

The Global Market for Cellulose Nanofibers 2022

https://marketpublishers.com/r/GFA426D2B19FEN.html

Date: January 2022

Pages: 349

Price: US\$ 1,400.00 (Single User License)

ID: GFA426D2B19FEN

Abstracts

Cellulose nanofibers (CNF), also called cellulose nanofibrils or nanofibrillated cellulose, are sustainable materials with high mechanical strength and stiffness (stronger than steel), high aspect ratios, high transparency, high chemical resistance and impressive rheological, optical and film-forming properties. They are also lightweight and have made a recent impact in industrial applications in biopolymers, bio-composites and hygiene and sanitary products.

Industrial products have been introduced to the market recently in packaging, composites and thermoplastics, biomedicine and hygiene, mainly in the Japanese market. Advanced applications in paper batteries and flexible electronics are also expected once current processing challenges have been overcome.

CNF production is now at the industrial scale, with numerous large paper manufacturers establishing multi-ton production facilities. Japanese chemicals manufacturers have also initiated cellulose nanofiber production capabilities. Facilities have also been established in Europe (mainly Scandinavia), Canada and the United States.

Report contents include:

Global production capacities, by CNF producer, current and planned.

Production volumes by region.

Commercialized products on the market incorporating CNFs.

Stage of commercialization for cellulose nanofiber applications by company (TRL).



CNF applications by industry.

Demand in tons per market, current and forecast to 2032.

Market drivers, trends and challenges, by end user markets.

Competitive landscape of CNF by market, volumes, key trends and growth. Potential for CNF to gain market share by market volume across all end user markets. Markets covered include Polymer composites, Automotive, Building & Construction, Packaging, Textiles, Biomedicine, Pharma, Healthcare, Sanitary and Hygiene Products, Paints & Coatings, Aerogels, Oil & Gas, Filtration, Cosmetics, Food Additives, Electronics, Batteries, Aerospace and 3D printing.

In-depth market assessment of opportunities for CNF including potential revenues, growth rates, pricing, most likely applications and market challenges.

In-depth analysis of market by applications including estimated market size, penetration and growth. Applications covered include: Polymer composite parts; Biodegradable and renewable nanocomposites; Automotive composites; Packaging films; Aerogels; Construction materials; Packaging fillers/additives; Paint and coatings additives; Deodorant sheets; Pharmaceutical additives; Renewable plastic parts/casings; Transparent films for electronics; Flexible and printed electronics; Batteries; Flexible and paper batteries; Filtration membranes.

In-depth key player profiles of 91 companies, including products, current capacities and plans for new capacities, production processes, prices per kg and commercial activities. Companies profiled in the report include Asahi Kasei, Chuetsu Pulp & Paper Daicel, Daiichi Kogyo, Daio Paper, GranBio Technologies, Nippon Paper, Oji Holdings, Sugino Machine, Seiko PMC and more.



Contents

1 EXECUTIVE SUMMARY

- 1.1 The market for cellulose nanofibers
- 1.2 Industry developments 2020-22
- 1.3 Market outlook in 2022 and beyond
- 1.4 Global production of nanocellulose (cellulose nanofibers, microfibrillated cellulose and cellulose nanocrystals)
 - 1.4.1 Global nanocellulose production capacities 2021, by type
- 1.4.2 Cellulose nanofibers (CNF) production capacities 2022, in metric tonnes by producer
 - 1.4.3 Microfibrillated cellulose (MFC) production capacities 2022
 - 1.4.4 Cellulose nanocrystals (CNC) production capacities 2022
- 1.5 Market challenges for cellulose nanofibers
- 1.6 Cellulose nanofibers commercial products
- 1.7 Cellulose nanofibers market by region
 - 1.7.1 Japan
 - 1.7.2 China
 - 1.7.3 Malaysia
 - 1.7.4 Western Europe
 - 1.7.5 North America
- 1.8 Global government funding
- 1.9 Market impact from COVID-19 crisis

2 OVERVIEW OF NANOCELLULOSE

- 2.1 Cellulose
- 2.2 Nanocellulose
- 2.3 Properties of nanocellulose
- 2.4 Advantages of nanocellulose
- 2.5 Manufacture of nanocellulose
- 2.6 Production methods
- 2.7 Types of nanocellulose
 - 2.7.1 Microfibrillated cellulose (MFC)
 - 2.7.2 Cellulose nanofibers (CNF)
 - 2.7.2.1 Applications
 - 2.7.3 Cellulose nanocrystals (CNC)
 - 2.7.3.1 Synthesis



