

The Nanocellulose Market, Production and Pricing Report 2022

https://marketpublishers.com/r/NCEAF179FF6DEN.html

Date: September 2022

Pages: 418

Price: US\$ 950.00 (Single User License)

ID: NCEAF179FF6DEN

Abstracts

Best Regards, Nanocellulose (NC) can be classified into cellulose nanocrystals (CNC), cellulose nanofiber (CNF), and bacterial nanocellulose (BNC). They are are novel biomaterials with multiple industrial uses for replacing fossil derived raw materials. Desirable properties include high surface area, unique morphology, excellent mechanical properties, specific high strength and modulus, good biocompatibility, renewability, tailorable surface chemistry and good optical properties. Their use in the development of a variety of sustainable and renewable materials has grown considerably in recent years.

The market mainly consists of CNFs at present, as alternatives to resins, synthetic thickeners, strengtheners, and plastic additives. CNF-based products have already hit the market, mainly in Japan, and are viewed as important advanced biomaterials solutions in the packaging and composites markets. CNC and BNC products are near or on market in personal care and cosmetics sectors.

The Nanocellulose Market, Production and Pricing Report 2022 report includes:

Pricing landscape for nanocellulose (Cellulose nanofibers, cellulose nanocrystals and bacterial nanocellulose), by types and producers.

Analysis of the global market for cellulose nanofibers, cellulose nanocrystals and bacterial nanocellulose, segmented by market. Markets covered include packaging, composites, construction, textiles, biomedicine & healthcare, hygiene & sanitary products, personal care & cosmetics, paints & coatings, aerogels, filtration, oil & gas, electronics and batteries.



Production volumes by nanocellulose producer (current and planned).

Commercial nanocellulose product guide.

The market in Japan including all commercial product offerings.

154 company profiles including production processes, products and pricing, target markets and collaborations. Profiles of all the major players in nanocellulose production (cellulose nanofibers, cellulose nanocrystals and bacterial nanocellulose producers). Companies profiled include Asahi Kasei, Blue Biofuels, Inc., Bucha Bio, CelluComp Ltd., Chuetsu Pulp & Paper Co., Ltd., Daicel, Daio Paper Corporation, Inventwood LLC, Melodea, SAPPI, DKS Co. Ltd. and many more.



Contents

1 EXECUTIVE SUMMARY

- 1.1 The market for nanocellulose
- 1.2 Industry developments 2020-22
- 1.3 Market outlook in 2022 and beyond
- 1.4 Global production of nanocellulose
 - 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 Nanocellulose commercial products

2 OVERVIEW OF NANOCELLULOSE

- 2.1 Cellulose
- 2.2 Nanocellulose
- 2.3 Properties of nanocellulose
- 2.4 Feedstocks
- 2.5 Advantages of nanocellulose
- 2.6 Synthesis and Production methods
 - 2.6.1 Acid hydrolysis
 - 2.6.2 TEMPO oxidation
 - 2.6.3 Ammonium persulfate (APS) oxidation
 - 2.6.4 Ball milling
 - 2.6.5 Cryocrushing
 - 2.6.6 High-shear grinding
 - 2.6.7 Green production methods
 - 2.6.7.1 Ultrasonication
 - 2.6.7.2 High-pressure homogenization
 - 2.6.8 Recent methods
 - 2.6.8.1 Microwave irradiation
 - 2.6.8.2 Enzymatic processing
 - 2.6.8.3 Deep eutectic solvents (DESs)
 - 2.6.8.4 Pulsed electric field
 - 2.6.8.5 Electron beam irradiation



- 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 Production
 - 2.7.3.4 Applications
 - 2.7.4 Bacterial Nanocellulose (BNC)
 - 2.7.4.1 Production
 - 2.7.4.2 Applications

3 NANOCELLULOSE PRICING

- 3.1 Cellulose nanofiber (CNF)
- 3.2 Cellulose nanocrystal (CNC)
- 3.3 Bacterial nanocellulose (BNC)

