

# Index

- A**
- Abaca, 226, 230, 231
  - Abdominal wall, 574–576
  - Abrasion resistance, 643
  - Acetic anhydride, 604, 637
  - Acetobacter xylinum*, 545, 551, 568
  - Acetylation, 85, 109, 603, 604, 635
  - Acid
    - coupled steam treatment, 555
    - hydrolysis, 540, 549, 555, 556, 558, 559
  - Acidification, 437
  - Acknowledgment, 653
  - Acne, 429
  - Acrylamide, 435
  - Acrylate latex, 550, 562, 563
  - Acrylation, 110–111, 603, 605, 607, 625
  - Acrylic monomers, 561
  - Acrylic resin, 609
  - Acrylonitrile, 434, 435
  - Activation function neuron (FAN), 226
  - Activation neurons function, 226
  - Adhesion, 107, 109, 112, 241, 243, 246, 254, 255, 258, 259, 294, 296, 308, 309, 311, 312, 314, 317–319, 321, 323
  - Adhesives, 438, 440, 444
  - Adsorption, 349, 360, 363, 366
  - Advanced Materials and Processes Research Institute (AMPRI), 609, 613, 615, 628, 637, 640, 643, 644, 649, 650
  - Aerosil, 359–362, 364, 370
  - Agave fibre, 17, 18
  - Agave sisalana*, 592–594
  - Agricultural crops, 544, 548
  - Agricultural fibers, 549
  - Agro-polymers
    - poly(lactic acid), 456–459
    - polyhydroxyalkanoates, 459–461
  - Aircrafts, 114–116
  - Algae, 545, 550, 555, 573
  - Algal nanocellulose, 550–551
  - Algorithm, 218, 226, 231
  - Aliphatic copolyesters, 462, 464
  - Alkaline treatment, 382, 386, 388
  - Alkali treatment, 85, 603–604, 607, 609, 625, 635
  - Alkyldimethylchlorosilanes, 559
  - All-cellulosic, 399–419
  - Alpha cellulose
    - carboxymethylation, 53–54
    - characteristics, 53
    - cianoethylation, 54–55
    - hydroxypropylation, 55–56
    - isolation, 52–53
  - Aminopropyl, 334
  - Ammonium peroxydisulfate, 561
  - Amorphous, 331, 541, 544, 549, 555
  - Amylase, 433
  - Amylolytic enzymes, 433
  - Amylopectin, 433
  - Anaerobic, 426, 445
  - Anhydro-D-glucoscopyranose, 331
  - 1,4-β anhydroglucose units, 601
  - Animal fibre, 5–6
  - Animal wound dressing, 545
  - Anisotropic, 402–405, 409, 410, 418, 419
  - Anisotropy
    - axial, 159
    - transverse, 159
  - Annual plant, 72
  - Antimicrobial agent, 559
  - Antimicrobially active, 559
  - Antimicrobials, 81
  - Antioxidants, 81
  - Applications, 216–218, 222, 224, 225, 227, 229, 230, 234, 236
    - automotive, 393, 394

- Applications (*cont.*)  
 building, 393  
 packaging, 393  
 sisal fiber polymer composite, 589–653
- Arithmetic average, 232, 236
- Aromatic compounds, 81
- Aromatic copolyesters, 462, 464
- Articular capsule, 574
- Articulation, 576
- Artificial blood vessels, 545
- Artificial cardiovascular tissues, 567
- Artificial neural network, 224, 226, 230, 236
- Ash  
 black, 349, 363, 364  
 white, 349, 360, 362, 364
- Aspect ratio, 411–413
- Aspen, 391–392
- ASTM International, 79
- Atomic force microscopy (AFM), 15–17,  
 23, 28, 31, 32, 34–36, 402, 405–407,  
 414, 445
- Autograft skin, 571
- Autologous cells, 567
- Automotive applications, 644–647
- Automotive industry, 644, 646–647
- Automotive parts, 217
- Availability, 593, 637, 638
- B**
- Bacteria, 71, 72, 85, 86, 426, 432, 435, 437,  
 440, 445
- Bacterial cellulose (BC), 169–173, 545,  
 551–554, 556, 558, 560, 562, 565,  
 566, 569, 570, 573
- Bacterial cellulose/poly(ethylene oxide)-  
 nanocomposites, 563
- Bacterial nanocellulose, 545, 551–554, 568  
 grafts, 567
- Bacteriostatic, 71
- Bagasse, 217, 219, 221
- Ballistic, 393
- Bamboo, 232, 233, 235
- Banana, 217, 219–221, 224, 544, 549, 558
- Banana fibre (BaF), 30, 33, 219, 224,  
 671–676, 679, 682, 683, 694
- Band structure, 404
- Barley, 549
- Bast fibers, 65, 73, 75, 97–117
- Benzoylation, 333, 609, 631, 633, 635
- Benzoylation-acetylation, 333, 334
- Bioactivity, 568
- Biobased monomers, 521–522
- Biocellulose, 573, 574
- Biocompatibility, 545, 567, 568
- Biocomposite, 61–87, 544, 649, 651  
 mechanical properties, 471–474  
 thermal properties, 467–471
- Biodegradability, 425–446
- Biodegradable, 5, 6, 24, 26, 326, 338
- Biodegradable aliphatic copolyesters, 462
- Biodegradable aromatic copolyesters, 462
- Biodegradable plastics, 435, 440–442, 445
- Biodegradable polymers, 521–522, 650  
 classification, 455–456
- Biodegradation, 426, 431–433, 440–441, 445,  
 509–516, 521
- Bioenergy, 80
- Biofibers, 544
- Biogas, 598, 612, 651, 652
- Biological mechanism, 553
- Biological protection, 577
- Biomass, 113, 116
- Biomaterial, 564, 568, 574
- Biomax<sup>®</sup>, 462
- Biomedical application, 549, 556, 559, 562
- Bioplastic films, 444
- Biopolyesters, 457
- Biopolymerization, 552
- Biopolymers, 114, 116, 429, 430, 439,  
 441–446, 563  
 consumption, 116  
 nanocomposites, 527–530
- Bioproducts, 80
- Biosynthesis, 545, 546, 552, 558
- Biotechnology, 545, 577
- Bladder, 577
- Bleaching, 549, 550, 608, 626, 627
- Blood remnants, 567
- Blood vessels, 545, 564–567, 576, 577
- Bone colonization, 568
- Bone graft, 567–569
- Brazilian fibers, 216, 222, 223, 232
- Brittle materials, 226
- Building materials, 637, 638, 640, 643,  
 644, 650  
 delamination, 703, 708, 713
- Buriti fibers, 219, 232, 235, 243
- Burns, 564, 571–572, 577
- C**
- Calcium-deficient hydroxyapatite (CDHAP),  
 567, 568
- Calender, 76, 77
- Canada, 64, 74, 75
- Capsular tissue, 569
- Car, 99, 100, 114–116