- 2.7.3.2 Properties
- 2.7.3.3 Applications
- 2.7.4 Bacterial Nanocellulose (BNC)
 - 2.7.4.1 Applications
- 2.8 Synthesis

3 MARKET OPPORTUNITIES IN CELLULOSE NANOFIBERS

4 REGULATIONS AND STANDARDS

- 4.1 Standards
 - 4.1.1 International Standards Organization (ISO)
 - 4.1.2 American National Standards
 - 4.1.3 CSA Group
- 4.2 Toxicity
- 4.3 Regulation

5 CELLULOSE NANOFIBERS SUPPLY CHAIN

6 CELLULOSE NANOFIBERS PRICING

7 MARKETS FOR CELLULOSE NANOFIBERS

- 7.1 Composites
 - 7.1.1 Market overview
 - 7.1.2 Applications
 - 7.1.2.1 Automotive composites
 - 7.1.2.2 Biocomposite films & packaging
 - 7.1.2.3 Barrier packaging
 - 7.1.2.4 Thermal insulation composites
 - 7.1.2.5 Construction composites
 - 7.1.3 Global market in tons to 2032
 - 7.1.4 Product developers
- 7.2 Automotive
 - 7.2.1 Market overview
 - 7.2.2 Applications
 - 7.2.2.1 Composites
 - 7.2.2.2 Air intake components
 - 7.2.2.3 Tires



- 7.2.3 Global market in tons to 2032
- 7.2.4 Product developers
- 7.3 Buildings and construction
 - 7.3.1 Market overview
 - 7.3.2 Applications
 - 7.3.2.1 Sandwich composites
 - 7.3.2.2 Cement additives
 - 7.3.2.3 Pump primers
 - 7.3.2.4 Thermal insulation and damping
 - 7.3.3 Global market in tons to 2032
 - 7.3.4 Product developers
- 7.4 Paper and board packaging
 - 7.4.1 Market overview
 - 7.4.2 Applications
 - 7.4.2.1 Reinforcement and barrier
 - 7.4.2.2 Biodegradable food packaging foil and films
 - 7.4.2.3 Paperboard coatings
 - 7.4.3 Global market in tons to 2032
 - 7.4.4 Product developers
- 7.5 Textiles and apparel
 - 7.5.1 Market overview
 - 7.5.2 Applications
 - 7.5.2.1 CNF deodorizer and odour reducer (antimicrobial) in adult and child diapers
 - 7.5.2.2 Footwear
 - 7.5.3 Global market in tons to 2032
 - 7.5.4 Product developer profiles
- 7.6 Biomedicine and healthcare
 - 7.6.1 Market overview
 - 7.6.2 Applications
 - 7.6.2.1 Wound dressings
 - 7.6.2.2 Drug delivery stabilizers
 - 7.6.2.3 Tissue engineering scaffolds
 - 7.6.3 Global market in tons to 2032
 - 7.6.4 Product developers
- 7.7 Hygiene and sanitary products
 - 7.7.1 Market overview
 - 7.7.2 Applications
 - 7.7.3 Global market in tons to 2032
 - 7.7.4 Product developers



- 7.8 Paints and coatings
 - 7.8.1 Market overview
 - 7.8.2 Applications
 - 7.8.3 Global market in tons to 2032
 - 7.8.4 Product developers
- 7.9 Aerogels
 - 7.9.1 Market overview
 - 7.9.2 Global market in tons to 2032
 - 7.9.3 Product developers
- 7.10 Oil and gas
 - 7.10.1 Market overview
 - 7.10.2 Applications
 - 7.10.2.1 Oil recovery applications (fracturing fluid)
 - 7.10.2.2 CNF Membranes for separation
 - 7.10.2.3 Oil and gas fluids additives
 - 7.10.3 Global market in tons to 2032
 - 7.10.4 Product developers
- 7.11 Filtration
 - 7.11.1 Market overview
 - 7.11.2 Applications
 - 7.11.2.1 Membranes for selective absorption
 - 7.11.3 Global market in tons to 2032
 - 7.11.4 Product developers
- 7.12 Rheology modifiers
 - 7.12.1 Market overview
 - 7.12.2 Applications
 - 7.12.2.1 Food additives
 - 7.12.2.2 Pickering stabilizers
 - 7.12.2.3 Hydrogels
 - 7.12.3 Global market in tons to 2032
 - 7.12.4 Product developers
- 7.13 Other markets
 - 7.13.1 Printed, stretchable and flexible electronics
 - 7.13.1.1 Market assessment
 - 7.13.1.2 Product developers
 - 7.13.2 3D printing
 - 7.13.2.1 Market assessment
 - 7.13.2.2 Product developers
 - 7.13.3 Aerospace