4 MARKETS FOR NANOCELLULOSE

- 4.1 Composites
 - 4.1.1 Market overview
 - 4.1.2 Applications
 - 4.1.2.1 Automotive composites
 - 4.1.2.2 Biocomposite films & packaging
 - 4.1.2.3 Barrier packaging
 - 4.1.2.4 Thermal insulation composites
 - 4.1.2.5 Construction composites
 - 4.1.3 Global market in tons to 2032
 - 4.1.4 Product developers
- 4.2 Automotive
 - 4.2.1 Market overview
 - 4.2.2 Applications
 - 4.2.2.1 Composites
 - 4.2.2.2 Air intake components
 - 4.2.2.3 Tires
- 4.2.3 Global market in tons to 2032
- 4.2.4 Product developers



- 4.3 Buildings and construction
 - 4.3.1 Market overview
 - 4.3.2 Applications
 - 4.3.2.1 Sandwich composites
 - 4.3.2.2 Cement additives
 - 4.3.2.3 Pump primers
 - 4.3.2.4 Thermal insulation and damping
 - 4.3.3 Global market in tons to 2032
 - 4.3.4 Product developers
- 4.4 Paper and board packaging
 - 4.4.1 Market overview
 - 4.4.2 Applications
 - 4.4.2.1 Reinforcement and barrier
 - 4.4.2.2 Biodegradable food packaging foil and films
 - 4.4.2.3 Paperboard coatings
 - 4.4.3 Global market in tons to 2032
 - 4.4.4 Product developers
- 4.5 Textiles and apparel
 - 4.5.1 Market overview
 - 4.5.2 Applications
 - 4.5.2.1 CNF deodorizer and odour reducer (antimicrobial) in adult and child diapers
 - 4.5.2.2 Footwear
 - 4.5.3 Global market in tons to 2032
 - 4.5.4 Product developer profiles
- 4.6 Biomedicine and healthcare
 - 4.6.1 Market overview
 - 4.6.2 Applications
 - 4.6.2.1 Wound dressings
 - 4.6.2.2 Drug delivery stabilizers
 - 4.6.2.3 Tissue engineering scaffolds
 - 4.6.3 Global market in tons to 2032
 - 4.6.4 Product developers
- 4.7 Hygiene and sanitary products
 - 4.7.1 Market overview
 - 4.7.2 Applications
 - 4.7.3 Global market in tons to 2032
 - 4.7.4 Product developers
- 4.8 Paints and coatings
- 4.8.1 Market overview



- 4.8.2 Applications
- 4.8.3 Global market in tons to 2032
- 4.8.4 Product developers
- 4.9 Aerogels
 - 4.9.1 Market overview
 - 4.9.2 Global market in tons to 2032
 - 4.9.3 Product developers
- 4.10 Oil and gas
 - 4.10.1 Market overview
 - 4.10.2 Applications
 - 4.10.2.1 Oil recovery applications (fracturing fluid)
 - 4.10.2.2 CNF Membranes for separation
 - 4.10.2.3 Oil and gas fluids additives
 - 4.10.3 Global market in tons to 2032
 - 4.10.4 Product developers
- 4.11 Filtration
 - 4.11.1 Market overview
 - 4.11.2 Applications
 - 4.11.2.1 Membranes for selective absorption
 - 4.11.3 Global market in tons to 2032
 - 4.11.4 Product developers
- 4.12 Rheology modifiers
 - 4.12.1 Market overview
 - 4.12.2 Applications
 - 4.12.2.1 Food additives
 - 4.12.2.2 Pickering stabilizers
 - 4.12.2.3 Hydrogels
 - 4.12.2.4 Cosmetics and skincare
 - 4.12.3 Global market in tons to 2032
 - 4.12.4 Product developers
- 4.13 Other markets
 - 4.13.1 Printed, stretchable and flexible electronics
 - 4.13.1.1 Market assessment
 - 4.13.1.2 Product developers
 - 4.13.2 3D printing
 - 4.13.2.1 Market assessment
 - 4.13.2.2 Product developers
 - 4.13.3 Aerospace
 - 4.13.3.1 Market assessment



