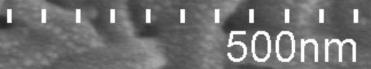
DIRECTORY OF CELLULOSE NANOMATERIALS 2025

Biobased Markets

May 2025





As a diversified, innovative and trusted leader focused on sustainable processes and products, we are building a more circular economy by making what we should, not just what we can. Our market offerings such as dissolving pulp, wood pulp, biomaterials, timber, packaging and speciality papers, graphic papers, casting and release papers and forestry products are manufactured from woodfibre sourced from sustainably managed forests and plantations, in production facilities powered, in many cases, with bio-energy from steam and existing waste streams.

Sappi Valida is a leading producer of fibrillated cellulose with naturally derived functionality for a wide range of applications including personal care, agriculture, coatings, construction additives and packaging. Sappi Valida is available in commercial volumes from a number of production facilities.

For more information on Valida visit our website:

https://www.sappi.com/valida-home

Contact: Valida@sappi.com



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On the Cover

Thanks to Dr. Miriam Gallur Blanca, Materials and Packaging Area Manager and collaborators Dr. Rafael Sánchez and Mrs. Pilar Albaladejo, from ITENE, for the cover image, a SEM microphotograph of MFC.

ITENE, is Spain's Technological Institute of Packaging, Transport and Logistics, and develops different types of nanocellulose, primarily MFC, at pilot scale in an automatized continuous mechanical grinder. ITENE's Materials and Packaging Area has expertise in research & development of cellulose nanomaterials to improve packaging properties like barriers for packaging applications.

Microfibrillated cellulose (MFC) derived from lignocellulosic waste has gained increasing attention as a sustainable material with remarkable mechanical and structural properties. These fibers are extracted from wheat bran through chemical pretreatments that break down the complex structure of plant biomass, followed by a mechanical process to reduce the cellulose fibers to a nanoscale size obtaining microfibrillated cellulose (MFC). Scanning electron microscopy (SEM) is a key technique used to evaluate the morphology, size distribution, and surface characteristics of the MFC, providing detailed images that confirm successful fibrillation and the nanoscale diameter of the material. This material used as an additive to reinforce pulp results in an improvement of 90% on Bendset porosity and used as a coating could reach an improvement in oxygen transmission rate up to 40%.

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Introduction

About The Directory of Cellulose Nanomaterials

Following the update of the TAPPI Nano Production Summary (https://www.tappinano.org/whats-up/production-summary/), Biobased Markets, TAPPI, and TAPPI's Nanotechnology Division agreed that it would be good for the industry for Biobased Markets to publish *The Directory of Cellulose Nanomaterials*.

It was agreed that *The Directory* should be free, and listings should also be free, and that *The Directory* should be funded entirely through advertising. TAPPI Publications and the TAPPI Nanotechnology Division will help distribute it, and Biobased Markets will pursue other channels as well to get the broadest possible circulation and maximum exposure for the organizations listed in *The Directory*.

We believe *The Directory* is the world's most complete global listing of producers of nanocellulose, providers of technology related to nanocellulose, and service providers, research organizations and universities working with nanocellulose. Companies and other organizations who wish to be included in any future issues of *The Directory* should contact Biobased Markets.

Feel free to distribute *The Directory* yourself, in its entirety, as you see fit.

About Biobased Markets

Market-Intell LLC was founded in 2005 by Jack Miller to provide market intelligence in paper, print, and re-branded as Biobased Markets in 2018. Biobased Markets is now focused primarily on biobased materials, especially nanocellulose and lignin.

Market-Intell LLC and Biobased Markets have collaborated with organizations such as TAPPI, Fastmarkets RISI, and Biofuels Digest, as well as a number of independent associate consultants, universities, and research organizations. Services include business development, lead development, market research, support for due diligence for potential investors, and custom Webinars to provide education about lignin and nanocellulose applications and markets.

Market-Intell and Biobased Markets have served clients in North America. South America, Europe, and Asia.

Since 2005, Jack Miller has been Principal Consultant, Market-In tell LLC. Jack has served as an Associate Consultant with RISI and as a member of the Advisory Board of Sweetwater Energy, a biorefinery company. Jack was Business Development Consultant with CelluForce, Inc., from 2011 to 2013, and was Consulting Manager, Global Nanocellulose Sales, American Process, Inc. (now GranBio), in 2014 and 2015. Prior to 2005 Jack enjoyed a long career in the pulp and paper industry.

Jack is the author of:

- The Directory of Cellulose Nanomaterials, Biobased Markets, May, 2024
- TAPPI Cellulose Nanomaterials Production Summary, TAPPI, May 2024
- The Directory of Cellulose Nanomaterials, Biobased Markets, May, 2023
- Lignin 2021: A Pivotal Year, published by Biofuels Digest in March 2021
- Nanocellulose: Packaging Applications and Markets published by RISI in 2019
- Nanocellulose Challenges and Opportunities: End User Perspectives, published by TAPPI in 2018
- Lignin: Technology, Applications, and Markets published by RISI in 2017
- Nanocellulose Producers, Products and Applications, A Guide for End Users, published by TAPPI in 2017
- Nanocellulose: Technology, Applications and Markets, published by RISI in 2014.

Overview of Cellulose Nanomaterials

It is well known that the distinction between microfibrillated cellulose or cellulose microfibrils (MFC), and nanofibrillated cellulose or cellulose nanofibrils (CNF) is not clear cut. Some materials called CNF are primarily micro-scale while some called MFC are primarily nano-scale, and some are a mix of nano- and micro-scale particles (Figure 1).

Further, the distinction between MFC and "highly refined pulp" is also not clear cut. By some estimates, more than 75% of all "nanocellulose" is MFC, produced on site by mills and used in their own pulp, paper, and paperboard production, but much of this is in fact highly refined pulp. This Summary does not include "highly refined pulp" but does include what producers have reported as MFC. In this Summary, we use the terminology the producer uses. If nano or micro are not specified, the material is included under MFC.

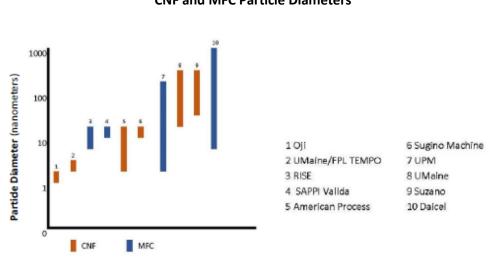


Figure 1
CNF and MFC Particle Diameters

Source: Nanocellulose: Producers, Products, and Applications, A Guide for End Users, TAPPI, 2017

It has also become apparent that the difference between CNF and CNC (cellulose nanocrystals) is becoming blurred. CNC was originally produced primarily from bleached pulp by means of sulfuric acid hydrolysis, which essentially separates the crystalline portion of cellulose from the non-crystalline or amorphous portion. CNF was produced by primarily mechanical means, in some cases with enzymatic or chemical pretreatment to reduce energy cost. CNF and CNC were very different, and the difference was quite clear.

Now, however, biorefinery processes have emerged that produce CNF or CNC from biomass. GranBio (American Process) uses sulfur dioxide and ethanol (AVAP® Process) to fractionate biomass into lignin, hemicellulose and cellulose, and can produce either CNC or CNF, or a blend of the two. More recently, Sweetwater Energy introduced its SunburstTM reactive extrusion process, a technology acquired by

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¹ Miller, J. Nanocellulose Producers, Products and Applications, A Guide for End Users, TAPPI, 2017.

Fibenol in 2023. The Sunburst process also fractionates biomass into lignin, hemicellulose and cellulose, and with further enzymatic hydrolysis can yield MCC, CNC or CNF.²

CNC and CNF cannot be definitively distinguished solely by particle size, crystallinity, or other metrics, though cellulose nanofibrils tend to be longer, and may be entangled, while nanocrystals tend to be more crystalline and can be presented as discrete particles. Work continues at TAPPI and ISO on standards, nomenclature, and characterization.

A more detailed discussion is beyond the scope here.

² Miller J. *Lignin 2021: A Pivotal Year*, BioFuels Digest, 2021.

³ https://www.iso.org/obp/ui/en/#iso:std:iso:ts:20477:ed-2:v1:en

Production Summary

Recent Updates

ANPOLY is new to our Production Summary. ANPOLY produces CNC and CNF and is committed to developing material mass production technologies beyond the laboratory stage to be applied to real industries. ANPOLY's nanocellulose has applications in lightweight composite materials, packaging materials, filtration devices, cosmetics, secondary batteries, and medical biomaterials. It currently has an annual CNF capacity of 100 tons (10 tons dry basis), and when the demo plant is completed at the end of this year, it will have a capacity of 1,000 tons starting next year.

CETIM, a private research center based in A Coruña, Spain, is new to our Production Summary. CETIM has been producing MFC and CNF since 2017 at pilot scale. CNF capacity is reported at 0.18 tpy, dry basis. They have also been involved in the production of lab-scale CNC.

In 2023 **Fibenol OÜ** acquired patents of the Sunburst[™] reactive extrusion process from Sweetwater Energy. The process deconstructs biomass into lignin, hemicellulose and cellulose in 20 seconds, and with further treatments can yield low-cost MCC, CNC, or CNF. Fibenol has increased its capacity to produce 200 tons of each grade of CNC paste, 20 wt%, 40 tons dry basis. In June 2024 Fibenol started a CBE supported flagship project called WOODCELL to scale up the MCC production to 4,000 tons dry basis scale (https://www.cbe.europa.eu/projects/woodcell).

As of December 2024, UB Forest Industries Green Growth Fund (UB FIGG), a private equity fund based in Finland, acquired 100% of the shares of **FiberLean Technologies Ltd.** FiberLean is now focussed on supplying market leading equipment for the production of MFC.

ITENE, Spain's Instituto Tecnologico del Embalaje, Transporte y Logistica (Packaging, Transport and Logistics Research Institute) operates a pilot plant to produce mechanical microfibrillated cellulose (MFC). The plant is updated to a continuous mode, and process automation has enabled an increase in capacity to increased up to 60kg/day of aqueous suspensions (up to 3 wt%).

NANOCEL is new to our Production Summary. NANOCEL is a technology-based company whose main activity is the technological development of the production and commercialization of new nano-scale products and biosustainable materials. NANOCEL reports production capacity of 0.18 tpy of CNF, dry basis.

Sappi Valida fibrillated cellulose is available in commercial volumes from multiple production facilities in the EU and in South Africa. In 2020 Sappi launched its natural Valida cellulose products suitable for a wide range of applications including personal care, homecare, agriculture, coatings, concrete, barrier coating and moulded fibre products.

Sugino Machine reports an increase in CNF capacity to 39 tpy.