7.13.3.1 Market assessment

7.13.3.2 Product developers

7.13.4 Batteries

7.13.4.1 Market assessment

8 CELLULOSE NANOFIBER COMPANY PROFILES

9 RESEARCH SCOPE AND METHODOLOGY

9.1 Report scope

9.2 Research methodology

10 REFERENCES



List Of Tables

LIST OF TABLES

- Table 1. Markets and applications for cellulose nanofibers and TRL.
- Table 2. Cellulose nanofibers market in 2020-2022-industry product and production activity.
- Table 3. Classification of Cellulose nanofibers applications by type of industrial product ranged in terms of their potential of consumption.
- Table 4. CNF production capacities (by type, wet or dry) and production process, by producer, metric tonnes.
- Table 5. MFC production capacities in metric tonnes and production process, by producer, metric tonnes.
- Table 6. Global demand for cellulose nanofibers/MFC by market in metric tonnes, 2018-2032.
- Table 7: Cellulose nanocrystal capacities (by type, wet or dry) and production process, by producer, metric tonnes.
- Table 8. Global demand for cellulose nanocrystals by market, 2018-2030.
- Table 9. Market and technical challenges in Cellulose nanofibers.
- Table 10. Cellulose nanofibers-based commercial products.
- Table 11. Regional demand for cellulose nanofibers, 2020, tons (total excludes MFC).
- Table 12. Cellulose nanofibers producers and product developers in Japan.
- Table 13. Cellulose nanofibers research centres, universities and companies in China.
- Table 14. Cellulose nanofibers producers and product developers in Europe.
- Table 15. Cellulose nanofibers producers and product developers in North America.
- Table 16. Assessment of impact from COVID-19 crisis by end user market.
- Table 17. Properties and applications of nanocellulose.
- Table 18. Properties of nanocellulose, by type.
- Table 19. Properties of cellulose nanofibrils relative to metallic and polymeric materials.
- Table 20. Types of nanocellulose.
- Table 21. Types of nanocellulose.
- Table 22. Applications of cellulose nanofibers (CNF).
- Table 23. Synthesis methods for cellulose nanocrystals (CNC).
- Table 24. CNC sources, size and yield.
- Table 25. CNC properties.
- Table 26. Mechanical properties of CNC and other reinforcement materials.
- Table 27. Applications of nanocrystalline cellulose (NCC).
- Table 28. Applications of bacterial nanocellulose (BNC).
- Table 29. Market opportunity assessment for Cellulose nanofibers, by application.



- Table 30. Safety of Micro/Nanofibrillated cellulose.
- Table 31. Global Cellulose nanofibers market supply chain analysis.
- Table 32. Product/price/application matrix of cellulose nanofiber producers.
- Table 33. Market overview for nanocellulose in composites.
- Table 34. Comparative properties of polymer composites reinforcing materials.
- Table 35. Scorecard for cellulose nanofibers in composites.
- Table 36. Market assessment for cellulose nanofibers in composites-application, key benefits and motivation for use, megatrends, market drivers, technology drawbacks, competing materials, material loading, main global composites OEMs.
- Table 37. Global market demand for cellulose nanofibers in composites, 2018-2032 (metric tonnes).
- Table 38. Companies developing cellulose nanofibers composites.
- Table 39. Market overview for cellulose nanofibers in automotive.
- Table 40. Scorecard for cellulose nanofibers in automotive.
- Table 41. Market assessment for cellulose nanofibers in automotive-application, key benefits and motivation for use, megatrends, market drivers, technology drawbacks, competing materials, material loading, main global automotive OEMs.
- Table 42. Components featured in the NCV.
- Table 43. Global market demand for cellulose nanofibers in the automotive sector 2018-2032 (tons).
- Table 44. Companies developing cellulose nanofibers products in the automotive industry.
- Table 45. Market overview for cellulose nanofibers in construction.
- Table 46. Scorecard for cellulose nanofibers in construction
- Table 47. Market assessment for cellulose nanofibers in construction-application, key benefits and motivation for use, megatrends, market drivers, technology drawbacks, competing materials, material loading, main global construction OEMs
- Table 48: Market demand for cellulose nanofibers in construction, 2018-2032 (tons).
- Table 49. Companies developing cellulose nanofibers in construction.
- Table 50. Oxygen permeability of nanocellulose films compared to those made form commercially available petroleum-based materials and other polymers.
- Table 51. Scorecard for cellulose nanofibers in paper and board packaging.
- Table 52. Market assessment for cellulose nanofibers in paper and board packaging-application, key benefits and motivation for use, megatrends, market drivers, technology drawbacks, competing materials, material loading, main global paper and board packaging OEMs.
- Table 53. Global demand for cellulose nanofibers in paper & board packaging, 2018-2032 (tons).
- Table 54. Companies developing cellulose nanofibers products in paper and board.