- 4.13.3.2 Product developers
- 4.13.4 Batteries
 - 4.13.4.1 Market assessment

5 CELLULOSE NANOFIBER COMPANY PROFILES 205 (116 COMPANY PROFILES)

6 CELLULOSE NANOCRYSTAL (CNC) PRODUCER ANALYSIS

7 CELLULOSE NANOCRYSTAL (CNC) COMPANY PROFILES 360 (21 COMPANY PROFILES)

8 BACTERIAL CELLULOSE (BC) COMPANY PROFILES 389 (17 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. Market summary for nanocellulose-Selling grade particle diameter, usage, advantages, average price/ton, market estimates, global consumption, main current applications, future applications.
- Table 2. Markets and applications for nanocellulose.
- Table 3. The nanocellulose market in 2020-2022-industry product and production activity.
- Table 4. Classification of nanocellulose applications by type of industrial product ranged in terms of their potential of consumption.
- Table 5. CNF production capacities (by type, wet or dry) and production process, by producer, metric tonnes.
- Table 6. MFC production capacities in metric tonnes and production process, by producer, metric tonnes.
- Table 7. Global demand for cellulose nanofibers/MFC by market in metric tonnes, 2018-2032.
- Table 8: Cellulose nanocrystal capacities (by type, wet or dry) and production process, by producer, metric tonnes.
- Table 9. Global demand for cellulose nanocrystals by market, 2018-2030.
- Table 10. Market and technical challenges in nanocellulose.
- Table 11. Nanocellulose -based commercial products.
- Table 12. Properties and applications of nanocellulose.
- Table 13. Properties of nanocellulose, by type.
- Table 14. Chemical composition of different lignocellulosic feedstocks used for nanocellulose production (% dry basis).
- Table 15. Properties of cellulose nanofibrils relative to metallic and polymeric materials.
- Table 16. Extraction of nanocellulose (NC) from various lignocellulosic sources using different conventional technologies.
- Table 17. Types of nanocellulose.
- Table 18. Types of nanocellulose.
- Table 19. Applications of cellulose nanofibers (CNF).
- Table 20. Synthesis methods for cellulose nanocrystals (CNC).
- Table 21. CNC sources, size and yield.
- Table 22. CNC properties.
- Table 23. Mechanical properties of CNC and other reinforcement materials.
- Table 24. Applications of nanocrystalline cellulose (NCC).
- Table 25. Applications of bacterial nanocellulose (BNC).



- Table 26: Product/price/application matrix of cellulose nanofiber producers.
- Table 27: Product/price/application matrix of cellulose nanocrystal producers.
- Table 28: Product/price/application matrix of bacterial nanocellulose producers.
- Table 29. Market overview for nanocellulose in composites.
- Table 30. Comparative properties of polymer composites reinforcing materials.
- Table 31. Scorecard for nanocellulose in composites.
- Table 32. Market assessment for nanocellulose in composites-application, key benefits and motivation for use, megatrends, market drivers, technology drawbacks, competing materials, material loading, main global composites OEMs.
- Table 33. Global market demand for nanocellulose in composites, 2018-2032 (metric tonnes).
- Table 34. Companies developing nanocellulose in composites.
- Table 35. Market overview for nanocellulose in automotive.
- Table 36. Scorecard for nanocellulose in automotive.
- Table 37. Market assessment for nanocellulose in automotive-application, key benefits and motivation for use, megatrends, market drivers, technology drawbacks, competing materials, material loading, main global automotive OEMs.
- Table 38. Components featured in the NCV.
- Table 39. Global market demand for nanocellulose in the automotive sector 2018-2032 (tons).
- Table 40. Companies developing nanocellulose products in the automotive industry.
- Table 41. Market overview for nanocellulose in building and construction.
- Table 42. Scorecard for nanocellulose in building and construction.
- Table 43. Comparison of CNC with steel and other materials.
- Table 44. Market assessment for nanocellulose in building and construction-application, key benefits and motivation for use, megatrends, market drivers, technology drawbacks, competing materials, material loading, main global construction OEMs
- Table 45: Market demand for nanocellulose in building and construction, 2018-2032 (tons).
- Table 46. Companies developing nanocellulose in building and construction.
- Table 47. Oxygen permeability of nanocellulose films compared to those made form commercially available petroleum-based materials and other polymers.
- Table 48. Scorecard for nanocellulose in paper and board packaging.
- Table 49. Market assessment for nanocellulose 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 50. Global demand for nanocellulose in paper & board packaging, 2018-2032 (tons).