Cellulsoe Nanocrystals

CNC Capacity 2025 (tonnes per year, dry basis)

Producer	Process	Capacity
CelluForce, Canada	sulfuric acid hydrolysis	300
Anomera, Canada	carboxylated	170
GranBio, U.S.	SO ₂ fractionation	130
Navitas, Slovenia	proprietary	50
Fibenol, Estonia	reactive extrusion	40
Forest Products Lab, U.S.	sulfuric acid hydrolysis	3
Blue Goose Biorefineries, Canada	metal catalyzed oxidation	2
Innotech Alberta	sulfuric acid hydrolysis	<1
Cellulose Lab, Canada	various	<1
ANPOLY, Inc., Korea	sulfuric acid hydrolysis	n/a
FPInnovations, Canada	sulfuric acid hydrolysis	pilot
Hangzhou Yeuha Technology Co., China	proprietary	pilot
Nordic Bioproducts Group	from MCC	pilot
Tianjin Haojia Cellulose Co. Ltd., China	modified and unmodified	pilot

Cellulose Nanofibrils

Producer	Process	Capacity
Sappi Biotech, Global	proprietary	650
Nippon Paper, Japan	TEMPO, carboxylated	560
University of Maine, U.S.	mechanical	260
GranBio, U.S.	SO₂ fractionation	130
CelluComp, UK	chemical pretreatment	100
Oji Paper, Japan	phosphate esterification	40
Sugino Machine, Japan	oblique collision	39
Chuetsu Pulp and Paper, Japan	aqueous counter collision	30
Seiko PMC, Japan	modified hydrophobic	24
Cellulose Lab, Canada	TEMPO, other	18
ANPOLY, Korea	TEMPO	10
Tianjin Haojia Cellulose Co., Ltd, China	TEMPO, carboxylated	3
Dai-ichi Kogyo (DKS), Japan	TEMPO	1
U.S. Forest Products Lab, U.S.	TEMPO, mechanical	<1
NANOCEL, Spain	enzymatic, chemical, mechanical	<1
Marusumi Paper Co., Ltd Japan	chemical	n/a
Toagosei Co., Ltd., Japan	Sodium hypochlorite oxidation	n/a
ITENE, Spain	mechanical	pilot
Nordic Bioproducts Group	from MCC	pilot
Re-Fresh Global, Germany	enzymatic treatment	pilot
VTT, Finland	chemical, enzymatic, mechanical	pilot

Microfibrillated Cellulose

MFC Capacity 2025 (tonnes per year, dry basis)

Producer	Process	Capacity
Suzano, Brazil	mechanical	20,000
FiberLean Technologies, UK	mechanical	13,000
Sappi Biotech, Global	proprietary	6,220
Borregaard, Norway	proprietary	1,000
Woodspin, Finland	mechanical	1,000
Norske Skog, Norway	mechanical	526
Klabin, Brazil	mechanical	350
RISE, transportable container factory	enzymatic pretreatment	200
Daicel, Japan	high pressure homogenizer	200
Weidmann Fiber Technology, Switzerland	mechanical	150
CTP/FCBA, France	enzymatic pretreatment	25
RISE, Sweden	enzymatic pretreatment	25
Stora Enso, Finland	n/a	N/A
Empa, Switzerland	enzymatic pretreatment	pilot
InoFib, France	chemical pretreatment	pilot
ITENE, Spain	mechanical	pilot
KCL, Finland		pilot
Re-Fresh Global, Germany	enzymatic treatment	pilot
Tianjin Haojia Cellulose, China	modified: TEMPO, other	pilot
UPM, Finland	n/a	pilot

Cellulose Filaments

Cellulose Filaments Capacity 2025 (tonnes per year, dry basis)

Producer		Capacity	
Performance BioFilaments, Canada	mechanical	7,000	
Kruger, Canada	mechanical	6,000	
Tianjin Haojia Cellulose, China	n/a	n/a	

2025



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Our vision is to provide our customers with the world's best MFC grinding technology and support.

FiberLean's proprietary grinding process allows the production of MFC from a wide range of pulps used in the paper, packaging, tissue, speciality and pulp-based product industries.

This controlled milling approach results in a unique micro-structured network of cellulose fibrils which can be tailored to each application through adjustment of process parameters and selection of feed materials.

The robust and reliable design of the equipment enables continuous production of MFC at any scale, with onsite installations of grinders being modular to adjust production volumes to match each customer's requirements.

Producers of Cellulose Nanomaterials

At Pilot Scale or Larger

Anomera (Canada)

805-460, rue Sainte-Catherine Ouest Montreal, Québec, Canada H3B 1A7 514 845 4444 https://www.anomera.ca/

Anomera Inc. manufactures carboxylated Cellulose Nanocrystals (CNC) in a patented eco-friendly method that delivers a high-performance nanomaterial. This platform product uses renewable raw materials sustainability harvested from Canadian forests to create a low energy, biodegradable alternative for formulating plastic free products in both industrial and cosmetic applications. Its pilot plant and R&D lab is based in Montreal, Quebec and its manufacturing facilities is located in Temiscaming Quebec. To request a sample or purchase a cosmetic product, contact Anomera's distributor Croda. For industrial applications, please contact Anomera directly.

Contact:

sales@anomera.ca



ANPOLY INC. (Republic of Korea)

#303, 66, Yunghapgisul-ro, Heunhgae-eup, Buk-gu, Pohang City Gyeongsangbuk-do, 37563, Republic of Korea +82 054-262-0222, +82 10-4342-0973 https://en.anpolyinc.com/

ANPOLY develops technologies that enhance the performance of eco-friendly products by applying valuable nanocellulose materials made from discarded resources to various industries. ANPOLY produces CNC and CNF and is committed to developing material mass production technologies beyond the laboratory stage to be applied to real industries. ANPOLY's nanocellulose has world-class ultra-small particles and has applications in lightweight composite materials, packaging materials, filtration devices, cosmetics, secondary batteries, and medical biomaterials. It currently has an annual CNF capacity of 100 tons, and when the demo plant is completed at the end of this year, it will have a capacity of 1,000 tons starting next year.

Contact:

https://en.anpolyinc.com/contact

Asahi Kasei (Japan)

Hibiya Mitsui Tower (TOKYO MIDTOWN HIBIYA) 1-1-2 Yurakucho, Chiyoda-ku, Tokyo 100-0006 Japan https://www.asahi-kasei.com/

Asahi Kasei is a leading global producer of fiber products, chemicals, and electronic related materials based on its core technology of chemistry. Asahi Kasei products include CeolusTM and CelphereTM microcrystalline cellulose, and NanoActTM cellulose nanobeads.

Contact:

https://www.asahi-kasei.com/contact_us/

Axcelon Biopolymers Corporation (Canada)

7-717 Richmond Street, London, Ontario N6A 1S2 http://axcelonbp.com/

Axcelon Biopolymers Corporation (ABC) is an innovative biomaterials company focused on leveraging its unique bacterial nanocellulose (BNC) platform technology to develop high-value products for wound care, medical devices, tissue engineering, and industrial applications. Axcelon's products include Nanoderm®, a microfibrillar biosynthetic cellulose film that stimulates the skin's natural regenerative mechanism to help promote quicker wound healing with a one-time application dressing.

Contact:

Dino Mili, President & COO dmili@axcelonbp.com

Blue Goose Biorefineries Inc. (Canada)

#104-2518 Faithfull Avenue Saskatoon, Saskatchewan 306-280-6831 www.bluegoosebiorefineries.com

Blue Goose Biorefineries (BGB) is a wholly-owned subsidiary of Nano-Green Biorefineries Inc., a privately held Canadian company. Blue Goose's BGB UltraTM CNC is an aqueous suspension of carboxylated cellulose nanocrystals that is produced with a transition metal catalyzed oxidative process. Samples of BGB UltraTM are available at https://bluegoosebiorefineries.com/shop/.

Contact:

Blaine Kunkel, CEO

bkunkel@bluegoosebiorefineries.com

Borregaard ASA (Norway)

PO Box 162 1701 Sarpsborg +47 (0) 69 11 80 00 www.borregaard.com

Borregaard, a leading biorefinery company, has produced commercially available cellulose fibrils since 2016, in Sarpsborg, Norway. Exilva is an insoluble microfibrillated cellulose, which interacts both physically through its extreme surface area and chemically through hydrogen bonding. Its novel nature gives it rheological, mechanical and barrier functionalities, which as an additive, imparts a unique combination of properties in finished product systems. Free samples of Exilva are available online.

Contact:

Chief Technology Officer, Cellulose Fibrils hans.henrik.ovrebo@borregaard.com

CELLICON (Netherlands)

Leemansweg 15 6827BX Arnhem The Netherlands +31 (6) 26 337 608

CELLICON's proprietary G2 technology creates valuable grades of micro and nanocellulose from cellulose-containing feedstocks, such as biomass and textile waste. The innovative process is based on simple molten salt hydrates, and can be operated at low cost with low energy consumption.

Contact:

https://www.cellicon.org info@cellicon.nl

CelluComp Ltd (UK)

Unit 3, West Dock Harbour Place Burntisland, Fife KY3 9DW +44 (0)1592 870335 https://www.cellucomp.com/

CelluComp is a Scottish-based company whose "principle activity is to develop and commercialize Curran®," CNF, from root vegetables, primarily from sugar beet pulp. Curran is a commercial product. produced as a slurry, with a solids level of approximately 20%.

Contact:

enquiries@cellucomp.com



CelluForce (Canada)

2000 McGill College Avenue, 6th Floor Montreal, Quebec, H3A 3H3 514-360-1023 www.celluforce.com

CelluForce is the world leader in the development, production and commercialization of Cellulose NanoCrystals (CNC) and formulated products. The company operates the world's largest CNC plant, capable of producing 300 tonnes per year of high-quality sulfated cellulose nanocrystals. The company's products are currently used in several applications including oil and gas completion fluids, cosmetics, paints, coatings and rubber products. CelluForce was created in 2010 and its current shareholders are Domtar, FPInnovations, Schlumberger, Suzano and Investissement Quebec.

Contact:

info@celluforce.com

Cellulose Lab (Canada)

2 Garland Court, Room 212, Enterprise Bld. Fredericton, NB, E3B 5A3, Canada www.celluloselab.com

Cellulose Lab has been a pioneer in nanocellulose production since 2016, offering a diverse range of nanocellulose products including CNC, CNF, and bacterial cellulose (BC), all available in various forms such as anionic, cationic, hydrophobic, and other specialized forms. CNC capacity is 1kg per day and CNF capacity is 50 kg/day.