- Carbodiimide derivatives, 561
- Carbohydrate, 436, 540, 545, 559
- Carbon dioxide, 99, 117
- Carbon fiber, 242–244, 259
- Carboxylated MFC, 563
- Carboxylated nanocellulose, 560
- Carboxymethyl cellulose (CMC), 437, 563
- Cardiovascular surgery, 567
- Carotid artery, 566, 567, 569
- Cartilage, 574, 576
- Castor oil, 439
- Cellobiose, 540
- Cells, 215, 219, 223, 229
  - entrapment, 562
  - growth, 229
- Cellulose, 7–9, 11–15, 17–22, 24, 26–37, 97–117, 329–331, 348, 360, 361, 364, 365, 367, 368, 434–438, 441, 539–577, 592, 600–604, 606–609, 611, 613, 614, 616, 625, 635, 638, 649, 652
  - applications, 48–50
  - chain, 541–543, 555
  - chemical functionalization, 43–57
  - esters and ethers, 47–49
  - fiber, 379, 380, 389, 390, 392, 481–484
  - implant, 569
  - membrane, 552, 574, 575
  - microfibrils, 181, 183, 194, 203–205
  - nanocomposites, 525, 539–577
  - nanofibers, 540, 544–547, 549, 553, 554, 556–558, 562
  - nanoparticles, 549, 558
  - non conventional sources, 43–57
  - reactivity, 46, 47, 50
  - sources, 45, 46, 50
  - structure, 46, 181–182, 198
  - type, 181
  - wall, 565
- $\gamma$ -cellulose, 437
- Cellulose I, 541, 542
- Cellulose II, 541, 542
- Cellulose III, 541, 542
- Cellulose IV, 542
- Cellulose acetate butyrate, 560, 563
- Cellulosic fibrils
  - cryocrushing, 124
  - fibre saturation point (FSP), 125
  - fibrillated cellulose, 123
  - fibril-water interactions, 125
  - grinding, 123–125
  - hierarchical structure, 123
  - homogenisation, 123
  - mechanical disintegration, 123
  - rhology, 124, 125
  - ultrasound sonication, 123
- Characteristic life, 229, 230
- Characterization, 650
- Chelator, 165
- Chemical composition, 69, 70, 83, 85, 219
- Chemical constituents, 215
- Chemical methods, 603–611
- Chemical modification, 558–561, 624–626, 635–636
- Chemical processing, 542
- Chemical reactivity, 299
- Chemical-retting, 73
- Chemical treatments, 108, 159, 172, 246, 254, 545, 553
- Chemistry, 545
- Chiral nematic, 402, 403
- Chitosan, 429
- Chitosan/chitin nanocomposites, 525
- Chlorophyceae*, 550
- Chondrocytes, 574
- Chronic ulcers, 571, 577
- Chronic venous ulcers, 572
- Chronic wounds, 571–572
- Clemson Fiber Flax (CFF), 72, 73
- CLP curves, 248–252
- Coconut, 549
  - fiber, 379, 380, 392–394
- Cocrystallizations, 561
- Coefficient variation, 225, 229, 235
- Cohesion, 67
- Coir fiber, 219–225, 222, 223, 225, 227–229, 232–235, 245, 250–252, 544
- Collagen, 568, 570
- Compatibility, 159, 172
- Compatibilization, 379, 381–383
- Compatibilizers, 378, 383, 384, 386, 389, 390
- Composite properties
  - crystallinity, 199, 200, 204
  - glass-rubber transition, 198, 199
  - melting temperature, 199
  - microstructure, 196–198
  - percolation theory, 202, 204
  - storage modulus, 201
  - swelling, 203–205
  - thermal decomposition, 200
  - water vapor transmission/permeability, 205
- Composites, 63–65, 75, 80, 82–87, 97–117, 217, 218, 221, 222, 226, 231, 235, 236, 241–259, 345–370, 427, 428, 702–704, 706–712, 714, 718
  - fiber moving, 268
  - interphase, 272–280

- Composites (*cont.*)  
 laminates, 389  
 mechanical properties, 264–285  
 paper, 123, 135–146, 150  
 rupture, 248  
 transcrystallinity, 264, 285
- Composition, 600, 602, 603, 611–613, 625
- Compost, 511, 512, 514
- Compounding, 484–488
- Compression molding, 82, 86, 235, 618–619,  
 621, 629, 668, 683, 689, 691, 692, 695
- Compressive stress, 160
- Computer analysis, 234
- Conclusions, 651–653
- Consistency, 87
- Constant strain rate, 232
- Consumption scenario, 597–598
- Contact angle, 705
- Conventional usage, 217
- Copolymer, 550, 559
- Copolymerization, 334
- Corn, 549, 569
- Cornea, 574, 577
- Corona treatment, 382, 390
- Correlation, 216, 218, 223, 224, 235
- Cosmetics, 545, 547, 573–574, 577
- Cosmetic tissues, 545, 573–574
- Cotton, 219, 221, 223, 540, 544, 545, 555–558  
 fibers, 223  
 standards, 78
- Council of Scientific and Industrial Research  
 (CSIR), 615, 637, 640
- Coupling agent (CA), 490–492, 494, 495, 497,  
 498, 500–502  
 IR spectrum, 705
- Cox, 411
- Critical length, 243, 246–254, 258
- Critical length pullout (CLP), 243, 246–252,  
 258
- Critical surface energy, 162, 163, 173
- Crop mulcher, 442
- Cross-linking, 400–402, 406–409, 413–415,  
 417, 418
- Cross section, 220, 223, 229, 232, 243,  
 244, 249
- Crushing rollers, 75, 76
- Crystalline, 331, 333  
 forms, 541–544  
 nanocrystals, 549
- Crystallinity, 8, 9, 15, 16, 22  
 X-ray diffraction, 167
- Crystallinity index, 219
- Crystallization, 552, 561, 563
- Crystal modulus, 544
- Crystal structure  
 cellulose I $\alpha$ , 541, 542  
 cellulose I $\beta$ , 542, 562
- Cultivation, 594–598, 615, 640, 650, 652
- Culture, 169, 170, 172, 173
- Cumulative distribution functions, 229
- Curaua fiber, 217, 219, 221, 222, 232, 233,  
 235, 236, 243, 245, 250, 252, 380,  
 387–388, 393
- Cutin, 432
- Cyanoethylation, 334, 337, 608, 626, 627, 631,  
 633, 636
- D**
- Debonding, 247, 249, 252, 256
- Decomposition, 332
- Decortication equipment, 75
- Defects, 218, 219, 222–224, 228–231, 233, 236  
 population, 239
- Defects/flaws, 228
- Defense, 638, 649, 652
- Defibrillation, 329
- Degradation, 159, 161, 162, 164, 166, 167, 326,  
 329, 336, 339, 601, 603, 606, 613, 615,  
 625, 650  
 thermal, 345–370
- Degree of crystallinity, 549
- Degree of polymerisation, 157, 158
- Degree of polymerization, 552, 555
- Dehydration, 613, 615
- Density, 65–67, 72, 74, 80, 82, 83, 85, 86, 100,  
 105, 112, 117
- Dental, 564
- Deproteinized, 550
- Dermis, 571
- Dermolysis, 577
- Dewaxing, 337, 607–608, 627
- Dew-retting, 73, 74, 84, 85
- Dextrin, 433
- D13.17 (Flax and Linen), 79
- Dialysis, 555
- Diameter, 102, 104, 105, 107, 243–245,  
 247–249, 251, 254–256  
 range, 221  
 variation, 226, 249
- Diclofenac, 429
- Dielectric, 540
- Differential scanning calorimetry (DSC),  
 612, 614
- Digestive tract, 576
- Diisocyanates, 400–402, 417
- Dimensional change, 709