- Table 51. Companies developing nanocellulose products in paper and board.
- Table 52. Market overview for nanocellulose in textiles and apparel.
- Table 53. Scorecard for nanocellulose in textiles and apparel.
- Table 54. Market assessment for nanocellulose in textiles and apparel-application, key benefits and motivation for use, megatrends, market drivers, technology drawbacks, competing materials, material loading, main global textiles and apparel OEMs.
- Table 55. Demand for nanocellulose in textiles, 2018-2032 (tons).
- Table 56. Companies developing nanocellulose products in textiles and apparel.
- Table 57. Market overview for cellulose nanofibers in medicine and healthcare.
- Table 58. Scorecard for nanocellulose in medicine and healthcare.
- Table 59. Market assessment for nanocellulose in medicine and healthcare-application, key benefits and motivation for use, megatrends, market drivers, technology drawbacks, competing materials, material loading, main global medicine and healthcare OEMs.
- Table 60. Global demand for nanocellulose in medical and healthcare, 2018-2032 (tons).
- Table 61. Nanocellulose product developers in medicine and healthcare.
- Table 62. Market overview for nanocellulose in the hygiene and sanitary products market.
- Table 63. Global demand for nanocellulose in hygiene and absorbents, 2018-2032 (tons).
- Table 64. Nanocellulose product developers in hygiene and sanitary products.
- Table 65. Market overview for nanocellulose in paints and coatings.
- Table 66. Scorecard for nanocellulose in paints and coatings.
- Table 67. Market assessment for nanocellulose in paints and coatings-application, key benefits and motivation for use, megatrends, market drivers, technology drawbacks, competing materials, material loading, main global paints and coatings OEMs.
- Table 68. Global demand for nanocellulose in paint and coatings, 2018-2032 (tons).
- Table 69. Companies developing nanocellulose products in paints and coatings, applications targeted and stage of commercialization.
- Table 70. Market overview for nanocellulose in aerogels.
- Table 71. Scorecard for cellulose nanofibers in aerogels.
- Table 72. Market assessment for nanocellulose in aerogels-application, key benefits and motivation for use, megatrends, market drivers, technology drawbacks, competing materials, material loading, main global aerogels OEMs.
- Table 73. Global demand for nanocellulose in aerogels, 2018-2032 (tons).
- Table 74. Nanocellulose in product developers in aerogels.
- Table 75. Market overview for nanocellulose in in oil and gas.
- Table 76. Scorecard for nanocellulose in in oil and gas.
- Table 77. Market assessment for nanocellulose in 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 78. Global demand for nanocellulose in the oil and gas market, 2018-2032 (tons).
- Table 79. Nanocellulose product developers in oil and gas exploration.
- Table 80. CNF membranes.
- Table 81. Market overview for nanocellulose in filtration.
- Table 82. Scorecard for nanocellulose in filtration.
- Table 83. Market assessment for nanocellulose in filtration-application, key benefits and motivation for use, megatrends, market drivers, technology drawbacks, competing materials, material loading, main global filtration OEMs.
- Table 84: Global demand for nanocellulose in the filtration market, 2018-2032 (tons).
- Table 85. Companies developing nanocellulose products in filtration.
- Table 86. Market overview for nanocellulose in rheology modifiers.
- Table 87. Scorecard for nanocellulose in rheology modifiers.
- Table 88. Market assessment for nanocellulose 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 89. Global demand for nanocellulose in the rheology modifiers market, 2018-2032 (tons).
- Table 90. Commercial activity in nanocellulose rheology modifiers.
- Table 91. Properties of flexible electronics?cellulose nanofiber film (nanopaper).
- Table 92. Market assessment for nanocellulose 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 93. Companies developing nanocellulose products in printed, stretchable and flexible electronics.
- Table 94. Market assessment for nanocellulose 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 95. Companies developing nanocellulose printing products.
- Table 96. Market assessment for nanocellulose in aerospace-application, key benefits and motivation for use, megatrends, market drivers, technology drawbacks, competing materials, material loading.
- Table 97: Companies developing nanocellulose products in aircraft and aerospace.
- Table 98. Market assessment for nanocellulose in Batteries-application, key benefits and motivation for use, megatrends, market drivers, technology drawbacks.
- Table 99: Granbio Nanocellulose Processes.
- Table 100. Nippon Paper commercial CNF products.