Contact:

contact@celluloselab.com;

Centre Technique du Papier (France)

Domaine Universitaire - CS 90251 38044 GRENOBLE - Cedex 9 +33 (0) 4 76 15 40 15 https://www.webctp.com/

Centre Technique du Papier (CTP) is the French Pulp and Paper Research and Technical Centre located at the University Campus, in Grenoble. CTP, in partnership with FCBA, operates the "NaMiCell" MFC/CNF pilot plant. The plant produces up to 100 kg per day of MFC/CNF in batches of 30 kg to 70 kg in the form of a 3% gel by way of a patented protocol. TEMPO MFC/CNF can also be produced on request.

Contact:

https://www.webctp.com/fr/contact/-acces

Chemkey Advanced Materials Technology (Shanghai) Co., Ltd (China)

B316, No.4226 Duzhuang Road, Shanghai, China 021-64196821 http://chemkey.com.cn/

Chemkey can provide lab samples of cellulose nanocrystals, microfibrillated cellulose, and cellulose nanofibers:

Contact:

http://en.chemkey.com.cn/c/127.html

Chuetsu Pulp and Paper (Japan)

282 U.J., Takaoka-shi Toyama Prefecture, 933-8533 0766 26 2401 www.chuetsu-pulp.co.jp

Chuetsu is a leading pulp and paper producer. In June 2017, Chuetsu started commercial production at Satsuma-Sendai, Kagoshima, Japan, to produce CNF using bamboo, hardwood and softwood bleached kraft pulp as its raw material. Chuetsu manufactures a unique CNF called Nanoforest[®] using the Aqueous Counter-Collision Method ("ACC method"). Nanoforest-S is a commercial product available as 2 wt. % and 10 wt. % solids.

Contact:

https://www.cpc-cenf.com/form.html

Daicel (Japan)

Grand Front Osaka Tower-B, 3-1 Ofuka-cho, Kita-ku, Osaka +81 6 7639 7171 https://www.daicel.com/en/

Daicel is a leading Japanese chemical company. Daicel produces CELISH cellulose fiber, microfibrillated by special manufacturing process, and is produced from highly refined, pure fiber raw materials. The raw material fiber is unraveled into tens of thousands of strands, and the fiber thickness is refined to between several μ m and 0.01 μ m. Because it is refined so that it does not impair the exact basic characteristics of the cellulose raw material (physical and chemical stability etc.), high-value-added product settings are possible.

Contact:

https://www.daicelmiraizu.com/en/inquiry/index.html

Daio Paper Corporation (Japan)

Tokyo Headquarters lidabashi Grand Bloom, 10-2 Fujimi 2 chome, Chiyoda Ward, Tokyo 102-0071 +81 3 6856 7500 http://www.daio-paper.co.jp/en/index.html

Daio is a full range of papermaking company that manufactures and sells paper, converted paper products, and functional materials. Daio products include cost-competitive ELLEX CNF. ELLEX is available as an aqueous dispersion (capacity 100 tpy), dry powder (capacity 10 tpy), and molded sheet.

Contact:

https://www.daio-paper.co.jp/en/contact/form-08/

DKS Co., Ltd. (Japan)

5 Ogawara-cho, Kisshoin, Minami-ku Kyoto 601-8391, Japan +81-75-323-5911 www.dks-web.co.jp

DKS Co. Ltd. (DKS) focuses on chemistry for a broad range of fields, including textiles, resins, industrial materials, materials for daily living, the environment, and energy. DKS produces carboxymethyl cellulose (CMC) and TEMPO oxidized cellulose nanofibers "RHEOCRYSTA" as aqueous functional additives.

Contact:

https://www.dks-web.co.jp/english/form/inquiry/

Empa (Switzerland)

Ueberlandstrasse 129 8600 Dübendorf / Switzerland +41 58 765 11 11 https://www.empa.ch/web/empa/

An institute of the ETH domain., Empa is the Swiss Federal Laboratories for Materials Testing and Research. Empa operates a MFC pilot plant and conducts applications research with industry partners.

Contact

https://www.empa.ch/web/empa/contact-form

Fibenol OÜ (Estonia)

Mõisa 4, 13522 Tallinn, Estonia +372 5323 3550 https://fibenol.com/

Fibenol has developed next-generation sugars, high-purity hydrolysis lignin, and microcrystalline cellulose (MCC) from hardwood. It offers three MCC grades based on lignin content: crude (25-30%), blonde (5-10%), and white (<5%). Fibenol can produce 200 tons of each MCC paste (20 wt%), totaling 40 tons dry. In June 2024, it launched the CBE-backed WOODCELL project to scale MCC production to 4000 tons dry. (https://www.cbe.europa.eu/projects/woodcell)

Contact:

info@fibenol.com



FiberLean Technologies Ltd. (UK)

Trebal Refinery, Trethurgy, St Austell, Cornwall, PL26 8YQ, UK www.fiberlean.com

FiberLean Technologies Ltd supplies equipment to produce MFC via its patented wet stirred media grinding based process. FiberLean offers both large and small grinders with capacities of approximately 1,400 and 400 dmt MFC per annum respectively, and FiberLean plants are modular and scalable. FiberLean offers technical services to support its customers in the production and application of the MFC.

FiberLean is also committed to expanding the use of MFC through applied research into new and developing applications for MFC in paper and packaging. FiberLean's production process is based on chemical pulp and no longer requires the presence of minerals in the process, unless requested by customers.

In addition to the supply of MFC grinding equipment, FiberLean has its own MFC production capacity of $^{\sim}2,000$ dmt MFC per annum available as a 18% solids cake product from its plant at Trebal, Cornwall. FiberLean utilizes its MFC production capacity for equipment trials, and it is also available for direct sale to MFC customers.

Contact:

info@fiberlean.com

FineCell (Sweden)

Teknikringen 56-58 SE-114 28 Stockholm Sweden www.finecell.se

FineCell has developed a new way to produce dry dispersible nano-sized cellulose from cellulose pulp. The technology is based on research at KTH, Royal Institute of Technology, and is patented globally. FineCell's cellulose has key applications as ingredient for cosmetics, personal & home care products, and paints & coatings. A demo plant is under construction and is expected to be operational in 2025.

Contact:

peter.axegard@finecell.se (CEO)
joachim.reimer@finecell.se (CTO)

Foamlab B.V.(Netherlands)

Alexander Fleminglaan 1 2613 AX Delft, The Netherlands +31 6 160 240 61 www.foamlab.co

Foamlab develops and produces bacterial cellulose based foams and aerogels. Our aerogels have remarkable strength while being extremely lightweight. They are available as film, powder and foam in a variety of densities.

Contact

info@foamlab.co

FPInnovations (Canada)

570 Boulevard St-Jean,
Pointe-Claire, Quebec H9R 3J9 Canada
+1 (514) 630-4100 or info@fpinnovations.ca
http://www.fpinnovations.ca/

Specializing in innovative scientific solutions, FPInnovations inaugurated its first CNC research facility with a state-of-the-art pilot plant in 2011. We also produced the first cellulose filaments (CF) in the laboratory and its pilot plant. Today we collaborate with many strategic research alliances, members, and partners. Using the technology developed by our research staff, industry now benefits in developing nanocellulose markets and applications. CelluForce (CNC), Kruger Biomaterials, and Performance Biofilaments (CF) are examples of our collaborations.

Contact:

jimmy.jong@fpinnovations.ca

GranBio USA

300 Mcintosh Parkway Thomaston, Georgia, 30286 http://www.granbio.com.br/en/

GranBio has developed two patented BioPlus® nanocellulose production technologies for different markets, BioPlus® with AVAP® and BioPlus® with GreenBox®. Both processes are demonstrated at the scale of 1/2 tpd at GranBio Biorefinery in Thomaston, Georgia. These processes allow for the economical extraction of commercial-scale nanocellulose from any biomass with adjustable particle size and composition. Nanocellulose fibrils produced through the chemical-free GreenBox process have exceptionally low cost that enables their use in large volumes.

Contact:

Kim Nelson, CTO Nanocellulose knelson@granbio.com

Guilin Qihong Technology Co. Ltd. (China)

12 Jiangan Road, Qixing District, Guilin City, Guangxi Province. 156#7706#2278 http://www.qh-tech.cn/en/h-default.html

Guilin Qihong Technology Co., Ltd. focuses on research for the production and application of cellulose Nanofiber. Our products include carboxylated cellulose nanofibers (CNF), sulfate esters nanocrystals (CNC), hydrophobic nanocellulose (hydrophobic-CNC), and bacterial cellulose (BC). We own several national patents for inventions and processing technology and we are sincerely looking forward to cooperating with partners.

Contact:

Email 414328106@qq.com

Hangshi Technology Development (Hangzhou) Co., Ltd. (China)

No.168 Qianwu Road, Qingshanhu Science and Technology City, Lin'an District, Hangzhou City, Zhejiang Province, China +86-572-8276858

http://www.hangshitech.com/index_en.html

Led by Hangzhou Research Institute of Chemical Industry Co. with Zhejiang University Quzhou Research Institute, Hangshi Group, Jingxiu Environmental Protection, Dubai Technology, and other research institutes and enterprises, Zhejiang Biodegradable and Nano Materials Innovation Center is a new type of industry-university-research innovation alliance with the strong support of governments at all levels of the country. The Innovation Center and South China University of Technology and has built a 100kg/d micro and nano cellulose green pilot test line.

Contact:

http://www.hangshitech.com/contact_en.html

Hansol Paper (Republic of Korea)

23-24F, Tower B, 100, Eulji-ro, Jung-gu, Seoul, Republic of Korea https://www.hansolpaper.co.kr/eng/main

Hansol is a leading producer of paper and biomaterials. Hansol Paper has been concentrating its investment on developing nanocellulose from pulp since 2010, and set up the production system in late 2018. Hansol's goal is to advance into the material industry beyond the paper industry through nanocellulose, which has great potential for business expansion across different industries.

Contact:

https://www.hansolpaper.co.kr/eng/customer/inquiry

Holmen AB (Sweden)

PO Box 5407 SE-114 84 Stockholm +46 8 666 21 00 www.holmen.com

One of the largest forest owners in Sweden, Holmen is a major producer of paper, paperboard and wood products, plus renewable energy from wind and water. Holmen is also a 42.4% owner of Melodea Ltd., a producer of CNC.

Contact:

https://www.holmen.com/en/contacts/

InnoTech Alberta (Canada)

250 Karl Clark Road Edmonton, AB T6N 1E4 780-450-5111 www.innotechalberta.ca

InnoTech Alberta, a subsidiary of Alberta Innovates, is a leading research and technology organization serving the needs of industry, entrepreneurs, and public sector. Our organization's multidisciplinary expertise, cross-sector teams, and pilot-scale research facilities accelerate technology development. InnoTech Alberta operates a cellulose nanocrystals (CNC) pilot plant that can produce up to 20 kg per week of CNC from a variety of feedstocks.

Contact:

info@innotechalberta.ca.