Dimensional variation, 223  
 Dimensionless shape parameter, 231  
 Dimensions, 218, 221–224, 232, 236, 243, 258  
 Dinitrophenylation, 333, 334  
 Disaccharides, 434  
 Discontinuous reinforcement composites, 86  
 Dislocations, 67  
 Dispersant, 563  
 Dispersion  
   of strength, 231  
   in stress, 248, 251  
   in stress values, 248, 251  
 Disposal diapers, 563  
 DNA oligomers, 561  
 Door frame, Holdfasts, 714  
 Door panels, 693, 694, 696  
 Door shutter, Termite, 712  
 Drawbacks, 218  
 Drug delivery, 562, 563  
 Duodenal lesions, 577  
 Duramater, 576  
 Dynamic mechanical analysis, 612  
 Dynamic mechanical thermal analysis,  
   317–318

## E

Ecoflex<sup>®</sup>, 462  
 Elastic modulus, 552  
 Electrical application, 647  
 Electric discharge, 602  
 Electroluminescent, 553  
 Electrolyte solvent, 563  
 Electron microscopy, 567  
 Electrospinning, 558  
 Elementary fibers, 65, 67  
 Elongation, 612, 613, 616, 621, 630, 632–634,  
   637, 644  
 Embedded area, 257  
 Embedded length, 245, 247, 248, 250, 251,  
   256, 258  
 E-modulus, 563  
 Endogenous cells, 565  
 Endoprosthesis, 564–567  
 Endothelial cell, 567  
 Energy, 80–82, 100, 110, 114–116  
 Engineered paper grades, 122  
 Engineering materials, 218  
 Environment, 98, 113, 114  
 Environmental aspects, 520–521, 530–531  
 Environmental benign, 521  
 Environmental friendly, 394  
 Environment-friendly, 326, 426–430, 438,  
   444, 445

Enzyme-retching, 71, 73, 74  
 Epicutaneous test, 573  
 Epidermis layer, 571  
 Epithelial lesions, 577  
 Epoxides, 563  
 Epoxy, 243, 250–252, 256, 257, 259  
   composites, 620, 621  
   resins, 562  
 Epoxypropyltrimethylammonium chloride  
   (EPTMAC), 559  
 Equivalent diameter, 232, 243, 247  
 Esophagus, 576  
 Esterification, 109, 117, 558, 559  
 Etherification, 558  
 Ethyl 2-bromoisobutyrate, 561  
 Ethyl cellulose, 429, 437  
 European Union, 63, 82  
 E.U.'s End-of-Life Vehicle (ELV), 82  
 Exothermic process, 300  
 Extract fibers, 74  
 Extraction, 163–169, 326, 328–329, 338  
   method, 219  
   process, 222

## F

Fabric, 612, 618, 637, 638, 642, 643, 648,  
   649, 652  
 Facial peeling, 577  
 Failure mode, 254, 257  
 Fatigue, 679–680, 689, 1 695  
 Fatty acids, 167  
 Feminine hygiene, 435  
 Femoral trochlea, 574  
 Fermentation, 567, 569  
 Ferromagnetic, 540  
 Fertilizer, 72  
 Fiber, 215–236  
   cross section, 220  
   diameter, 235  
   dimensions, 221  
   distribution, 486, 498  
   extractions, 598–599  
   fragmentation, 252–255  
   fragmentation test, 252–255  
   length, 621–622  
   length distribution, 486–487  
   loading, 622, 629–634  
   pellets, 487–488  
   pollution, 244–246  
   pullout test, 244–246  
   quality, 69, 73, 77, 79, 82–84, 87  
   reinforced polymer, 617–637  
   rupture, 247

- Fiber (*cont.*)  
 selection, 218, 222, 236  
 strength, 223, 225, 229  
 strength variation, 223, 224, 229  
 surface modification, 601–617
- Fiber/matrix interface, 258
- Fibre-matrix, 668, 669, 671, 676–680, 682–684  
 adhesion, 617–618, 624–626, 635–636  
 coupling, 489–490, 500–502  
 decoupling, 500–502, 504  
 interphase, 634–635  
 interphase adhesion, 624
- Fibril-calcium carbonate composites, 123
- Fibril distribution, 233
- Fibrillated pulp, 546
- Fibrillation, 333
- Fibroblasts, 553, 554, 576
- Fibrocarrilage, 574
- Fibrous plants, 99–102, 105, 112, 116, 117
- Fickian diffusion, 428
- Filament winding, 619
- Fillers, 113, 117, 345–370
- Filters, 117
- Fineness, 66, 69, 72, 73, 77, 79, 80, 84
- Flaw  
 distribution, 225  
 size distributions, 223
- Flax (*Linum usitatissimum* L.), 62, 98–108,  
 114, 217, 221, 379, 380, 383–384, 443,  
 544, 548, 556, 562  
 composites, 664–665  
 fibers, 61–87
- Flax seed, 64, 65, 71, 72, 81, 82
- Flax seed industry, 82
- Flexible polymer, 563
- Flexural performance, 86
- Flexural properties, 622, 623
- Flexural strength, 665
- Flocculation, 563
- Fly ash, 628, 640, 642
- Food packaging, 415, 418, 419
- Fractographic studies, 236
- Fractographs, 219, 222, 235
- Fracture  
 mechanism, 222  
 mode, 219  
 strength, 227–229, 232
- Frictional, 66, 71
- FT-IR, 445
- Functional composites, 553
- Functionalized nanocellulose, 559
- Fungi, 164, 166–169, 173, 426, 440, 445
- Furfuryl alcohol, 561
- Fusarium lini*, 432
- Future prospects, 651–653
- G**
- Gamma treatment, 603
- Gas, 402, 408, 415–419
- Gauge lengths, 225, 226, 229, 231
- Gels, 124, 125, 127, 150
- Geometric properties, 558
- Geotextiles, 117, 638, 648–649, 652
- Glacial acetic acid, 604
- Glass fiber, 484, 615, 618, 637, 644, 646, 650
- Gluconacetobacter xylinus*, 545, 551
- Glycosidic linkage, 540  
 $\alpha$ -1,4 glycosidic linkage, 433
- Good wetting, 83
- Grading systems, 77
- Graft copolymerization, 626
- Grafting, 334, 337, 383, 391
- Grafting copolymerization, 110, 117
- Grafting-from, 560
- Grafting-onto, 560
- Granulation tissue, 571
- Green methods, 531–532
- Griffith's theory, 218
- Growing market, 217
- H**
- Halpin-Tsai equation, 228, 231, 411, 412
- Hammer milling, 64, 75, 80
- Hammers, 75
- Hand lay-up/spray up, 618
- Hardwood, 556
- Harvesting, 72, 74, 84, 87, 594–598
- Health benefits, 64–65, 81
- Heat stability, 493–495
- Hemicellulose, 102, 104, 105, 107, 329–331,  
 333, 348, 361, 364, 365, 367, 368, 438,  
 545, 553, 600, 601, 604, 611, 613, 614,  
 625, 626, 638
- Hemp, 98–100, 102–106, 113, 114, 116, 379,  
 380, 384, 386, 393, 427, 443, 544, 548,  
 556, 558, 562, 563
- Hemp composites, 665–667
- Henequen fiber, 254, 379, 380, 388
- Herbicide, 72, 73
- Hernias, 577
- Hexamethylenetetramine, 337
- Hierarchical composites, 172, 173
- High-density polyethylene (HDPE), 382, 387,  
 388, 390–392
- High-strength materials, 419
- Histograms, 225, 229, 230, 232