Table 101. Oji Holdings CNF products.

Table 102: CNC producers and production capacities.

Table 103: Target market, by cellulose nanocrystal producer.

Table 104. Fibnano properties.



List Of Figures

LIST OF FIGURES

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

Figure 2. Market segmentation by type of nanocellulose, capacities and demand 2021, metric tonnes.

Figure 3. Global demand for cellulose nanofibers/MFC in metric tonnes by market, 2018-2032.

Figure 4. Global demand for cellulose nanocrystals by market, 2018-2032.

Figure 5. Aruba 23.

Figure 6. Dorayaki.

Figure 7. ENASAVE NEXT.

Figure 8. Flat4-KAEDE.

Figure 9. GEL-KAYANO.

Figure 10. Hada care acty.

Figure 11. Hiteeth All in One Mouth Gel.

Figure 12. HYPERNANO X series.

Figure 13. Kirekira! toilet wipes.

Figure 14. ONKYO Scepter SC-3(B) 2-way Speaker System.

Figure 15. Pioneer SE-MONITOR5 Headphones.

Figure 16. 'Poise' series Super strong deodorant sheet.

Figure 17. RUBURI Precursor Lubris for raw concrete pumping.

Figure 18. SC-3 (B) speakers.

Figure 19. SE-MONITOR5 headphones.

Figure 20. 'Skin Care Acty' series Adult diapers.

Figure 21. 'SURISURI' Lotion.

Figure 22. X9400 series.

Figure 23. Schematic diagram of partial molecular structure of cellulose chain with numbering for carbon atoms and n= number of cellulose repeating unit.

Figure 24. Scale of cellulose materials.

Figure 25. Nanocellulose preparation methods and resulting materials.

Figure 26. Production of nanocellulose from lignocellulosic biomass using enzymatic treatment (endoglucanases and xylanases) followed by mechanical treatment.

Figure 27. EBI pretreatment combined with HPH for CNC production.

Figure 28. Types of nanocellulose.

Figure 29. Relationship between different kinds of nanocelluloses.

Figure 30. Various preparation methods for nanocellulose.



- Figure 31. CNF gel.
- Figure 32. TEM image of cellulose nanocrystals.
- Figure 33. CNC preparation.
- Figure 34. Extracting CNC from trees.
- Figure 35. CNC slurry.
- Figure 36. Bacterial nanocellulose shapes
- Figure 37. Applications of nanocellulose in composites.
- Figure 38. Global market demand for nanocellulose in composites, 2018-2032 (metric tonnes).
- Figure 39. CNF mixed PLA (Poly Lactic Acid).
- Figure 40. CNF resin products.
- Figure 41. Interior of NCV concept car.
- Figure 42. Applications of nanocellulose in automotive.
- Figure 43. Interior of the NCV prototype.
- Figure 44. Global demand for nanocellulose in the automotive sector, 2018-2032 (tons).
- Figure 45: Daio Paper's cellulose nanofiber material in doors and hood of race car.
- Figure 46: CNF composite.
- Figure 47: Engine cover utilizing Kao CNF composite resins.
- Figure 48. CNF car engine cover developed in Japan Ministry of the Environment's
- (MOE) Nano Cellulose Vehicle (NCV) Project.
- Figure 49. Comparison of nanofillers with supplementary cementitious materials and aggregates in concrete.
- Figure 50. Applications of nanocellulose in building and construction.
- Figure 51. Demand for nanocellulose in construction, 2018-2032 (tons).
- Figure 52. Applications of nanocellulose in paper and board packaging.
- Figure 53. Global demand for nanocellulose in the paper & board/packaging, 2018-2032 (tons).
- Figure 54. Applications of nanocellulose in textiles and apparel.
- Figure 55. Asics GEL-KAYANO 25 running shoe.
- Figure 56. Demand for nanocellulose in the textiles, 2018-2032 (tons).
- Figure 57. CNF deodorant products.
- Figure 58. Applications of nanocellulose in medicine and healthcare.
- Figure 59. Global demand for nanocellulose in medical and healthcare, 2018-2032 (tons).
- Figure 60. Fibnano.
- Figure 61. Global demand for nanocellulose in hygiene and absorbents, 2018-2032 (tons).
- Figure 62. Applications of nanocellulose in paints and coatings.
- Figure 63. Global demand for nanocellulose in paint and coatings, 2018-2032 (tons).