Innotech Materials LLC (U.S.)

10437 Innovation Drive, Suite 324 Wauwatosa, WI 53226 414-488-2092 http://www.innotechmaterials.com/

Innotech Materials has developed a process for catalytic oxidation of commercial cellulose to produce hydrophobic and hydrophilic nanocellulose. Innotech products include: Oxidized Nanocellulose for applications in polymer biocomposites; Methyl Nanocellulose and Hydroxypropyl Methyl Nanocellulose for personal care, cosmetics, and pharmaceuticals; Carboxy Methyl Nanocellulose for bioadhesives; Hydrophobic Nanocellulose for bioplastic packaging.

Contact:

info@innotechmaterials.

Innovatech Engineering (U.S.)

1650 Summit Lake Dr. Suite 103 Tallahassee, FL 32317 United States (850) 391-2396 https://innovatech.us/

Innovatech is focused on bringing new technology to the market, specifically the commercialization of nanocellulose. Innovatech produces Nanopaper nanocellulose sheets in thicknesses from 0.012 to 0.015 millimeters. Nanopaper can be translucent, or transparent, made from TEMPO oxidized cellulose nanofibers.

Contact:

info@innovatech.us

Innventia (Sweden)

See RISE.

Klabin S.A. (Brazil)

Avenida Brigadeiro Faria Lima 3600 - 3, 4 e 5 andares, Itaim B Sao Paulo 04.538-132 +55 11.30465800 https://www.klabin.com.br/en/home/

Klabin is Latin America's leading producer of containerboard, boxboard and packaging papers. In February 2018, Klabin acquired a minority interest in Israel-based Melodea Ltd., a producer of cellulose nanocrystals. In September 2018, Klabin announced an investment of Real 32 million for its research and development program for the construction of a Pilot Mill Complex in Telêmaco Borba (Paraná) to begin operating in 2019. The complex was developed to conduct testing and research on MFC to be incorporated into the company's paper production lines.

Contact:

https://www.klabin.com.br/general/contact-us/contact-us/

Kruger (Canada)

3285, Chemin Bedford Montréal, Québec H3S 1G5 514-343-3100 http://bio.kruger.com/

Kruger Inc. is a major Canadian producer of tissue products, renewable energy, paper and paperboard made from recycled fibers, specialty papers for eco-friendly food packaging and labelling products, and cellulosic biomaterials. In September 2013, Kruger Biomaterials formed a strategic alliance with FPInnovations to produce and commercialize cellulose filaments, a form of cellulose nanofibrils. FiloCell is produced at 30% solids, with width of 30-500 nm, and most frequently 80-300 nm, and with length of 100-2,000 μ m. Current capacity is 6,000T/y.

Contact:

https://biomaterials.kruger.com/contact-us/

Marubeni (Japan)

4-2, Ohtemachi 1-chome, Chiyoda-ku, Tokyo 100-8088, Japan [81] (3) 3282-2111 https://www.marubeni.com/en/

Marubeni Corporation and its consolidated subsidiaries use their broad business networks, both within Japan and overseas, to conduct importing and exporting, as well as domestic business, encompassing a diverse range of business activities across wide-ranging fields including lifestyle, ICT business & logistics, food, agri business, forest products, chemicals, and much more. In 2022 Marubeni and Chuetsu Pulp announced new agricultural material that uses the ACC cellulose nanofiber nanoforest® manufactured by Chuetsu. See Chuetsu.

Contact:

https://www.marubeni.com/en/contact_form/

Marusumi Paper Co., Ltd. (Japan)

826 Kawanoe-cho,Shikokuchuo,Ehime, 799-0196, Japan https://www.marusumi.co.jp/en/paper/cnf/

NANOCEL TECHNOLOGY S.L. (Spain)

Parque Empresarial de Alvedro, Calle J, Nave 25, 15180, Culleredo, A Coruña, Spain +34 698 162 438 https://nanocel.es

NANOCEL is a technology-based company whose main activity is the technological development of the production and commercialization of new nano-scale products and biosustainable materials. The company uses various raw materials – virgin biomass such as Kraft cellulose, or recycled – for the development and sale of nanocellulose (in emulsion, dry, or modified). NANOCEL is strategically oriented towards the development of sustainable nanoparticle applications such as packaging, paper, plastics, construction, cosmetics, pharmaceuticals, food, etc...

Contact:

info@nanocel.es

Navitas d.o.o (Slovenia)

Podcerkev 1A 1386 Stari trg pri Ložu Slovenia (EU) +386 41 648 879 https://www.nanocrystacell.eu/

Navitas started production of Nanocrystacell CNC in 2020 in Slovenia following development beginning in 2018. Capacity is 10 tonnes per year, and the glycol-based process results in CNC with negligible sulfur content. Nanocrystacell is available as freeze vacuum dried powder or aqueous suspension. Capacity is 50 tonnes per year, dry basis.

Contact:

contact@nanocrystacell.eu

Nippon Paper Industries Co., Ltd. (Japan)

Ochanomizu Sola City
4-6, Kandasurugadai, Chiyoda-ku, Tokyo 101-0062, Japan
Tel: +81-(0)3-6665-1111
https://www.nipponpapergroup.com/english/products/cnf/

Nippon Paper is Japan's largest manufacturer of paper and paperboard, and is also one of the world's largest producers of CNF with capacity for 560 tonnes per year. In October 2013, Nippon established the first precommercial plant in Japan at its Iwakuni mill. Nippon later started operations at the Ishinomaki Mill (TEMPO), the Fuji Mill (Kyoto Process), and the Gotsu Mill for food and cosmetics additives. Nippon Paper's work with CNF is focused on composites, cosmetics, filtration, gas barrier films and health care products.

Contact:

https://www.nipponpapergroup.com/english/inquire/

Nordic Bioproducts Group (Finland)

Office & BIG R&D Lab
Tietotie 1A, 02150 Espoo, Finland
https://nordicbioproducts.fi/

Nordic Bioproducts Group (NBG) is a Finnish producer of microcrystalline cellulose (MCC) at a capacity of 10,000 tonnes/year. The AaltocellTM technology minimizes energy, chemical and water usage, as well as waste generation, resulting in MCC with a markedly reduced carbon footprint compared to the market standard. The MCC exhibits unique, tailorable properties that widen the application horizon from pharma, food and cosmetics towards high performance materials. Furthermore, NBG converts MCC into carboxylated cellulose nanomaterials at a pilot scale.

Contact: Kalle Riihinen kalle.riihinen@nbg.fi

Norske Skog ASA (Norway)

PB 294 Skøyen
0213 Oslo, Norway
https://www.norskeskog.com/products/enesrgy-bio-products/cebina

Norske Skog installed their MFC pilot plant at Saugbrugs in 2017 and has a current capacity of 525 tonnes of CEBINATM. In 2022 a unique solution for dry MFCs was announced, with a 25 tonne pilot being built in 2023. Commercial production of systems where 30 % dry weight MFCs are incorporated into epoxy resin, polyols or castor oil is ongoing. Both waterborne- and dry MFCs have been supplied to several industry-scale projects.

Contact:

CEBINA@norskeskog.com

Oji Holdings (Japan)

47-5, Ginza 4-chome Chuo-ku, Tokyo 104-0061 +81 3 3563 1111 https://www.ojiholdings.co.jp/english/

Oji is a leading Japanese paper company. Oji produces CNF through nanofibrillation of pulp, and has developed a manufacturing process using a unique chemical treatment, "phosphorylation," which enables Oji to produce CNFs with high quality (high transparency, high viscosity, and thixotropy). Oji manufactures transparent CNF slurry and coarse CNF slurry (AUROVISCO), hydrophobic CNF powder, and CNF sheet (AUROVEIL).

Contact:

https://www.ojiholdings.co.jp/english/r d/contact.html?frmid=29

Performance BioFilaments Inc. (Canada)

Suite 1120, 700 West Street Vancouver, BC, Canada V6C 1G8 (1) 604 806-0261 www.performancebiofilaments.com/

Performance BioFilaments, Inc. was launched in 2014 as a joint venture between Mercer International, Inc. and Resolute Forest Products. Performance BioFilaments supplies NanoFibrillated Cellulose (NFC) as wet crumb (30% solids), and as a dispersed pumpable slurry (2-10% solids).

Contact:

Keith Gourlay, Director of Technology Development kgourlay@performancebiofilaments.com



Re-Fresh Global (Germany)

c/o B-Part Am Gleisdreieck Luckenwalder Str. 6b 10963 Berlin https://re-fresh.global/

Re-Fresh Global is a biotech company with a patented process that converts textile waste into nanocellulose materials called **Re-Nano™**

Re-Nano™ is a patented microfibrillated cellulose that enhances the strength, stability, and flexibility of numerous natural products and can replace current virgin and synthetic additives, thereby significantly reducing your company's carbon footprint as an eco-friendly solution. Re-Fresh Global offers a range of valuable resources for over 14 industries, including Re-SanPulp, a customizable textile pulp made from recycled synthetic fibers, and Re-Thanol, a bio-ethanol with diverse industrial applications. video

Contact:

community@re-fresh.global

RISE Research Institutes of Sweden AB (Sweden)

Sven Hultins plats 5, 412 58, Gothenburg, Sweden 010-516 50 00 https://www.ri.se/en

RISE is Sweden's research institute and innovation partner. RISE Innventia, an early leader in the development of MFC, reduced energy usage in producing MFC through six generations of development, including enzymatic pretreatment. RISE operates a 100 kg/day MFC pilot plant at Innventia and a mobile demonstration plant for MFC trials at mills around the word. The mobile demo plant is able to produce highly refined fiber (HF), highly refined enzyme treated fiber (HFE) or MFC at the rate of 100 kg of dry product per hour.

Contact:

https://www.ri.se/en/about-rise/contact-us

RISH Research Institute for Sustainable Humanosphere (Japan)

Kyoto University Gokasho, Uji City, Kyoto Prefecture, Japan. 611-0011 +774-38-3346 https://www.rish.kyoto-u.ac.jp/?lang=en

The RISH at Kyoto University is a leader in cellulose nanofibril research. Professor Hiroyuki Yano of RISH was the first in Japan to become engaged in the research of cellulose nanofibers. The Kyoto Process is based on the "Pulp Direct-Kneading Method." RISH has a pilot plant with capacity of 1 tpy of thermoplastic resins with 10 wt. % CNF. One application is the Nanocellulose Vehicle (NCV): the use of CNF in 13 components enables weight reduction of 16% compared to standard vehicles. https://www.youtube.com/watch?v=06H8wP9axjU

Contact:

Prof. Hiroyuki Yano <u>yano@rish.kyoto-u.ac.jp</u>

Sappi | Valida (The Netherlands)

Sappi Biochemtech BV Biesenweg 16 | 6211 AA Maastricht | The Netherlands https://www.sappi.com/valida-home

Sappi is a leading global provider of everyday materials made from woodfibre-based renewable resources. As a diversified, innovative and trusted leader focused on sustainable processes and products, we are building a more circular economy by making what we should, not just what we can. Our market offerings such as dissolving pulp, wood pulp, biomaterials, timber, packaging and speciality papers, graphic papers, casting and release papers and forestry products are manufactured from woodfibre sourced from sustainably managed forests and plantations, in production facilities powered, in many cases, with bio-energy from steam and existing waste streams. Sappi Valida is a leading producer of fibrillated cellulose with naturally derived functionality for a wide range of applications including personal care, agriculture, coatings, construction additives and packaging. Sappi Valida is available in commercial volumes from a number of production facilities.