- Histology, 564, 566, 567  
 Hollocellulose, 330  
 Homogenization process, 546, 558  
 Human patch test, 573  
 Human skin, 553, 564  
 Humidity, 106, 114  
     fungal disfigurement, 708  
 Hybrid composites, 86  
 Hybrid polymer network, 706–708  
 Hybrid textiles, 86  
 Hydrogel, 547, 563  
 Hydrogen bonding, 541–542  
 Hydrophilic, 83, 84, 158, 159, 172, 333  
 Hydrophilic fibres, 676, 678, 679, 689  
 Hydrophilic flax fibers, 83  
 Hydrophobic, 158–160, 162, 163, 167  
 Hydrophobic polymers, 83  
 Hydroxyl groups, 157, 159, 167, 556, 558,  
     560, 561  
 Hydroxyls, 331, 333  
 Hydroxypropyl cellulose (HPC), 401–410,  
     414, 416–418, 429, 437  
 Hygroscopicity, 549  
 Hyperbolic equation, 233  
 Hypertrophic scars, 572  
 Hypromellose, 437
- I**
- Impact, 706, 711–715, 717  
     properties, 482, 492–493, 497–499  
     strength, 319–322, 608, 621–623, 626–629,  
     631, 632, 636, 637, 643, 644  
 Improved performance, 218  
 IMZ implant, 564  
 Incontinence pads, 547  
 Indigenous fungi, 72  
 Industrial oil, 80, 81  
 Industrial sectors, 222  
 Inguinal hernias, 577  
 Injection molding, 618, 619, 629  
 Inoculating, 567  
 Insecticide, 72  
 Insects, 426, 445  
 In situ chemical polymerization, 547  
 In situ polymerization, 561  
 Insulating/Insulation, 100, 114, 428, 432  
 Intercropping, 596  
 Interface, 326, 327, 332, 337  
 Interface resistance, 246  
 Interfacial, 326, 334, 338  
 Interfacial adhesion, 85, 381, 386, 388, 390,  
     394, 561  
 Interfacial debonding, 252  
 Interfacial shear strength (IFSS), 241–259  
 Interfacial shear stress, 160  
 Interfacial strength, 83, 85  
 Intermolecular, 331  
 Intermolecular hydrogen bond, 541–542  
 Intestinal tube, 576  
 Intramolecular, 331  
 In vivo tissue, 567  
 Ionic liquids (ILs), 531–532  
 Irregularities, 243–245  
 Irrigation, 595, 596  
 Isocyanate-mediated coupling, 561  
 Isocyanates, 85, 111–112, 117  
 Isocyanate treatment, 608, 635  
 Isolation, 541, 546, 549, 555–558, 577  
 Isora fibre, 101–103, 105, 106  
     chemical composition, 295–296  
     chemical reactivity, 299  
     materials and experimental techniques, 295  
     physical and mechanical properties, 296  
     surface morphology, 297–298  
     theoretical strength, 296–297  
     thermal analysis, 300–302  
     wide angle X-ray diffraction studies, 302  
 Isotropic, 402–418
- J**
- Jute, 98–107, 114, 217, 219, 221, 225, 226,  
     230–232, 235, 379, 380, 384–386, 393,  
     427, 428, 443, 544
- K**
- Kenaf fibers, 98, 100, 102–106, 114, 256,  
     257, 544  
 Keratinocytes, 553  
 Keratosis pilaris, 429  
 Keratoconjunctivitis sicca, 437  
 Knee joint, 570, 574  
 Kopak, 219  
 Kraft pulp, 546, 562, 572  
 Kulkarni, 227–229
- L**
- Lactic acid, 456–457  
 Lacuna, 219, 229  
 Laminates, 618, 642, 643  
 Laminectomy, 574  
 Landfiller, 444  
 Land preparation, 595  
*Lantana camara* and Bamboo, proximate  
     analysis, 43, 51  
 Lanthanide alkoxides, 430  
 Larger diameter, 234