- Table 55. Market overview for cellulose nanofibers in textiles and apparel.
- Table 56. Scorecard for cellulose nanofibers in textiles and apparel.
- Table 57. Market assessment for cellulose nanofibers in textiles and apparelapplication, key benefits and motivation for use, megatrends, market drivers, technology drawbacks, competing materials, material loading, main global textiles and apparel OEMs.
- Table 58. Demand for cellulose nanofibers in textiles, 2018-2032 (tons).
- Table 59. Companies developing nanocellulose products in textiles and apparel.
- Table 60. Market overview for cellulose nanofibers in medicine and healthcare.
- Table 61. Scorecard for cellulose nanofibers in medicine and healthcare.
- Table 62. Market assessment for cellulose nanofibers in medicine and healthcareapplication, key benefits and motivation for use, megatrends, market drivers, technology drawbacks, competing materials, material loading, main global medicine and healthcare OEMs.
- Table 63. Global demand for cellulose nanofibers in medical and healthcare, 2018-2032 (tons).
- Table 64. Cellulose nanofibers product developers in medicine and healthcare.
- Table 65. Market overview for cellulose nanofibers in the hygiene and sanitary products market.
- Table 66. Global demand for cellulose nanofibers in hygiene, 2018-2032 (tons).
- Table 67. Cellulose nanofibers product developers in hygiene and sanitary products.
- Table 68. Market overview for cellulose nanofibers in paints and coatings.
- Table 69. Scorecard for cellulose nanofibers in paints and coatings.
- Table 70. Market assessment for cellulose nanofibers in paints and coatingsapplication, key benefits and motivation for use, megatrends, market drivers, technology drawbacks, competing materials, material loading, main global paints and coatings OEMs.
- Table 71. Global demand for cellulose nanofibers in paint and coatings, 2018-2032 (tons).
- Table 72. Companies developing cellulose nanofibers products in paints and coatings, applications targeted and stage of commercialization.
- Table 73. Market overview for cellulose nanofibers in aerogels.
- Table 74. Scorecard for cellulose nanofibers in aerogels.
- Table 75. Market assessment for cellulose nanofibers in aerogels-application, key benefits and motivation for use, megatrends, market drivers, technology drawbacks, competing materials, material loading, main global aerogels OEMs.
- Table 76. Global demand for cellulose nanofibers in aerogels, 2018-2032 (tons).
- Table 77. Cellulose nanofibers product developers in aerogels.
- Table 78. Market overview for cellulose nanofibers in oil and gas.