Contact:

Valida@sappi.com

ScienceK (China)

Zhejiang, China http://www.sciencek.com

ScienceK, a pioneer in the nanocellulose industry, provides a full range of scientific research services. Science K provides CNC 5 kg/day dry power; CNF 200 kg/day, 1% by mechanical method; CNF 200kg/day 1% TEMPO plus mechanical; BC, 200 kg/day 5%.

Contact:

sciencek@qq.com

Seiko PMC Corporation (Japan)

Wakamatsu Bldg. 8th Floor, 3-6, Nihonbashi Honcho 3-chome, Chuo-Ku, Tokyo, Japan 103-0023 +81-3-6202-7331 http://www.seikopmc.co.jp

Seiko PMC Corporation produces papermaking chemicals and resin products. Seiko produces STARCEL® CNF resin composite using the Kyoto Process.

Contact:

http://www.seikopmc.co.jp/cgi-bin/contact_e.cgi

Shengquan Group (China)

Shengquan Industrial Park, Zhangqiu District, Jinan City, Shandong Province, China https://e.shengquan.com

The Jinan Shengquan Group Share-Holding Co., Ltd. industrial layout includes biorefinery, high-performance resin and composites, foundry materials, health & pharmaceutical industry, new energy, etc. Shengquan 超变力® nanocellulose is made of plant fiber as raw material and has diameter is less than 100nm and aspect ratio not less than 200. It can be modified into anionic, cationic, silane-coupled chemical functional nanocellulose by oxidation, lipidation, silanization and other modification technologies.

Contact:

zacktang@shengquan.com

Stora Enso Oyj (Finland)

PO Box 309 FI-00101 Helsinki +358 20 46 131 http://www.storaenso.com/

Stora Enso was one of the first companies to successfully launch paperboard enhanced with MFC commercially.

Contact:

https://www.storaenso.com/en/contact-us

Sugino Corp. (Japan)

1380 Hamilton Pkwy. Itasca, IL 60143 888.784.4661 www.suginocorp.com

Star Burst, Sugino's full line of wet jet milling devices, disperse, emulsify, pulverize, and reform surfaces of raw materials by obliquely colliding the particles pressurized up to 245 MPa at the relative velocity of Mach 4. Star Burst does not use any grinding media and can deliver homogenized particle size with minimal contamination. BiNFi-s are Sugino original nano-sized nanofibers utilizing Star Burst technology. They are biomass fibers of cellulose, chitin, chitosan, and silk with 10 to 20nm diameter and multiple micron lengths.

Contact:

kyoneda@suginocorp.com

Suzano Papel e Celulose S.A. (Brazil)

Av. Brigadeiro Faria Lima 1355 – do 6º ao 8º andar Pinheiros CEP 01452-919 São Paulo, SP, Brasil www.suzano.com.br

Suzano is the largest pulp manufacturer in the world, the leader in the toilet paper segment in Brazil and one of the largest paper producers in Latin America. In Brazil, Suzano produces microfibrillated cellulose in a 700 tpy (dry basis) pilot plant, and in 2023 started operations of an industrial-scale plant with capacity of 20 ktpy (dry basis). Woodspin, a joint venture between Suzano and Spinnova, also started operations in 2023. With Woodspin, Suzano produces MFC on site in Finland for use in Spinnova textiles. Suzano is also an equity partner in CelluForce.

Contact:

https://www.suzano.com.br/en/products-and-brands/raw-material/microfibrillated-cellulose

Toagosei Co. Ltd., (Japan)

1-14-1 Nishi-Shimbashi, Minato-ku, Tokyo 105-8419

TEL: +81-3-3597-7215

https://www.toagosei.co.jp/english/index.html

Taogosei produces cellulose nano fibers (CNF) from non-edible biomass. Toagosei was able to reduce the energy required for fibrillation, and achieve a lower cost through our proprietary oxidized cellulose fibrillation technology. Our Aronfibro is fibrillated into short, single nano fibers for excellent dispersion, and adding it to resins, rubbers, paints, adhesives, and other material can help improve their properties. Aronfibro is available as a paste with approximately 10% solids.

Contact:

sales@toagosei.net

TPI Chemicals FZCO (UAE)

Premises No:HD155, Floor No:25, Sheikh Rashid Tower, Dubai World Trade Centre, Dubai, UAE + 90 536 561 3709 https://www.tpi-chemicals.com/

TPI Chemicals is a know-how based and technology oriented Cellulosic Polymers Developer and Supplier. MFC (Micro fibrillated Cellulose) is one of the Cellulose Derivatives TPI Chemicals develops and supplies. Please feel free to contact us for more information.

Contact:

e-mail: info@tpi-chemicals.com

University of Maine (U.S.)

The Process Development Center 5737 Jenness Hall Orono, ME 04469 207-581-2237 https://umaine.edu/pdc/

The Process Development Center (PDC) offers a broad range of technical services and resources. The University of Maine (UMaine) Nanomaterial Pilot Plant opened in 2012 at the PDC and is a joint project with the US Forest Service. The pilot plant has capacity for 1 ton per day of CNF and is the largest CNF plant in the US. The UMaine PDC supplies cellulose nanofibrils (CNF) and cellulose nanocrystals (CNC) to academic, public, and private research groups interested in evaluating and developing applications for these materials.

Contact:

umaine.pdc@maine.edu

UPM Biomedicals (Finland)

Alvar Aallon katu 1 P.O. Box 380 00101 Helsinki, Finland +358 204 15 111 https://www.upmbiomedicals.com/

UPM Biomedicals offers our natural biocompatible innovation, UPM Nanocellulose. UPM Nanocellulose is already used in in vitro 3D cell culture (>180 protocols available for GrowDex®), in in vivo cell transplantation, in bioinks (GrowInk™) and in CE-marked wound dressings (FibDex®, medical device class II). We already supply several companies, such as BICO AB (Cellink), with our material for formulation of their own products.UPM also offers licenses for specific application fields.

Contact:

biomedicals@upm.com

USDA Forest Service, Forest Products Laboratory (U.S.)

One Gifford Pinchot Drive Madison, WI 53726 608-231-9200 https://research.fs.usda.gov/fpl

Established in 1910 by the U.S. Department of Agriculture Forest Service Chief Gifford Pinchot, the U.S. Forest Products Laboratory, became the first research facility focusing on study of physical properties and resource utilization of wood. The Forest Products Laboratory funded a first of its kind in the U.S. production facility for renewable, forest-based nanomaterials. The Laboratory's pilot plant produces cellulose nanocrystals (30 kg/wk) and TEMPO-based cellulose nanofibers (5 kg/wk).

Contact:

https://research.fs.usda.gov/fpl/contactus

VERDE Nanomaterials Inc. (U.S.)

California, USA (510) 883-3258 www.verdenano.com

VERDE Nanomaterials, founded in 2022, is an innovative startup developing a cost-effective process for producing cellulose nanofibers (CNFs) from waste resources, including agricultural residues and other fiber-based byproducts. Leveraging research from the University of Washington, VERDE's core technology utilizes green chemistry principles and simple unit operations to enable a more sustainable and economically viable process to make CNFs.

Contact: contact@verdenano.com



VTT Technical Research Centre (Finland)

PO Box 1000 FI-02044 VTT +358 20 722 111 www.vtt.fi

VTT can make various MFC and CNF grades for application testing. These grades can be produced from customer's raw materials with varying degrees of fibrillation (coarse, medium, fine fibre size) including specific aseptic grades for cosmetic and pharmaceutical applications. VTT produces tailor-made samples for R&D purposes from lab to pilot scale using standard equipment such as Masuko grinders and microfluidizers, unmodified, chemically modified, and enzymatically aided, up to 20 kg/day. VTT's services include semi-pilot scale nanocellulose barrier coating concept and MFC film pilot line, which are available for confidential customer projects.

Contact:

Jaakko Kuusisaari, Solution Sales Lead jaakko.kuusisaari@vtt.fi

+358405015197

Weidmann Fiber Technology (Switzerland)

Neue Jonastrasse 60 8640 Rapperswil SG Switzerland https://weidmannfibertechnology.com/

Part of Weidmann Holding AG, Weidmann Fiber Technology operates a production plant that produces Celova® microfibrillated celluloses and cellulose powder. The purely mechanical process uses no chemical or enzymatic pretreatment. Raw materials include pulp and perennial plants. Applications include personal care, barrier and film coatings, home and industrial care, energy storage, paints and adhesives.

Contact

https://weidmannfibertechnology.com/#Contact%20us

Woodspin (Finland)

A joint venture between Suzano and Spinnova. See Suzano.

Zelfo Technology GmbH (Germany)

Am Wasserturm 1, 16247 Joachimsthal UNESCO Biosphere Schorfheide-Chorin, Brandenburg, Germany +49 (0)33361 64931 https://www.zelfo-technology.com

We specialise in producing fibrillated macro (MaFC) micro (MFC) and nano (NFC) cellulose fibres, either as separate entities or in controlled mixtures. Zelfo Technology's experience in these fields extends to sources from preprocessed and non-processed ligno-cellulosic fibres and we aim to generate the best performance properties from all constituent parts of the source material. Engineered fibres perform as biobased binders, composites and absorbents etc.

Contact:

https://www.zelfo-technology.com/about-us-contact

Zhejiang Jinjiahao Green Nanomaterial co., ltd (China)

No.37 Venus Road, Longyou Industrial Zone, Quzhou City, Zhejiang Province, China 0570 — 7566665 http://www.cnjjh.cn/

Zhejiang Jinchang Specially Paper Co., Ltd. was founded in March 2009. The company specializes in design, development, production, processing, and sale of specially papers. Jinjiahao nanofibers allow new or improved products and processes in different applications.

Contact:

http://www.cnjcpaper.com/contacten.aspx

Equipment and Technology Providers

Betulium Oy (Finland)

Tekniikantie 2, FI-02150 Espoo Finland www.betulium.com

Betulium was sold to KCL. See KCL.

Chemstone (U.S.)