- Large scatter, 222, 223, 227  
 Leaf fiber, 100, 112, 219, 230, 231  
 Leaf fibre, 6, 17, 30, 34  
 Leaf sheaths, 219  
 Length, 65–67, 76, 77, 79, 80, 86, 105  
 Light, 82  
 Lignin, 65, 69–71, 81, 84, 102, 104, 105, 107, 110, 111, 219, 222, 330, 331, 333, 348, 361, 364, 365, 367, 368, 545, 549, 553, 559, 600, 601, 604, 608, 611, 613, 615, 616, 625–627, 636, 649  
 Lignin–carbohydrate, 559  
 Lignocellulose-based fibers, chemical composition, 455  
 Lignocellulose fillers (LF), 466–467  
 Lignocellulosic fibers, 215–236, 241–259, 326, 333, 428  
   adhesion, 268, 281, 282, 284, 285  
   flax, 274, 278  
   hemp, 267, 282  
   mercerization, 267, 269, 276  
   modification, 269, 275–277, 282–284  
   nucleation, 264, 271, 277–280, 285  
   pulling, 265–272  
   surface, 274–276, 282, 285  
   topography, 271, 275, 276, 285  
 Lignocellulosics, 4, 6, 8  
 Linear relationship, 228  
 Linear thermal coefficient of expansion, 160  
 Linen, 62–65, 71, 75, 78, 79, 84  
 Lipids, 69, 80  
 Liquid ammonia treatment, 108, 117  
 Liquid-crystalline, 402, 403, 410, 411, 418, 419  
 Long-line fibers, 64, 74, 75  
 Low-density polyethylene (LDPE), 382, 387–389, 392, 514  
 Lower heat value, 80  
 Lumen, 4, 6, 15, 19–21, 219  
 Lyotropic, 403, 404
- M**  
 Macromolecules, 426, 440, 441  
 Magnetic, 540  
 Mammary teats, 574  
 Man-made cellulose fiber, 481–484  
 Marble slurry dust, 642  
 Material performance, 224  
 Matrix, 65, 69, 73, 82–86, 104, 107, 109, 110, 112, 117, 216, 218, 219, 226, 231, 236, 427, 428, 436, 437, 440, 441  
   adhesion, 83  
   materials, 216, 218  
   shear strength, 247  
   Matrix–fiber interface, 231, 236  
   Maximum likelihood technique, 229, 230  
   Maximum packing fraction, 412, 414  
   Mean roughness, 407  
   Mean strength, 225  
   Mechanical disintegration, 545  
   Mechanical interlock, 167, 169, 173  
   Mechanical properties, 79, 82, 83, 87, 244, 255, 256, 258, 601–603, 607, 609, 611–617, 619–622, 624–627, 629–637, 643, 651–653, 664, 665, 667–669, 671, 675–679, 681  
   Mechanical strength, 430, 434, 440  
   Mechanical treatments, 125, 150  
   Medical applications, 150, 564  
   Medical devices, 545, 564  
   Medicine, 545, 547, 564–577  
   Meniscal lesions, 568  
   Meniscal tissue, 569  
   Meniscus, 568–570, 577  
   Meniscus implant, 568–570  
   Mercerization, 108, 112, 117, 333  
   Methacrylate propyl trimethoxy silane, 334  
   Methodology, 218, 219, 224  
   Microbial cellulose, 551, 567, 568, 576  
   Microbial degradation, 441, 445  
   Microbond tests, 243, 244, 255–258  
   Microcrystalline cellulose (MCC), 418, 557, 558  
   Microbond, 243, 257  
   Microdroplet, 255–256  
   Microdroplet test, 255, 256  
   Microfibrillar, 331, 336  
   Microfibrillar cellulose, 123, 150  
   Microfibrillated cellulose (MFC), 121–150, 545–547, 549, 562, 563  
   Microfibrils, 7, 8, 12–14, 16, 21, 26–28, 36, 67, 69, 219–221, 231, 436, 544, 546, 549, 550, 552, 555, 562, 664, 671–673, 675–679, 689  
   Microindentation test, 243, 257, 258  
   Micromechanical method, 244, 252, 255  
   Micromechanical properties, 244  
   Miconerves, 577  
   Microorganisms, 426, 430, 431, 436, 440, 441, 445  
   Microsurgery, 565, 566, 577  
   Microsurgical, 565–567  
   Microsurgical suture, 565  
   Microvessel endoprosthesis, 564–567  
   Microvessel replacement, 565  
   Mineral cellulosic fibril composites  
     abalone shell, 127



- biopolymers, 126–132
- colloidal PCC, 127, 129, 131
- composite PCC, 127–131
- co-precipitation, 127–132
- Hollander, 132–134
- particle size, 129–133
- PCC morphology, 129–132
- pigments, 126–132
- refining, 127, 130, 132–134
- rhombohedral PCC, 127, 129, 130, 132
- scalenoedral PCC, 127, 129–131
- scanning electron microscopy (SEM), 129, 130, 132, 133
- Supermass colloider, 127, 132–134
- surface area, 129, 131–133
- Mineral pigments
  - filler content, 135
  - in situ precipitation, 135
  - Lumen loading, 135
  - magnetic compounds, 135
  - microfines-filler composite, 135
  - papermaking, 134–135
  - preflocculation, 135
- Modeling, 243, 252
- Moisture, 663, 670, 676–679, 683, 685, 693
  - content, 159
- Monomer, 334
- Monosaccharides, 434, 540
- Morphological factors, 223
- Morphology, 215–236
- Mucoadhesive, 563
- Multicellular flax fibers, 65
- N
- Nanocellulose, 150, 544–577
  - esterification, 559
  - film, 559
- Nanocellulosic fibrils, 123, 124, 134–150
- Nanocellulosic gel composites, 123–134
- Nanocellulosic material, 545, 559
- Nanocomposites, 523–524, 661–696
- Nanocrystal production
  - acid hydrolysis, 185–187, 189
  - effect of experimental parameters, 186
  - stability, 186
  - surface charge, 186
- Nanocrystals, 544, 549
- Nanodimension, 546
- Nanofibres, 26–37
- Nanofibrillar cellulose, 144, 150
- Nanofibrillated cellulose (NFC), 121–150
- Nanofibrillated cellulose production
  - carboxymethylation, 185
  - enzymatic hydrolysis, 185
  - mechanical processing, 183, 185
  - TEMPO-mediated oxidation, 185
- Nanofibrils, 27, 28, 33
- Nanomaterials, 546, 550
- Nanoparticle morphology
  - aspect ratio, 190
  - geometry, 189
  - nature, 184
- Nanowhiskers, 540, 544, 563
- NaOH, 230, 246, 256
- Native composite, 545
- Natural fibers, 216–219, 223–227, 231, 236, 243–245, 254, 255, 544, 552, 611–617
  - bast, 379, 380, 383–386
  - leaf, 379, 380, 386–389
  - seed, 379, 389
- Natural fibres, 3–37
  - cellulose, 157, 158, 166, 167, 169–173
  - hemicellulose, 157, 158, 167, 173
  - jute, 701–718
  - lignin, 157, 158, 167, 168, 173
  - pectin, 157, 164–166, 173
  - waxes, 157
- Natural oil polyols (NOPs), 438–439
- Natural rubber composites
  - bonding agent effects, 312, 314–315
  - cure characteristics, 305
  - effect of fibre length, 307
  - fibre breakage, 304–305
  - fibre loading, 313–314
  - fibre orientation effects, 307–308
  - green strength measurements, 306
  - preparation and characterisation, 303–304
- Nature's composite, 65, 82
- Near-infrared spectroscopy, 71, 79, 80
- Needle-punched, 328
- Nerves microsurgery, 565
- Nervus ischiadicus, 565, 566
- Nettle, 100–103, 105, 106
- Neural network, 226, 231
- Never-dried cellulose membranes, 571
- New uses, 222
- Nielsen, L.E., 412
- NIR spectroscopy, 80
- N-isopropylacrylamide, 561
- Nitration, 333, 334
- N-octadecyl isocyanate, 560, 563
- Nodes, 67
- Noncellulosic, 331, 332
- Noncellulosic compounds, 556
- Noncellulosic polysaccharides, 69
- Nonfibrous, 329

