrogels 341
 soyprotein isolate (SPI) 27
Spodoptera frugiperda (Sf9) cells 4
Staphylococcus aureus 26, 29, 114, 215
 stereocomplexed nanohydrogels 301
 stimuli responsive nanogels 229
 stimuli-sensitive drug delivery systems 102
 supercritical carbon dioxide (scCO₂) 130, 135
 supramolecular hydrogels 11
 surface biochemistry properties 55
 surface morphology 28
 swelling ratio 77
 synthetic polymer complexes 98
 systemic toxicology 223
- t**
- tanshinone IIA (TAIIA) 344–345
 temperature-responsive nanogels 231, 300
 TEMPO-oxidized birch cellulose-based (TC) aerogels 11
 TEMPO oxidized cellulose nanofibrils 219
 tensile strength 213
 tetracycline hydrochloride 220
 tetraethyl ortho-silicate (TEOS) 133
 tetrazole and triazole linked quinoline 280
 theragnosis 108
 thermo gravimetric analysis (TGA) 78
 third generation hydrogels 300
 3D cell cultures, NFC 337
 3D hierarchical microstructure, PAni hydrogel 179
 3D structure, polymers 177
 tissue engineering 39
- appliances 104
 BC 54–57
 cartilage 340
 CNC 143–144
 nanohydrogels 71
 PEO/PET hydrogel 157
 skin tissue repair materials 59
 wound cleansing and quick healing 60
 tissue repair materials 59
 tolerable formulations 212
 tragacanth gum 3-aminopropyl-glyceroldiglycidylether (TGAP-GDE)
 nanohydrogels 299
 tragacanth gum-glutaraldehyde (TG-GA) nanohydrogel 298
 tramadol hydrochloride drug 106
 transdermal drug delivery systems (TDSS)
 MIP composite 218
 retinol, hydrophobic model drug 217
 single/multi-microscopic-layer patches 217
 transfer, drug quantities 217
 transmission electron microscopy (TEM) 2, 141
 cellulose nanocrystals 141
 hydrogels 76
 triazole containing macrocycles 283
 tricarboxylic acid cycle 23
 trimethyl chitosan (TMC) 111
 triple-combination local therapy 241
 truncated BID (tBID) 272
- u**
- uricase (UOx) 198
 uridine diphosphate glucose (UDP-glucose) 23, 54
- v**
- van der Waals forces 234
 vegetable cellulose (VC) 21
- w**
- water absorbency hydrogel 72

water-in-oil emulsion system 70
wenxian panlaoshide 189
wide angle X-ray study (WAX) 75
Wistar rats, direct topical
 application 218
wound dressing 30
wound healing 338

X

XCell® 30
Xeroform™ 30
X-linked inhibitor of apoptosis
 (XIAP) 273
X-ray diffraction (XRD) 75