18066 Ventura Blvd Encino, CA 91316 818) 757-1305 https://chemstone.com/

In 2023 Chemstone acquired HS Manufacturing Group (HSMG), a technology provider focused on biodegradable packaging solutions. PROTĒAN® is an environmentally friendly and non-toxic barrier coating and additive technology platform that can deliver critical water, oil and grease resistance properties. PROTĒAN® has been proven to provide excellent oil and grease barrier, especially when combined with wet end surface applications of MFC or CNF, and the performance can be further improved with the addition of MFC or CNF in the base sheet.

Contact:

https://chemstone.com/contact-us.html

Fibenol OÜ (Estonia)

Mõisa 4, 13522 Tallinn, Estonia +372 5323 3550 https://fibenol.com/

In 2023 Fibenol acquired the SunburstTM reactive extrusion process that deconstructs biomass into lignin, hemicellulose and cellulose in 20 seconds, and with further enzymatic hydrolysis can yield low-cost CNC or CNF. In March 2022 Fibenol received final acceptance of its first commercial Sunburst unit at the Sweetwoods Project in Estonia. Fibenol will consider joint product development agreements, as well as licensing and other partnership structures to continue to deploy the technology commercially. Samples can be available subject to NDA and MTA.

Contact:

info@fibenol.com

Hielscher Ultrasonics GmbH (Germany)

Oderstr. 53, 14513 Teltow, Germany +1 (973) 532-6488

https://www.hielscher.com/ultrasonic-homogenizers-for-liquid-processing-3.htm

Hielscher Ultrasonics specializes in the design and manufacturing of high-power ultrasonic homogenizers for lab, bench-top and production level. Ultrasonic power is an effective and energy-efficient means to apply high shear and intense stress to liquids, powder/liquid mixtures and slurries. Hielscher equipment includes devices for the ultrasonication of any liquid volume, from several microliters through hundreds of cubic meters per hour.

Contact:

info@hielscher.com

KCL (Finland)

KCL Oy Keskuslaboratorio-Centrallaboratorium Ab Tekniikantie 2 FI-02150 Espoo, Finland +1 358 40 5227104

KCL is Europe's leading open access pilot and laboratory service provider. Services include biomaterial processing, extrusion and dispersion coating and lamination, laboratory services and more. KCL hosts the BIOHUB cluster tailored for the biomaterials sector with a dedicated space for testing, piloting, and laboratory facilities. In 2013, KCL acquired Betulium Oy, a producer of MFC from industrial side-steams such as sugar beet pulp. In addition, KCL has pilot-scale production of cationized, phosphorylated, and sulphated cellulose nanofibers (CNF).

Contact:

Dr. Antti Laukkanen, R&D director antti.laukkanen@kcl.fi

Masuko Sangyo Co., Ltd. (Japan)

1-12-24 Honcho, Kawaguchi-city, Saitama-pref, JAPAN 332-0012 +81-48-222-4343 http://www.masuko.com/English/index.html

In 1965, Masuko became the first manufacturer in the world to commercialize an innovative friction grinder using a grinding wheel, the "Supermasscollider" Since then, Masuko has introduced a broad range of machines that achieve ultra-fine pulverization for an expanding range of materials, including the production of cellulose nanofibrils (CNF). Masuko grinders are in commercial production of CNF at various locations globally.

Contact:

http://www.masuko.com/English/form/index.php

MetGen (Finland)

Rakentajantie 26 20780 Kaarina, Finland +358 2 237 7077 https://www.metgen.com/

MetGen is a privately held company founded in 2008 on the core competence of genetic engineering and synthetic biology. Today MetGen offers a full range of biotechnology solutions, including enzymes to support biorefineries. Full technology solutions are not only in the field of hydrolysis for biomass fractionation, but also for the production of clean sugars, sugar fermentation, and lignin refining. METNIN™ is a unique market driven technology to valorize the lignin streams from modern biorefineries, and pulp mills.

Contact:

https://www.metgen.com/contact-us/

Microfluidics International Corporation (U.S.)

90 Glacier Drive, Suite 1000 Westwood, MA 02090 Telephone: +1 (617)-969-5452 https://www.microfluidics-mpt.com/

Microfluidics International Corporation, the manufacturer of Microfluidizer high shear fluid processors, is a leader in the design and production of laboratory and commercial processing equipment used in the production of microand nano-scale materials including nanocellulose. Microfluidizer technology is employed in the production of cellulose nano- and micro- fibrils at corporations and research centers around the globe.

Contact:

https://www.microfluidics-mpt.com/contact-us

Sugino Corp. (Japan)

1380 Hamilton Pkwy. Itasca, IL 60143 888.784.4661 www.suginocorp.com

Star Burst, Sugino's full line of wet jet milling devices, disperse, emulsify, pulverize, and reform surfaces of raw materials by obliquely colliding the particles pressurized up to 245 MPa at the relative velocity of Mach 4. Star Burst does not use any grinding media and can deliver homogenized particle size with minimal contamination. BiNFi-s are Sugino original nano-sized nanofibers utilizing Star Burst technology. They are biomass fibers of cellulose, chitin, chitosan, and silk with 10 to 20nm diameter and multiple micron lengths.

Contact:

kyoneda@suginocorp.com

Valmet North America (U.S.)

3720 Davinci Court Norcross, GA 30092 www.valmet.com

Valmet is a leading global developer and supplier of process technologies, automation, and services for the pulp, paper, and energy industries. For MFC production, Valmet has a unique, refiner-based technology. The production process combines advanced refiner and plate technology with an innovative control system designed to maximize production efficiency. Valmet MFC can use disk or conical refining technology to produce MFC in either a batch or continuous refining process. Valmet's MFC Business Research Team has a pilot research plant in Finland and an alliance with the University of Maine Process Development Center (PDC) in the US.

Contact:
David Cowles
david.cowles@valmet.com

Vireo Advisors LLC (U.S.)

WBENC Certified Woman Owned Business P.O. Box 51368, Boston, MA 02205 USA https://www.vireoadvisors.com

Vireo Advisors, LLC is an international expert advising firm with significant experience supporting the commercialization of novel forms of celluloses and other biobased materials. We conduct occupational and product-specific safety evaluations and create market and regulatory documentation and roadmaps to set clear expectations, reduce business risk, and inform product design. Tapping into our broad network, we build consortia, identify opportunities, and convene key stakeholders to identify solutions to complex problems.

Contact:

https://www.vireoadvisors.com/contactus

Government, University, Research, and Consultants

Aalto University (Finland)

Aalto University P.O. Box 11000 (Otakaari 1B) FI-00076 AALTO +358 9 47001

https://www.aalto.fi/en/department-of-bioproducts-and-biosystems/biobased-materials-technology

The biobased materials technology group (BIOMAT) led by Dr. Maloney carries out research in the development of next generation fiber products. The target is to develop technologies that enable renewal of the paper and board industries: nanocellulose films, nanopapers and nanostructuring of fibers for high-bulk board. Various grades of nanocellulose can be produced in our labs. Specialized methods for measuring nanocellulose quality are available. Methods for measuring nanocellulose/water interactions including water removal are especially notable.

Contact:

thaddeus.malonev@aalto.fi

AFRY Management Consulting, Inc. (U.S.)

295 Madison Avenue, Suite 300 New York, NY 10017 www.afry.com

AFRY is a global engineering, design, and advisory firm driving sustainable transformation. We deliver solutions across energy and industrial sectors. AFRY supports nanocellulose project developers with feasibility studies and process engineering. Our expertise spans the complete nano- and micro-fibrillated cellulose value chain, including market intelligence, pilot plant design, scale-up, supply chain optimization, and end-use applications and markets. We enable commercialization through targeted business, technical, regulatory, and strategic guidance.

Contacts:

alexander.koukoulas@afry.com

Agroforestry Nanotechnology Research Group (GNanoAgro-UFPR) (Brazil)

632 Lothario Meissner Avenue Curitiba, Paraná State, Brazil 80210170 +55 41 3360 4223 www.gnanoagro.ufpr.br

The Agroforestry Nanotechnology Research Group (GNanoAgro/UFPR), associated with LCNano/UFPR within the SisNANO Network (MCTI, Federal Government of Brazil), specializes in education, innovation, scientific and technological research, and technical consulting services for public or private institutions. Our focus includes

developing new nanostructured products from natural fibers, enhancing polymeric nanocomposites, and modifying surface materials for various applications.

Contact:

https://gnanoagro.ufpr.br/contato/

Alberta Innovates (Canada)

250 Karl Clark Road Edmonton, BC T6N1E4 780-427-1956 www.albertainnovates.ca

See InnoTech Alberta in the Producers Section.

American University (U.S.)

4400 Massachusetts Avenue, NW Washington, DC 20016 +1 202 885-1000 https://www.american.edu/

American University engages students to create meaningful change in the world through experiential learning and student driven research. Located in Washington DC, it is known for strong international relations, public policy, and business programs. Combined with recent investments in the STEM fields, the university is well positioned to work with industry and government agencies to advance the commercialization of new biomaterials.

Contact:
Douglas M. Fox
Department of Chemistry
dfox@american.edu

Auburn University (U.S.)

Auburn, Alabama 36849 (334) 844-4000 https://www.auburn.edu/

Beijing Forestry University (China)

No. 35 Tsinghua East Road Haidian District, Beijing, P.R. China http://eng.bjfu.edu.cn/

BioApplied Innovation Pathways (Canada)

1 Research Drive, Suite 107 Dartmouth, NS B2Y 4M9 +1 (902) 701-9761 (office) https://bioapplied.com/

BioApplied™ provides business services to support the circular bioeconomy. These services include ecosystem development, business research, and business development and product deployment – with deep experience commercializing nano-cellulosic materials. Since our formation in 2011, we have built an exceptional Network of Industrial, Technical, Academic, Government, Entrepreneurial, and Financial expertise. We welcome your call and will be delighted to discuss, explore, discover...

Contact:

greg.maloney@bioapplied.com +1 (514) 497-0360 (mobile)

BioPRIA (Australia)

Monash University
15 Alliance Lane
Clayton 3800, Australia
+61 3 99053456
https://www.monash.edu/; https://www.biopria.com.au/

BioPRIA at Monash University has lab refiners, homogenisers and reactors for producing CNC, CNF and TOCN at the 10-100s of gram scale. The Institute has developed new methods for characterizing cellulose nanomaterials and can rapidly manufacture 10-200 freestanding pure and composite cellulose nanofiber films using spray coating. The Institute has a comprehensive suite of equipment for measuring nanocellulose film properties, including barrier performance.

Institute Contact:

https://www.biopria.com.au/contact/

BioProducts Institute (Canada)

See University of British Columbia.

Biorenewable Deployment Consortium LLC (U.S.)