- Figure 64. Hefcel-coated wood (left) and untreated wood (right) after 30 seconds flame test.
- Figure 65: Global demand for nanocellulose in in aerogels, 2018-2032 (tons).
- Figure 66. Global demand for nanocellulose in the oil and gas market, 2018-2032 (tons).
- Figure 67. Nanocellulose sponge developed by EMPA for potential applications in oil recovery.
- Figure 68. Applications of nanocellulose in filtration.
- Figure 69. Global demand for nanocellulose in the filtration market, 2018-2032 (tons).
- Figure 70. Multi-layered cross section of CNF-nw.
- Figure 71. Applications of nanocellulose in rheology modifiers.
- Figure 72. Global demand for nanocellulose in the rheology modifiers market,
- 2018-2032 (tons).
- Figure 73. 'SURISURI' products.
- Figure 74. Foldable nanopaper antenna.
- Figure 75: Flexible electronic substrate made from CNF.
- Figure 76. Oji CNF transparent sheets.
- Figure 77. Electronic components using NFC as insulating materials.
- Figure 78: Anpoly cellulose nanofiber hydrogel.
- Figure 79. MEDICELLU.
- Figure 80: Ashai Kasei CNF production process.
- Figure 81: Asahi Kasei CNF fabric sheet.
- Figure 82: Properties of Asahi Kasei cellulose nanofiber nonwoven fabric.
- Figure 83. CNF nonwoven fabric.
- Figure 84. Borregaard Chemcell CNF production process.
- Figure 85. nanoforest products.
- Figure 86. Chuetsu Pulp & Paper CNF production process.
- Figure 87. nanoforest-S.
- Figure 88. nanoforest-PDP.
- Figure 89. nanoforest-MB.
- Figure 90. Daicel Corporation CNF production process.
- Figure 91. Celish.
- Figure 92: Trunk lid incorporating CNF.
- Figure 93. Daio Paper CNF production process.
- Figure 94. ELLEX products.
- Figure 95. CNF-reinforced PP compounds.
- Figure 96. Kirekira! toilet wipes.
- Figure 97. Color CNF.
- Figure 98. DIC Products CNF production process.



- Figure 99. DKS Co. Ltd. CNF production process.
- Figure 100: Rheocrysta spray.
- Figure 101. DKS CNF products.
- Figure 102: CNF based on citrus peel.
- Figure 103. Citrus cellulose nanofiber.
- Figure 104. Imerys CNF production process.
- Figure 105. Filler Bank CNC products.
- Figure 106: Cellulose Nanofiber (CNF) composite with polyethylene (PE).
- Figure 107: CNF products from Furukawa Electric.
- Figure 108. Granbio CNF production process.
- Figure 109: Cutlery samples (spoon, knife, fork) made of nano cellulose and

biodegradable plastic composite materials.

- Figure 110. Non-aqueous CNF dispersion 'Senaf' (Photo shows 5% of plasticizer).
- Figure 111: CNF gel.
- Figure 112: Block nanocellulose material.
- Figure 113: CNF products developed by Hokuetsu.
- Figure 114. Kami Shoji CNF products.
- Figure 115. Dual Graft System.
- Figure 116: Engine cover utilizing Kao CNF composite resins.
- Figure 117. Acrylic resin blended with modified CNF (fluid) and its molded product