- Nonionic surfactants, 559  
 Nonpolar polymers, 559  
 Nonpolar solvents, 559  
 Nontoxic, 651  
 Nonuniform distribution, 229  
 Nonuniformity, 218  
 Nonwood cellulose, 548  
 Nonwood plants, 549  
 Nonwovens, 117, 328, 337, 665  
 North American textile mills, 64  
 Norway spruce, 557  
 Novel composite paper  
   bending stiffness, 138–140  
   bulk, 136, 138, 139  
   cellulosic nanofines, 136  
   composite paper, 136, 141–144  
   consistency, 137, 144, 146  
   FIB-SEM microscopy, 144  
   filled paper, 135  
   fracture toughness, 138, 141–143  
   glue, 136  
   handsheets, 137–146  
   honeycomb structure, 145  
   light scattering, 138, 144, 145  
   optical properties, 135, 136  
   PCC content, 137–142, 144  
   permeability, 140  
   precipitated calcium carbonate (PCC),  
     135–146  
   reinforcing fibres, 137, 142, 143  
   strength, 135–138, 140–144  
   strengthening agents, 136  
   Supermass colloid, 137, 146  
 Nucleating agent, 394  
 Nursery, 594–595  
 Nutraceutical, 81  
 Nutritional oil, 81  
 Nutritional uses, 80
- O**
- Oil based nanocomposites, 527  
 Oilseed, 63, 64, 71, 84  
 Oligosaccharides, 434, 559  
 Omega-3, 81  
 Omega-3 fatty acids, 64, 65, 81  
 Opening and cleaning equipment, 76  
 Optical properties, 135, 136, 150  
 Optimized derivatives  
   characterization, 56–57  
   rheology, 56–57  
 Order parameter, S, 404, 405, 410, 411, 413  
 Oregon, 63  
 Organic fatty acid chlorides, 559  
 Osseous defects/Osseus defects, 564, 568  
 Osteoarthritis, 568  
 Osteochondral, 574  
 Oxidase, 432  
 Oxidation, 558, 560  
 Oxidative polymerization, 561  
 Oxygen-permeable polymer, 567
- P**
- Packaging material, 427–429, 442–443, 628,  
   637, 649, 652  
 PALF nanocellulose, 549  
 Palm, 111, 112, 556  
 Palmyrah, 224  
 Paper, 121–150  
 Paracrystalline, 555  
 Parapatellar skin incision, 574  
 Parenchyma cells, 69  
 Patella, 574, 575  
 PCC-cellulosic fibril composites  
   air permeability, 148  
   bending stiffness, 148, 149  
   composite fillers, 147–149  
   composite handsheets, 147  
   density, 147, 148  
   fines, 146–148  
   internal bond strength, 148  
   light scattering, 148, 149  
   network structure, 147, 149  
   optical pores, 149  
   PCC morphology, 131, 147–150  
   reference handsheets, 147  
   Supermass colloid, 146  
 Peanut oil, 439  
 Pectin, 102, 104, 105, 330, 332  
 Pelvic floor, 576  
 Peptide coupling, 561  
 PE-rayon: 20  
 Percolation effect, 473  
 Peripheral nerves, 574  
 Permanganate treatment, 604–606, 625  
 Permeability, 84, 416–418  
 Permeation, 415, 416  
 Peroxide treatment, 85, 607, 625, 636, 637  
 Pesticide, 72  
 Petroleum-based polyesters  
   biodegradable aliphatic copolyesters, 462  
   biodegradable aromatic copolyesters, 462  
   polycaprolactone, 461–462  
 Pharmaceuticals, 545  
 PHB-rayon, 502–504  
 Phenol formaldehyde, 562  
 Photodegradation, 426, 440, 441, 509, 512–515

- Photo-oxidation resistance, 444
- Physical methods, 107, 602–611
- Physical treatments, 107
- Physico-chemical, 611–617
- Piassava, 219, 220, 232, 233, 235, 243, 246, 250–252
- Pineapple, 219, 221, 222, 224, 544, 549
- Pineapple leaf, 325–339, 379, 380, 388–389, 544, 549
- PLA/MFC, 563
- Plantation, 593, 595–597
- Plant fibers, 544, 592, 601–603, 611, 617, 643–646, 652
- PLA-rayon, 498–502
- Plasma
  - abrasion, 160
  - atmospheric pressure, 162–163
  - cleaning, 160
  - crosslinking, 160
  - etching, 161, 162
  - free radicals, 160
  - functionalisation, 160
  - low pressure, 160–162
  - treatment, 381, 383, 602, 635
- Plastic deformation, 409
- Plasticizers, 432, 435
- Plastics, 116, 150
- Polarized optical microscopy (POM), 402, 403
- Polyaniline, 561
- Polyanionic, 560
- Poly-anion cellulose (PAC), 437
- Polybutylene succinate (PBS), 435
- Polybutylene succinate adipate (PBSA), 435
- Polycaprolactone (PCL), 431, 461–462, 560, 561, 563
- Poly- $\epsilon$ -caprolactone (PCL), 429, 431
- Polyelectrolyte multilayers (PEMs), 563
- Polyester, 223, 225, 236, 243, 246, 250–252, 258
- Polyester-based composites, 235
- Polyester composites, 621, 622, 626, 628
  - characterisation, 317
  - dynamic mechanical thermal analysis, 317–318
  - flexural properties, 318–319
  - impact strength, 319–322
  - preparation, 315–317
  - tensile properties, 318
- Polyester matrix, 258
- Polyesters, 427, 429, 430, 432, 434–435
- Polyglycolic acid (PGA), 429–430
- Polyhydroxyalkanoates (PHAs), 430–431, 459–461
- Polyhydroxybutyrate (PHB), 430, 564
- Poly (3-hydroxybutyrate-co-3-hydroxyvalerate) (PHBV), 515
- Polyhydroxyoctanoate (PHO), 430, 431, 563, 564
- Poly(lactic acid) (PLA), 338, 428–429, 434, 443, 456–459, 515, 559, 563
- Poly(oxyethylene), 563
- Poly(styrene-co-butyl acrylate) latex, 562, 563
- Polymer, 107, 109–114, 116, 117, 243, 345–370
  - composites, 241–259, 547, 589–653
  - grafting, 558, 560
  - matrix, 600, 615, 620, 629, 634, 636, 651
- Polymer-based composites, 231
- Polymeric coating, 609–611
- Polymeric fibers, 223, 226
- Polymeric matrices, 244, 245, 247, 250, 252, 258, 259
- Polymeric resins, 257
- Polymorphic, 558
- Polymorphs, 541
- Polypropylene, 511, 514
  - $\beta$ -phase, 265
  - composite, 264, 265, 268, 270–285
  - crystallization, 271, 272, 274, 277–280
  - functions, 226
  - MAH grafted PP, 384, 387, 389
  - nucleation, 274, 277–280, 285
  - polymorphism, 265
  - processing, 264, 265, 282
  - structure, 265, 266
- Polypyrrole, 547
- Polysaccharide, 433–440
- Polysiloxanes, 335, 563
- Polystyrene, 258, 515
- Polysulfonates, 563
- Polytetrafluoroethylene (ePTFE), 575
- Polyurethane, 561, 563
- Poly(vinyl acetate), 563
- Poly(vinyl alcohol) (PVA), 515–516, 562, 563
- Polyvinyl chloride, 563, 567
- Postsurgery, 564
- Poultry feed, 82
- PP-rayon, 490–496
- Prehistoric, 62
- Premature rupture, 233
- Pre-treatment, 676, 677, 683
- Probability, 224, 226, 229, 230, 233, 234
- Probability density, 226, 229
- Probability density function (PDF), 226, 231
- Probability plot, 229, 234
  - techniques, 230
- Processing, 598–599, 601, 612, 617, 618, 637, 638, 640, 644, 649, 650, 653