2875 Ashton Road P.O. Box 17182 Sarasota, FL 34276 https://biorenewabledc.com/

The Biorenewable Deployment Consortium LLC (BDC) is an international company that assists its membership with the deployment of leading-edge advanced biofuels, biochemicals, and bioproducts technologies that do not require long-term subsidy making them more profitable and sustainable. The company identifies, performs due diligence, and promotes those processes that add value to its member companies under its brokering partnership initiatives.

Contact:

Eric.Horn@biorenewabledc.com

Center for Renewable Carbon (U.S.)

See University of Tennessee.

Centre Technique du Papier (France)

Domaine Universitaire - CS 90251 38044 GRENOBLE - Cedex 9 +33 (0) 4 76 15 40 15 http://www.webctp.com/gb/default.cfm

Centre Technique du Papier (CTP) is the French Pulp and Paper Research and Technical Centre located at the University Campus, in Grenoble. CTP, in partnership with FCBA, operates the "NaMiCell" MFC/CNF pilot plant. The plant produces up to 100 kg per day of MFC/CNF in batches of 30 kg to 70 kg in the form of a 3% gel by way of a patented protocol. TEMPO MFC/CNF can also be produced on request.

Contact:

https://www.webctp.com/en/contact/-access

CERMAV-CNRS Domaine Universitaire (France)

601 Rue de la Chimie, 38610 Gières, France +33 (0)4 76 03 76 03 https://cermav.cnrs.fr/en/

The CERMAV, the Centre de recherches sur les macromolécules végétales, is a CNRS research unit. CERMAV is a leader in glycosciences in Europe, focused on cellulose and lignin.

Contact:

direction@cermav.cnrs.fr

CETIM (Spain)

CETIM Technological Centre
Parque Empresarial de Alvedro calle H-20. 15180 Culleredo, A Coruña, Spain
+34 881 105 624
https://cetim.es/

CETIM, a private research center based in A Coruña, Spain, has been producing MFC and CNF since 2017 at pilot scale. They have also been involved in the production of lab-scale CNC. CETIM conducts research in advanced lignocellulosic materials for polymers, textiles, adhesives, coatings, papers and other high value-added applications. CETIM produces cellulose nanoparticles from recycled paper, biomass, and other sources.

Contact:

Info@cetim.es

Chinese Academy of Forestry (CAF) (China)

Wan Shou Shan
Beijing 100091, China
+86-10-62888927 62889092
http://en.caf.ac.cn/

Contact:

http://en.caf.ac.cn/Contact Us/Contact Us.htm

Chinese Academy of Sciences (CAS) (China)

52 Sanlihe Rd., Xicheng District, Beijing, China (100864) 86-10-68597521 (day) https://english.cas.cn/

The Chinese Academy of Sciences is the linchpin of China's drive to explore and harness high technology and the natural sciences for the benefit of China and the world. Comprising a comprehensive research and development network, a merit-based academic society and a system of higher education, CAS brings together scientists and engineers from China and around the world to address both theoretical and applied problems using world-class scientific and management approaches.

Contact:

cas_en@cas.cn

CIRCOT (India)

See ICAR-CIRCOT

Donghua University (China)

Songjiang Campus 2999 North Renmin Road 201620 Yan'an Road Campus: 1882 West Yan'an Road 200051 Shanghai-ICP-05003365 China http://www.dhu.edu.cn/

Edinburgh Napier University (Scotland)

Edinburgh, Scotland UK United Kingdom +44 (0)333 900 6040. http://www.napier.ac.uk/

Empa (Switzerland)

Ueberlandstrasse 129 8600 Dübendorf / Switzerland +41 58 765 11 11 https://www.empa.ch/web/empa/

An institute of the ETH domain., Empa is the Swiss Federal Laboratories for Materials Testing and Research. Empa operates a MFC pilot plant and conducts applications research with industry partners.

Contact:

https://www.empa.ch/web/empa/contact-form

FIBIC (Finland)

Innopoli 3, C-Building Vaisalantie 6 02130 Espoo Finland www.fibic.fi

Finnish Centre for Nanocellulosic Technologies (Finland)

P.O. Box 1000, FI-02044 VTT, Finland +358 20 722 111

See VTT.

FPInnovations (Canada)

570 Boulevard St-Jean,
Pointe-Claire, Quebec H9R 3J9 Canada
+1 (514) 630-4100 or info@fpinnovations.ca
www.fpinnovations.ca

Specializing in innovative scientific solutions, FPInnovations inaugurated its first CNC research facility with a state-of-the-art pilot plant in 2011. We also produced the first cellulose filaments (CF) in the laboratory and its pilot plant. Today we collaborate with many strategic research alliances, members, and partners. Using the technology developed by our research staff, industry now benefits in developing nanocellulose markets and applications. CelluForce (CNC), Kruger Biomaterials, and Performance Biofilaments (CF) are examples of our collaborations.

Contact:

jimmy.jong@fpinnovations.ca

Fujian Agriculture and Forestry University (China)

No. 15 Shangxiadian Road Cangshan District Fuzhou City, Fujian Province, 350002, China http://english.fafu.edu.cn/

Georgia Institute of Technology (U.S.)

Renewable Bioproducts Institute North Avenue, Atlanta, GA 30332 +1 404.894.2000 https://research.gatech.edu/rbi

Georgia Tech's Renewable Bioproducts Institute (RBI), formerly the Institute of Paper Science and Technology, champions innovation in converting biomass into value-added products, developing advanced chemical and biobased refining technologies, and advancing excellence in manufacturing processes.

Contact:

https://research.gatech.edu/rbi/contactus

Georgia Southern University (U.S.)

See Herty Advanced Materials Development Center

Grenoble Institute of Technology (INP) (France)

46 avenue Félix Viallet 38031 Grenoble Cedex 1 France +33 4 76 57 45 00 www.grenoble-inp.fr

Herty Advanced Materials Development Center (U.S.)

110 Brampton Rd., Savannah, Georgia 31408

The Herty Advanced Materials Development Center is an applied research center of Georgia Southern University, with focuses in contract research, development, and manufacturing; and a global leader in technology development. Herty offers laboratory, pilot, and production quantities of nanocellulose and a range of nanocellulose types including nanocrystalline and nanofibrillar morphologies. Applications include pharmaceutical and cosmetics, plastics and film, filled composites, viscosity modifiers, and propants.

Contact:

https://research.georgiasouthern.edu/herty/contact-us/

ICAR-CIRCOT (India)

Adenwala Road, Matunga(East), Mumbai-400 019. 022-24146002

India's Central Institute for Research on Cotton Technology (ICAR-CIRCOT) is one of the premier constituent institutes of the Indian Council of Agricultural Research (ICAR). Research related to nanocellulose includes development of a chemo-mechanical process for preparation of nanocellulose from cotton linters, and development of applications such as barrier films, packaging, and paint.

Contact:

director.circot@icar.gov.in

InnoTech Alberta (Canada)

250 Karl Clark Road Edmonton, BC T6N1E4 780-427-1956 www.albertainnovates.ca

InnoTech Alberta is a wholly owned subsidiary of Alberta Innovates. The organization's multidisciplinary, cross-sector teams offer a diversified range of scientific, engineering and technological research and testing capabilities, and the facilities to support technology scale-up. InnoTech Alberta operates a CNC pilot plant that is capable of producing up to 20 kg per week of CNC from a variety of feedstocks.

Contact:

info@innotechalberta.ca.

Innovatech Labs, LLC (U.S.)

13805 1st Ave N, Ste 100 Plymouth, MN 55441 888-740-5227 https://www.innovatechlabs.com/

Innovatech Labs, a <u>material testing lab</u>, specializes in unique materials analysis. Our analysts work directly with customers to determine which analytical technique(s) will obtain the data necessary to solve the problem at hand. The material testing methods include SEM, FTIR analysis, Auger, DSC, Light Microscopy, Ion Chromatography, GC/MS, Thermogravimetric analysis, and ESCA.

Contact:

info@innovatechlabs.com

INRAE (France)

147, rue de l'Université 75338 Paris Cedex 07 - France +33(0)1 42 75 90 00 https://www.inrae.fr/en

National Research Institute for Agriculture, Food and the Environment

INRAE is France's National Research Institute for Agriculture, Food and Environment. Its mission is to carry out excellent science in order to provide innovative solutions addressing global challenges, notably climate change, biodiversity and food security while at the same time enabling the much needed agroecological, nutritional and energy transition.

Contact:

https://www.inrae.fr/en/contact

Instituto Tecnologico del Embalaje, Transporte y Logistica-ITENE (Spain)

Parque Tecnológico C/ Albert Einstein, 1. 46980 PATERNA · VALENCIA +34 96 182 00 00 http://www.itene.com/en

The Additives and Raw Materials Research Unit has expertise in research & development of cellulose nanomaterials for packaging applications. The MFC Pilot Plant can produce MFC from different sources (agricultural wastes, recycled fibres, food wastes, annual plants or common trees). MFC production is 50kg/day of aqueous suspensions (up to 3 wt%). ITENE can also produce other cellulose nanoadditives (CNC and CNF) and can be functionalized for target applications such as barrier coatings for flexible packaging or reinforcements for biocomposites.

Contact:

Dr. Miriam Gallur miriam.gallur@itene.com

Korea Forest Research Institute (Republic of Korea)

Korea Forest Service Government Complex-Daejeon, Bldg. 1 189 Cheongsa-ro, Seo-gu, Daejeon Republic of Korea 35208 +82-42-481-4080 www.forest.go.kr

KTH Royal Institute of Technology (Sweden)

Valhallavägen 79 100 44 Stockholm Sweden +46 8 790 60 00 https://www.kth.se/

KU Leuven (Belgium)

Oude Markt 13 - bus 5005 3000 Leuven Belgium +32 16 324010 http://www.kuleuven.be/english/

Kyoto University (Japan)

Yoshidahonmachi, Sakyo Ward, Kyoto, Kyoto Prefecture 606-8501 +81 75-753-7531 http://www.kyoto-u.ac.jp/en

See RISH Research Institute for Sustainable Humanosphere in the Producers Section.

Lakehead University, Biorefining Research Institute (BRI) (Canada)

955 Oliver Rd, Thunder Bay, Ontario P7B 5E1, Canada https://www.lakeheadu.ca/centre/bri

BRI is committed to the comprehensive utilization of lignocellulosic biomass, aiming for sustainable production of high value bioproducts. BRI strategically integrates diverse conversion platforms to achieve cost-effectiveness and environmental sustainability, ensuring the optimal valorization of biomaterials. Ongoing research projects encompass the development of bio-inspired nanomaterials, including cellulose nanomaterials tailored for sustainable and multifunctional nanocomposite applications.