- Table 79. Scorecard for cellulose nanofibers in oil and gas.
- Table 80. Market assessment for cellulose nanofibers in oil and gas-application, key benefits and motivation for use, megatrends, market drivers, technology drawbacks, competing materials, material loading, main global oil and gas OEMs.
- Table 81. Global demand for cellulose nanofibers in the oil and gas market, 2018-2032 (tons).
- Table 82. Cellulose nanofibers product developers in oil and gas exploration.
- Table 83. CNF membranes.
- Table 84. Market overview for cellulose nanofibers in filtration.
- Table 85. Scorecard for cellulose nanofibers in filtration.
- Table 86. Market assessment for cellulose nanofibers in filtration-application, key benefits and motivation for use, megatrends, market drivers, technology drawbacks, competing materials, material loading, main global filtration OEMs.
- Table 87: Global demand for cellulose nanofibers in the filtration market, 2018-2032 (tons).
- Table 88. Companies developing cellulose nanofibers products in filtration.
- Table 89. Market overview for cellulose nanofibers in rheology modifiers.
- Table 90. Scorecard for cellulose nanofibers in rheology modifiers.
- Table 91. Market assessment for cellulose nanofibers in rheology modifiers-application, key benefits and motivation for use, megatrends, market drivers, technology drawbacks, competing materials, material loading, main global rheology modifier OEMs.
- Table 92. Global demand for cellulose nanofibers in the rheology modifiers market, 2018-2032 (tons).
- Table 93. Commercial activity in cellulose nanofibers rheology modifiers.
- Table 94. Properties of flexible electronics?cellulose nanofiber film (nanopaper).
- Table 95. Market assessment for cellulose nanofibers in printed, stretchable and flexible electronics-application, key benefits and motivation for use, megatrends, market drivers, technology drawbacks, competing materials, material loading, main global printed, flexible and stretchable electronics OEMs.
- Table 96. Companies developing cellulose nanofiber products in printed, stretchable and flexible electronics.
- Table 97. Market assessment for cellulose nanofibers in 3D priniting-application, key benefits and motivation for use, megatrends, market drivers, technology drawbacks, competing materials, material loading, main global 3D printing OEMs.
- Table 98. Companies developing cellulose nanofibers 3D printing products.
- Table 99. Market assessment for cellulose nanofibers in aerospace-application, key benefits and motivation for use, megatrends, market drivers, technology drawbacks, competing materials, material loading.
- Table 100: Companies developing cellulose nanofibers products in aircraft and



aerospace.

Table 101. Market assessment for cellulose nanofibers in Batteries-application, key benefits and motivation for use, megatrends, market drivers, technology drawbacks.

Table 102: Granbio Nanocellulose Processes.

Table 103. Nippon Paper commercial CNF products.

Table 104: Oji Holdings CNF products.



List Of Figures

LIST OF FIGURES

Figure 1. Market segmentation by type of nanocellulose, capacities and demand 2021, metric tonnes.

Figure 2. Global demand for cellulose nanofibers/MFC in metric tonnes by market, 2018-2032.

Figure 3. Global demand for cellulose nanocrystals by market, 2018-2032.

Figure 4. Dorayaki.

Figure 5. ENASAVE NEXT.

Figure 6. GEL-KAYANO™.

Figure 7. Kirekira! toilet wipes.

Figure 8. 'Poise' series Super strong deodorant sheet.

Figure 9. SC-3 (B) speakers.

Figure 10. SE-MONITOR5 headphones.

Figure 11. 'Skin Care Acty' series Adult diapers.

Figure 12. 'SURISURI' Lotion.

Figure 13. Regional demand for cellulose nanofibers, 2020.

Figure 14. Schematic diagram of partial molecular structure of cellulose chain with numbering for carbon atoms and n= number of cellulose repeating unit.

Figure 15. Scale of cellulose materials.

Figure 16. Types of nanocellulose.

Figure 17. Relationship between different kinds of nanocelluloses.

Figure 18. CNF gel.

Figure 19. TEM image of cellulose nanocrystals.

Figure 20. CNC preparation.

Figure 21. Extracting CNC from trees.

Figure 22. CNC slurry.

Figure 23. Nanocellulose preparation methods and resulting materials.

Figure 24. Various preparation methods for nanocellulose.

Figure 25. Applications of cellulose nanofibers in composites.

Figure 26. Global market demand for cellulose nanofibers in composites, 2018-2032 (metric tonnes).

Figure 27. CNF mixed PLA (Poly Lactic Acid).

Figure 28. CNF resin products.

Figure 29. Interior of NCV concept car.

Figure 30. Applications of cellulose nanofibers in automotive.

Figure 31. Interior of the NCV prototype.