- Processing condition, 242, 250, 252, 256  
 Processing extrusion, 271  
 Processing fiber pulling, 272  
 Processing injection molding, 271–272, 284  
 Processing of cellulose nanocomposites  
   electrospinning, 194–195  
   extrusion, 193  
   hydrodispersable polymers, 191  
   hydrosoluble polymers, 191  
   impregnation, 194  
   layer-by-layer films, 196  
   long chain grafting, 192–193, 195  
   nonaqueous, 191–192  
   polymer latexes, 190–191  
 Processing press molding, 272, 283, 284  
 Producers, 593, 594  
 Profiles, 716  
 Properties, 217–224, 226, 231, 232, 235, 236,  
   601–604, 606, 607, 609, 611–637, 640,  
   642–644, 647, 650–653  
 Protein, 5–6, 24, 550, 563  
 Protein nanocomposites, 526  
 Pseudo-plastic, 150  
 PU-cellulose, 562  
 Pullers, 73, 74  
 Pullout, 244–259  
   mechanism, 250  
   test, 244–247, 249, 250  
 Pultrusion, 618  
 Pyrolysis, 349, 351, 358–360, 362, 363,  
   365, 366
- Q**
- Quality fibers, 219  
 Quasi-stationary, 226
- R**
- Radiation, 110  
 Railways, 638, 648–650, 652  
 Ramie fibers, 98–106, 219, 222, 232–236, 250,  
   252, 255–257, 443, 555  
 Random distribution, 226  
 Raspador, 597–599, 609, 637, 638, 649, 652  
 Reactor, fluidized bed, 351, 353, 354, 357, 358  
 Reconstruction of nerves, 577  
 Recyclable, 394  
 Red mud, 628, 642, 643  
 Reepithelialization process, 553, 571  
 Regenerated cellulose, 563  
 Reinforcement, 98, 99, 101, 112–117,  
   215–236, 242, 243, 246, 612, 617, 621,  
   622, 634, 637, 638, 643, 646, 647,  
   651, 652
- Renewable biosources, 540  
 Renewable material, 216, 544  
 Renewable resources, 98, 116  
 Resins, 81, 85  
 Resin transfer moulding (RTM), 84, 618, 621,  
   683, 691–692  
 Resorcinol, 337  
 Retinaculum, 574, 575  
 Retroperitoneum, 577  
 Retting, 9–11, 219, 329, 333  
   dew, 164, 165, 167, 173  
   enzyme, 164–166, 173  
   natural, 168  
   water, 163–164, 173  
 Rheological behavior, 335, 390, 556  
 Rheology, 563  
 Rice, 549  
 Rice husks, 345–370  
 Rigorous cleaning techniques, 75  
 Ring-opening polymerization (ROP), 430,  
   431, 561  
 Rod-like nanocellulose, 556  
 Rollertop card, 76, 78  
 Roofing/Roofing sheet, 637, 640, 641, 643,  
   650, 703  
 Rubber, 347, 349, 357, 367–370  
   composites, 323  
 Ruminants, 436
- S**
- Sanitary napkins, 547  
 Scaffold, 549, 564, 567  
 Scanning electron microscope (SEM), 232,  
   251, 445, 609, 610, 624, 626  
 Scatter properties, 218, 222  
 Scatter strength properties, 231  
 Scutching wheel, 76, 77  
 Seed fibers, 100  
   cotton, 379, 389, 394  
 Self-reinforcing, 418  
 Serrations, 248, 250  
 Shape determining factor, 230  
 Shear deformation, 636  
 Shear rate, 403, 404  
 Shear strength, 241–259, 625  
 Shive, 65, 69, 71, 73, 75–77, 80, 81, 84, 86  
 Shive-containing fiberboards, 80  
 Short fibre composites (SFCs), 404, 411, 412  
 Silane treatment, 381, 382, 606–607, 625  
 Silanization, 109, 117  
 Silica, 347–360, 362, 364, 368–370  
 Silk, 5, 6, 24  
 Silylation, 558–560

- Simulations, 226
- Single fiber fragmentation (SFF), 243, 252–255, 258
- Single fiber pullout (SFP) test, 244–246
- Sisal fiber-reinforced–fly ash cement roofing sheets, 641
- Sisal fibers, 98–100, 217, 219–224, 226, 229–233, 235, 236, 246, 250–252, 258, 379, 380, 382, 386–388, 394, 544, 548, 556, 558, 589–653
  - composites, 638–644
  - waste, 651
- Sisal growth, 595
- Sisal-production, 597–598
- Skin-cleansing cloths, 547
- Skin grafting, 553, 564, 571, 577
- Skin wounds, 553
- Small angle light scattering (SALS), 402, 404, 411, 413
- Smaller diameter, 234
- Soft contact lens, 562
- Soft tissue, 554, 576
- Soft tissue augmentation material, 554
- Softwood, 556, 558
- Solid dosage forms, 547
- Songe gourde, 219, 243
- Sonication/cavitation techniques, 73
- Sorghum, 549
- Sorption, 106, 107
- Soy bean oil, 439
- Soy beans, 439, 440
- Soybean stock-based nanofiber, 562
- Soy plastics, 439–440
- Spherical nanocelluloses, 557
- Stability, 604, 625, 628, 635, 644, 651
- Standard deviations, 236
- Standardization, 718
- Stand-retting, 73
- Starch, 433–436, 440, 441, 443
- Starch-aliphatic polyester blends, 434–435
- Starch-based biodegradable polymers, 433–434
- Starch-based polymers, 563
- Starch nanocomposites, 525
- Static friction coefficient, 160
- Statistical analysis, 223, 226, 229, 232, 236, 249
- Statistical approach, 218, 226, 231
- Statistical distribution, 231–233
- Statistical distribution function, 231
- Statistical evaluation, 222
- Statistical model, 226, 231, 236
- Statistical techniques, 254
- Statistic methods, 244
- Steam explosion techniques, 73
- Stearic acid treatment, 606, 625
- Stem, 101, 102
- Stick–slip, 248, 250
- Stiffness, 608, 617, 627, 628, 644, 651, 677–679, 685, 686, 689, 693, 695
- Storage modulus, 563
- Strength, 65, 67, 71, 73, 74, 77, 79, 80, 82–87
- Strengthening mechanism, 219, 236
- Strength–length dependency, 231
- Strength properties, 135, 141, 149
- Strength variation, 223, 224, 229
- Stress transfer, 171
- Strong, 65, 71, 82, 83, 86, 87
- Structural defects, 233, 243
- Structural hierarchy, 541
- Structural parameters, 215
- Structure, 593, 594, 600, 601, 603, 606, 611, 623–625, 628, 635, 636
- Structure of natural fibers, 104
- Styrenebutyl acrylate latex, 563
- Subcutaneous tissue, 571, 574, 576
- Subjectively judged, 79
- Submicron, 546
- Sugar beet pulp, 556, 562
- Sugarcane, 217, 219, 221, 549
- Superabsorbents, 435
- Superficial, 571
- Superior performance, 219, 236
- Surface acetylation, 559
- Surface cationization, 559
- Surface chemical treatment, 246, 254, 259
- Surface energy, 160, 558
- Surface modification, 107, 111, 601–617, 625, 635, 637
  - chemical, 381, 392
  - physical, 381
  - silane coupling agent, 392, 393
- Surface-modified nanocellulose, 559
- Surface roughness, 160, 168
- Surface treatment, 71, 83–85, 87, 155–173
- Surfactant, 558, 559, 563
- Sustainability, 217
- Sustainable development, 217
- Sutures, 565–567, 569, 570, 574–576
- Swelling, 107, 117
- Synthetic fibers, 216–218, 222–225, 227, 232, 242–244, 249, 255, 257–259
- Synthetic fibre
  - carbon, 156, 160
  - glass, 156, 173
- Synthetic polymers, 217