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

- Figure 118: 0.3% aqueous dispersion of sulfated esterified CNF and dried transparent film (front side).
- Figure 119. Kruger Biomaterials, Inc. CNF production process.
- Figure 120. CNF deodorant.
- Figure 121. Chitin nanofiber product.
- Figure 122. Marusumi Paper cellulose nanofiber products.
- Figure 123. FibriMa cellulose nanofiber powder.
- Figure 124. Cellulomix production process.
- Figure 125. Nanobase versus conventional products.
- Figure 126. Uni-ball Signo UMN-307.
- Figure 127: CNF slurries.
- Figure 128. Range of CNF products.
- Figure 129: Nanocell serum product.
- Figure 130. Vatensel product
- Figure 131: Hydrophobization facilities for raw pulp.
- Figure 132: Mixing facilities for CNF-reinforced plastic.
- Figure 133. Nippon Paper CNF production process.
- Figure 134: Nippon Paper Industries' adult diapers.



- Figure 135. All-resin forceps incorporating CNF.
- Figure 136. CNF paint product.
- Figure 137. CNF wet powder.
- Figure 138. CNF transparent film.
- Figure 139. Transparent CNF sheets.
- Figure 140. Oji Paper CNF production process.
- Figure 141. CNF clear sheets.
- Figure 142. Oji Holdings CNF polycarbonate product.
- Figure 143. Fluorene cellulose powder.
- Figure 144. A vacuum cleaner part made of cellulose fiber (left) and the assembled vacuum cleaner.
- Figure 145. Performance Biofilaments CNF production process.
- Figure 146. XCNF.
- Figure 147. Innventia CNF production process.
- Figure 148: Innventia AB movable nanocellulose demo plant.
- Figure 149. CNF insulation flat plates.
- Figure 150. Seiko PMC CNF production process.
- Figure 151. Manufacturing process for STARCEL.
- Figure 152. Rubber soles incorporating CNF.
- Figure 153. CNF dispersion and powder from Starlite.
- Figure 154. Stora Enso CNF production process.
- Figure 155. Sugino Machine CNF production process.
- Figure 156. High Pressure Water Jet Process.
- Figure 157. 2 wt.? CNF suspension.
- Figure 158. BiNFi-s Dry Powder.
- Figure 159. BiNFi-s Dry Powder and Propylene (PP) Complex Pellet.
- Figure 160. Silk nanofiber (right) and cocoon of raw material.
- Figure 161. SVILOSA AD CNC products.
- Figure 162. Silver / CNF composite dispersions.
- Figure 163. CNF/nanosilver powder.
- Figure 164: Comparison of weight reduction effect using CNF.
- Figure 165: CNF resin products.
- Figure 166. University of Maine CNF production process.
- Figure 167. UPM-Kymmene CNF production process.
- Figure 168. FibDex wound dressing.
- Figure 169. US Forest Service Products Laboratory CNF production process.
- Figure 170: Flexible electronic substrate made from CNF.
- Figure 171. VTT 100% bio-based stand-up pouches.
- Figure 172. VTT CNF production process.



Figure 173: HefCel-coated wood (left) and untreated wood (right) after 30 seconds flame test.

Figure 174: Bio-based barrier bags prepared from Tempo-CNF coated bio-HDPE film.

Figure 175. S-CNF in powder form.

Figure 176. Zelfo Technology GmbH CNF production process.

Figure 177: R3TM process technology.

Figure 178: Blue Goose CNC Production Process.

Figure 179: Celluforce production process.

Figure 180: NCCTM Process.

Figure 181: CNC produced at Tech Futures' pilot plant; cloudy suspension (1 wt.%), gel-

like (10 wt.%), flake-like crystals, and very fine powder. Product advantages include:

Figure 182. Filler Bank CNC products.

Figure 183: Plantrose process.

Figure 184. CNC solution.

Figure 185. University of Maine CNF production process.

Figure 186. US Forest Service Products Laboratory CNF production process.

Figure 187. Cellugy materials.

Figure 188: Bacterial cellulose face mask sheet.

Figure 189. TransLeather.



I would like to order

Product name: The Nanocellulose Market, Production and Pricing Report 2022

Product link: https://marketpublishers.com/r/NCEAF179FF6DEN.html

Price: US\$ 950.00 (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/NCEAF179FF6DEN.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