- Figure 32. Global demand for cellulose nanofibers in the automotive sector, 2018-2032 (tons).
- Figure 33: Daio Paper's cellulose nanofiber material in doors and hood of race car.
- Figure 34: CNF composite.
- Figure 35: Engine cover utilizing Kao CNF composite resins.
- Figure 36. CNF car engine cover developed in Japan Ministry of the Environment's
- (MOE) Nano Cellulose Vehicle (NCV) Project.
- Figure 37. Comparison of nanofillers with supplementary cementitious materials and aggregates in concrete.
- Figure 38. Applications of cellulose nanofibers in construction.
- Figure 39. Demand for cellulose nanofibers in construction, 2018-2032 (tons).
- Figure 40. Applications of cellulose nanofibers in paper and board packaging.
- Figure 41. Global demand for cellulose nanofibers in the paper & board/packaging, 2018-2032 (tons).
- Figure 42. Applications of cellulose nanofibers in textiles and apparel.
- Figure 43. Asics GEL-KAYANO™ 25 running shoe.
- Figure 44. Demand for cellulose nanofibers in the textiles, 2018-2032 (tons).
- Figure 45. CNF deodorant products.
- Figure 46. Applications of cellulose nanofibers in medicine and healthcare.
- Figure 47. Global demand for cellulose nanofibers in medical and healthcare, 2018-2032 (tons).
- Figure 48. Fibnano.
- Figure 49. Global demand for cellulose nanofibers in hygiene, 2018-2032 (tons).
- Figure 50. Applications of cellulose nanofibers in paints and coatings.
- Figure 51. Global demand for cellulose nanofibers in paint and coatings, 2018-2032 (tons).
- Figure 52. Hefcel-coated wood (left) and untreated wood (right) after 30 seconds flame test.
- Figure 53: Global demand for cellulose nanofibers in aerogels, 2018-2032 (tons).
- Figure 54. Global demand for cellulose nanofibers in the oil and gas market, 2018-2032 (tons).
- Figure 55. Nanocellulose sponge developed by EMPA for potential applications in oil recovery.
- Figure 56. Applications of cellulose nanofibers in filtration.
- Figure 57. Global demand for cellulose nanofibers in the filtration market, 2018-2032 (tons).
- Figure 58. Multi-layered cross section of CNF-nw.
- Figure 59. Applications of cellulose nanofibers in rheology modifiers.
- Figure 60. Global demand for cellulose nanofibers in the rheology modifiers market,



- 2018-2032 (tons).
- Figure 61. 'SURISURI' products.
- Figure 62. Foldable nanopaper antenna.
- Figure 63: Flexible electronic substrate made from CNF.
- Figure 64. Oji CNF transparent sheets.
- Figure 65. Electronic components using NFC as insulating materials.
- Figure 66: Anpoly cellulose nanofiber hydrogel.
- Figure 67. MEDICELLU™.
- Figure 68: Ashai Kasei CNF production process.
- Figure 69: Asahi Kasei CNF fabric sheet.
- Figure 70: Properties of Asahi Kasei cellulose nanofiber nonwoven fabric.
- Figure 71. CNF nonwoven fabric.
- Figure 72. Borregaard Chemcell CNF production process.
- Figure 73. nanoforest products.
- Figure 74. Chuetsu Pulp & Paper CNF production process.
- Figure 75. nanoforest-S.
- Figure 76. nanoforest-PDP.
- Figure 77. nanoforest-MB.
- Figure 78. Daicel Corporation CNF production process.
- Figure 79. Celish.
- Figure 80: Trunk lid incorporating CNF.
- Figure 81. Daio Paper CNF production process.
- Figure 82. ELLEX products.
- Figure 83. CNF-reinforced PP compounds.
- Figure 84. Kirekira! toilet wipes.
- Figure 85. Color CNF.
- Figure 86. DIC Products CNF production process.
- Figure 87. DKS Co. Ltd. CNF production process.
- Figure 88: Rheocrysta spray.
- Figure 89. DKS CNF products.
- Figure 90: CNF based on citrus peel.
- Figure 91. Citrus cellulose nanofiber.
- Figure 92. Imerys CNF production process.
- Figure 93. Filler Bank CNC products.
- Figure 94: Cellulose Nanofiber (CNF) composite with polyethylene (PE).
- Figure 95: CNF products from Furukawa Electric.
- Figure 96. Granbio CNF production process.
- Figure 97: Cutlery samples (spoon, knife, fork) made of nano cellulose and
- biodegradable plastic composite materials.



Figure 98. Non-aqueous CNF dispersion 'Senaf' (Photo shows 5% of plasticizer).

Figure 99: CNF gel.

Figure 100: Block nanocellulose material.

Figure 101: CNF products developed by Hokuetsu.

Figure 102. Innventia CNF production process.

Figure 103: Innventia AB movable nanocellulose demo plant.

Figure 104. Kami Shoji CNF products.

Figure 105. Dual Graft System.