- T**
- Takayanagi's model, 474
- Talipot fibers, 224
- Technical textiles, 117
- TEMPO-oxidized, 560
- Tensile properties, 219, 221, 226, 231, 482, 490–492, 494–499, 501–502, 504, 609, 621, 624, 626, 633–635
- Tensile rupture, 250, 251
- Tensile strength, 65, 67, 83, 87, 106, 112, 218, 219, 221, 223, 229–231, 233, 235, 236, 247, 249, 663–666, 668, 669, 671, 675, 676, 678–680, 684, 686
- Tensile stress, 408, 414
- Tensile test, 244, 247, 253
- Termites, 436
- Test lengths, 223, 228
- Textiles, 379, 389
- Theoretical strength, 296–297
- Therapeutic application, 553
- Thermal analysis, 300–302, 445
- Thermal-degradation, 426
- Thermal expansion coefficient, 548, 553, 562
- Thermal gravimetric analysis (TGA), 612, 614, 625
- Thermal properties, 613–615, 623
- Thermal stability, 553, 557, 577, 665, 668, 672, 674, 680–682
- Thermogravimetric, 331, 335
- Thermoplastic composites, 378, 628–630, 632, 634, 635
- Thermoplastic matrices, 254
- Thermoplastic polymer composite, 628–637
- Thermoplastics, 427–429, 432, 434
- Thermoset, 427, 432, 440
- Thermoset polymer composite, 619–620, 626–628
- Thermotropic, 403
- Thinner fibers, 218, 232–234
- Thixotropic behavior, 556
- Tissue-engineered application, 549
- Tissue-engineered constructs, 549
- Tissue regeneration, 577
- T50-median, 230
- Topography, 402, 404, 405
- Top shaker, 76, 77
- Total rupture, 233
- Trachea, 576
- Transparent, 547, 548, 553, 554, 562, 564
- Transparent cellulose, 562, 564
- Triglycerides, 167
- Trimethoxy silane, 334
- Trochlear groove, 574, 575
- Trochleoplasty, 574, 576
- Tunicates, 540, 541, 544, 549, 550, 555, 556, 559–561
- Tunicin, 550, 551, 558
- Turners, 73, 74
- Two nonlinear equations, 229
- Two-parameter analysis, 224
- Two parameters, 227, 229, 230
- U**
- Ulcers, 564, 571, 572, 577
- Ultimate fibers, 79
- Ultrasonic treatment, 556, 558
- Uniform distribution, 229
- Unimodal, 224, 225, 229, 233
- Unimodal distribution, 224, 225
- United States Department of Agriculture 1995, 78
- Universal Standards, 79
- Unsaturated polyester resin, 294, 705–707, 710, 711
- Unsaturation, 432
- Urea–formaldehyde composite, 623
- Ureter, 576
- US Cotton Standards Act, 78
- USDA Flax Pilot Plant (Flax-PP), 73, 75, 76
- V**
- Vacuum-assisted resin transfer molding (VARTM), 84
- Valonia* cellulose, 555
- Variety, 593, 595, 615, 617, 623, 643
- Vascular wall, 565
- Vegetable fibers, 455
- Vegetable oils, 438, 439
- Velocity, fluidizing, 353–357
- Vermicomposting, 650
- Vessel implants, 565
- Veterinary medicine, 564, 574–577
- Vinyl monomers, 561
- Vitro scaffold, 567
- Voids, 230, 231
- Volume fraction, 617, 619, 620, 622, 634, 651
- W**
- Wall panels, Gelcoat, 717
- Warts, 429
- Waste, 99, 113, 116, 346, 348, 359, 369, 370 management, 650
- Water absorption, 606, 618, 622–624, 629, 642, 644
- Water resistant, 440, 442
- Water-retting, 73, 85

- Water uptake, 704, 711
  - Wax, 65, 69–71, 80, 81, 85
  - Wax content, 80
  - Weak links, 233
  - Weak points, 244, 245
  - Weeds
    - industrial feedstock, 57
    - management, 51, 57
  - Weibull analysis, 218, 222–227, 229, 230, 232, 236, 244
  - Weibull distribution, 224, 225, 229, 230, 232, 236, 253
  - Weibull method, 249
  - Weibull model, 225, 230, 236
  - Weibull modulus, 224, 229
  - Weibull parameters, 224, 253
  - Weibull plots, 225
  - Weibull-weak link, 224
  - Wettability, 71, 159–162, 173
  - Wheat/Wheat straw, 549, 556, 558
  - Wood, 100, 109, 112, 114, 116
    - composites, 668–671
    - fibers, 544, 546, 547
    - nanocellulose, 547
    - pulp, 545, 546
    - substitute, 640, 642–643, 645
  - Wood fiber, bamboo, 379, 390, 394
  - Wool fibers, 223–226
  - Wound covering bandage, 562
  - Wound dressings, 564, 571
  - Wound healing, 553, 571, 572, 577
  - Wrinkle resistance, 432
- X**
- Xerophyte, 647
  - Xyloglucan, 559
- Y**
- Yarns, 637, 638, 640, 650, 652
  - Yeasts, 426, 445
  - Yield, 593, 594, 597, 600, 650, 651
  - Yield stress, 408, 409, 414, 415
  - Young's modulus, 218, 221, 230, 231, 411, 412, 547, 548, 553, 562, 563, 569, 570
- Z**
- Zeta potential, 167