Figure 106: Engine cover utilizing Kao CNF composite resins.

Figure 107. Acrylic resin blended with modified CNF (fluid) and its molded product

(transparent film), and image obtained with AFM (CNF 10wt% blended).

Figure 108: 0.3% aqueous dispersion of sulfated esterified CNF and dried transparent film (front side).

Figure 109. Kruger Biomaterials, Inc. CNF production process.

Figure 110. CNF deodorant.

Figure 111. Chitin nanofiber product.

Figure 112. Marusumi Paper cellulose nanofiber products.

Figure 113. FibriMa cellulose nanofiber powder.

Figure 114. Cellulomix production process.

Figure 115. Nanobase versus conventional products.

Figure 116. Uni-ball Signo UMN-307.

Figure 117: CNF slurries.

Figure 118. Range of CNF products.

Figure 119: Nanocell serum product.

Figure 120: Hydrophobization facilities for raw pulp.

Figure 121: Mixing facilities for CNF-reinforced plastic.

Figure 122. Nippon Paper CNF production process.

Figure 123: Nippon Paper Industries' adult diapers.

Figure 124. All-resin forceps incorporating CNF.

Figure 125. CNF paint product.

Figure 126: CNF wet powder.

Figure 127: CNF transparent film.

Figure 128: Transparent CNF sheets.

Figure 129. Oji Paper CNF production process.

Figure 130: CNF clear sheets.

Figure 131. Oji Holdings CNF polycarbonate product.

Figure 132: Fluorene cellulose ® powder.

Figure 133. A vacuum cleaner part made of cellulose fiber (left) and the assembled vacuum cleaner.



- Figure 134. Performance Biofilaments CNF production process.
- Figure 135: XCNF.
- Figure 136: CNF insulation flat plates.
- Figure 137. Seiko PMC CNF production process.
- Figure 138. Manufacturing process for STARCEL.
- Figure 139: Rubber soles incorporating CNF.
- Figure 140. CNF dispersion and powder from Starlite.
- Figure 141. Stora Enso CNF production process.
- Figure 142. Sugino Machine CNF production process.
- Figure 143: High Pressure Water Jet Process.
- Figure 144: 2 wt.? CNF suspension.
- Figure 145. BiNFi-s Dry Powder.
- Figure 146. BiNFi-s Dry Powder and Propylene (PP) Complex Pellet.
- Figure 147: Silk nanofiber (right) and cocoon of raw material.
- Figure 148: SVILOSA AD CNC products.
- Figure 149: Silver / CNF composite dispersions.
- Figure 150: CNF/nanosilver powder.
- Figure 151: Comparison of weight reduction effect using CNF.
- Figure 152: CNF resin products.
- Figure 153. University of Maine CNF production process.
- Figure 154. UPM-Kymmene CNF production process.
- Figure 155. FibDex® wound dressing.
- Figure 156. US Forest Service Products Laboratory CNF production process.
- Figure 157: Flexible electronic substrate made from CNF.
- Figure 158. VTT 100% bio-based stand-up pouches.
- Figure 159. VTT CNF production process.
- Figure 160: HefCel-coated wood (left) and untreated wood (right) after 30 seconds flame test.
- Figure 161: Bio-based barrier bags prepared from Tempo-CNF coated bio-HDPE film.
- Figure 162. S-CNF in powder form.
- Figure 163. Zelfo Technology GmbH CNF production process.



I would like to order

Product name: The Global Market for Cellulose Nanofibers 2022

Product link: https://marketpublishers.com/r/GFA426D2B19FEN.html

Price: US\$ 1,400.00 (Single User License / Electronic Delivery)

If you want to order Corporate License or Hard Copy, please, contact our Customer

Service:

info@marketpublishers.com

Payment

To pay by Credit Card (Visa, MasterCard, American Express, PayPal), please, click button on product page https://marketpublishers.com/r/GFA426D2B19FEN.html

To pay by Wire Transfer, please, fill in your contact details in the form below:

First name:		
Last name:		
Email:		
Company:		
Address:		
City:		
Zip code:		
Country:		
Tel:		
Fax:		
Your message:		
	**All fields are required	
	Custumer signature	

Please, note that by ordering from marketpublishers.com you are agreeing to our Terms & Conditions at https://marketpublishers.com/docs/terms.html

To place an order via fax simply print this form, fill in the information below and fax the completed form to +44 20 7900 3970