Contact:

P: (807) 343-8110 EXT 8863 E: admin.bri@lakeheadu.ca

Luleå University of Technology (LTU) (Sweden)

Universitetsområdet, Porsön 971 87 Luleå Sweden +46 920 49 10 00 www.ltu.se

McGill University (Canada)

845 Rue Sherbrooke Ouest Montreal, Quebec, H3A 0G4 Canada +1 514 398 4455 www.mcgill.ca

McMaster University (Canada)

1280 Main Street West Hamilton, Ontario L8S 4L8 Canada +1 905 525 9140 http://www.mcmaster.ca/

Minho University (Portugal)

Biological Engineering Department Campus of Gualtar, 4710-057 Braga Portugal +351 253604418

Centre of Biological Engineering / Centro de Engenharia Biológica (uminho.pt)

The Functional Carbohydrates Group at the Center of Biological Engineering investigates the use of polysaccharides for various applications, including Bacterial NanoCellulose production, processing and application: fermentation (static & stirred culture), production scale up, dry formulations for Pickering emulsions, applications in textiles, biomedicine and food.

Contact:

fmgama@deb.uminho.pt

Monash University (Australia)

15 Alliance Lane Clayton 3800 Australia +61 3 99053456 https://www.monash.edu/

See BioPRIA.

Nanjing Forestry University (China)

No. 159 Lonpan Road Nanjing 210037 Jiangsu P.R. China +86-25-85427131 / 85427132 https://eng.njfu.edu.cn/

National Center for Nanoscience and Technology (NCNST) (China)

No. 11 ZhongGuanCun BeiYiTiao 100190 Beijing, P.R. China +86 10-82545545 http://english.nanoctr.cas.cn/

National Institute for Nanotechnology (NINT) (Canada)

11421 Saskatchewan Dr. Edmonton, Alberta T6G 2M9 Canada +1 780 641 1600 www.nrc-cnrc.gc.ca

National Institute of Standards and Technology (NIST) (U.S.)

100 Bureau Drive, Stop 1000 Gaithersburg, MD 20899-1000 U.S.A. +1 301 975 2300 www.nist.gov

National Research Council of Canada (NRC) (Canada)

1200 Montreal Road Ottawa, Ontario K1A 0R6 Canada 613-993-9101 http://www.nrc-cnrc.gc.ca/eng/index.html

North Carolina State University (U.S.)

Department of Forest Biomaterials 2820 Faucette Drive, CB 8005 Raleigh 27695 NC, USA https://faculty.cnr.ncsu.edu/nathalielavoine

Lavoine research group provides technical and consulting services on research & development of cellulose nanomaterials. We can produce aqueous suspensions (up to 5 wt%) of cellulose nanocrystals and cellulose nanofibrils/microfibrils, from different (ligno)cellulosic sources. Our lab has capabilities of producing few milliliters to liters of both materials, with different surface functionalities and performance for target applications and specifications. Also open to research/industrial partnerships and collaborations.

Contact:

Dr. Nathalie Lavoine, nmlavoin@ncsu.edu

Northeast Forestry University (China)

No. 26 Hexing Road, Xiangfang District Harbin, 150040 P.R. China http://en.nefu.edu.cn/

Oregon State University (U.S.)

College of Forestry Peavey Hall Corvallis, OR 97331 U.S.A. +1 514 737 4952 www.oregonstate.edu

Paper and Fibre Research Institute (Norway)

Høgskoleringen 6b, NO-7491 Trondheim +47 73 60 50 65 http://www.pfi.no/

Process Development Center (U.S.)

See University of Maine

Purdue University (U.S.)

610 Purdue Mall West Lafayette, Indiana 47907 U.S.A. +1 765 494 4600 https://www.purdue.edu/

The Youngblood Group at the School of Material Engineering investigates nanotechnology, surface science, advanced processing, and biomaterials. Sustainable Nanotechnology includes CNC and CNF processing: Fiber Spinning, Roll to Roll Continuous Fabrication, and Nanocomposites. CNC has also been demonstrated as an effective additive in cementitious materials, reducing stress while increasing degree of hydration at very low dosages. This technology is being commercialized under license.

Contact:

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Renewable Bioproducts Institute (U.S.)

See Georgia Institute of Technology

Research Council of Norway (Norway)

Stensberggata 26 Oslo, Norway +47 22 03 70 00 www.forskningsradet.no

Research Institute of Forestry New Technology (China)

http://en.caf.ac.cn/Organizational/jj7.shtml

See Chinese Academy of Forestry (CAF).

Research Institute of Wood Industry, Chinese Academy of Forestry (CRIWI) (China)

Haidian District, Beijing 100091, China. +86-10-62889410 http://criwi.caf.ac.cn/

RISE Research Institutes of Sweden AB (Sweden)

Sven Hultins plats 5, 412 58, Gothenburg, Sweden 010-516 50 00 https://www.ri.se/en

RISE is Sweden's research institute and innovation partner. RISE Innventia, an early leader in the development of MFC, reduced energy usage in producing MFC through six generations of development, including enzymatic pretreatment. RISE operates a 100 kg/day MFC pilot plant at Innventia and a mobile demonstration plant for MFC trials at mills around the word. The mobile demo plant is able to produce highly refined fiber (HF), highly refined enzyme treated fiber (HFE) or MFC at the rate of 100 kg of dry product per hour.

Contact:

https://www.ri.se/en/about-rise/contact-us

RISH Research Institute for Sustainable Humanosphere (Japan)

Kyoto University.
Gokasho, Uji City, Kyoto Prefecture, Japan. 611-0011
+774-38-3346
https://www.rish.kyoto-u.ac.jp/?lang=en

The Research Institute for Sustainable Humanosphere (RISH) at Kyoto University is a leader in cellulose nanofibril research. Professor Hiroyuki Yano of RISH was the first in Japan to become engaged in the research of cellulose nanofibers that form the cell walls in plants, beginning in 1996. The Kyoto Process is based on the "Pulp Direct-Kneading Method. RISH has a pilot plant with capacity of 1 tonne per year of thermoplastic resins with 10 wt. % CNF. Seiko PMC constructed a pilot plant based on this Kyoto process in 2013, and Nippon Paper did so in 2017.

Contact:

Prof. Hiroyuki Yano Lab. of Active Bio-based Materials Research Institute for Sustainable Humanosphere, Kyoto University Uji, Kyoto 611-0011 yano@rish.kyoto-u.ac.jp

Sichuan University (China)

No. 24 South, Section 1, Yihuan Road, Chengdu 610065 P.R. China http://www.scu.edu.cn/en/

South China University of Technology (SCUT) (China)

Guangzhou International Campus
777 Xingye Avenue East, Panyu District Guangzhou,
Guangdong, P.R. China
Post Code:511442
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http://www2.scut.edu.cn/gzic_en/

SCUT Guangzhou International Campus is a state-level campus jointly developed by the Ministry of Education, the People's Government of Guangzhou Municipality and South China University of Technology (SCUT). Research with nanocellulose includes preparation of CNC and CNF as well as development of applications.

Contact:

global@scut.edu.cn

TAPPI International Nanotechnology Division (U.S.)

15 Technology Parkway South Peachtree Corners, GA 30092 (770) 446-1400 https://www.tappinano.org/

Members of TAPPI's Nano Division strive to advance the responsible use and production of renewable and sustainable nanomaterials. TAPPI Nano has established itself as the preeminent conference on nanotechnology related to renewable nanomaterials. The 2024 TAPPI Nanotechnology Conference will be held in Atlanta, GA, from June 10th to 14th, 2024.

Contact:

Robert Davis, Division Manager for Nanotechnology rdavis@tappi.org

Technikum Laubholz (Germany)

Bahnhofstraße 41 + 52 73033 Göppingen Deutschland +49 1525 320 31 11 https://technikumlaubholz.de/en/

The Technikum Laubholz is the first independent non-university institute for leading-edge research in Baden-Württemberg with an exclusive focus on the development of all processes and products relating to wood as a renewable raw material. Technikum Laubholz is planning and building a plant for the production of nanocellulose from beech wood fibers using fully automated technology to optimize the entire process workflow with the help of artificial intelligence. Called KlckBio, the project is part of the ERDF's Innovation and Energy Transition program.

Contact

https://technikumlaubholz.de/en/contact/

Tianjin University of Science and Technology (China)

No. 29, 13th Avenue
Tianjin Economic and Technological Development Area (TEDA)
Tianjin, China
300457
http://www.xn--v5zvnq1bxbvs.com/gywm

University of Alberta (Canada)

116 St. and 85 Ave., Edmonton, Alberta, T6G 2R3 Canada https://www.ualberta.ca/

University of British Columbia (Canada)

BioProducts Institute 2385 East Mall Vancouver, BC Canada V6T 1Z4 https://bpi.ubc.ca/

The University of British Columbia BioProducts Institute (BPI) is an innovative ecosystem of high-impact fundamental and applied researchers working on solutions to today's climate and environmental challenges. Research themes center around biocatalytic transformation and engineering of biomass, bio-nanoparticle enabled materials, bio-based polymers and carbon materials, and biorefinery and biofuels systems.

Contact:

https://bpi.ubc.ca/contact-us

University of Grenoble Alpes (France)

621 avenue Centrale 38400 Saint-Martin-d'Hères +33 (0)4 57 42 21 42 https://www.univ-grenoble-alpes.fr/english/

Contact:

Contact us

University of Helsinki (Finland)

P.O. Box 4 (Yliopistonkatu 3) 00014 +358 (0) 2941 911 https://www.helsinki.fi/en/

University of Maine (U.S.)

The Process Development Center 5737 Jenness Hall Orono, ME 04469 207-581-2237 https://umaine.edu/pdc/

The Process Development Center (PDC) offers a broad range of technical services and resources. The University of Maine (UMaine) Nanomaterial Pilot Plant opened in 2012 at the PDC and is a joint project with the US Forest Service. The pilot plant has capacity for 1 ton per day of CNF and is the largest CNF plant in the US. The UMaine PDC supplies cellulose nanofibrils (CNF) and cellulose nanocrystals (CNC) to academic, public, and private research groups interested in evaluating and developing applications for these materials.

Contact:

umaine.pdc@maine.edu

University of Tehran (Iran)

16th Azar St., Enghelab Sq. Tehran, Iran +98 21 61113411 http://ut.ac.ir/en

University of Tennessee (U.S.)

Knoxville, Tennessee 37996 865-974-1000 https://www.utk.edu/

The UTK Center for Renewable Carbon conducts research on nanocellulose from pulp, agricultural sources and recycled cellulose. Research areas include MFC, CNF, and CNC, as well as nanocellulose composites, foams, films, coatings, suspensions and viscosity modifiers, and water absorbents. The University of Tennessee and Battelle Memorial Institute co-manage Oak Ridge National Laboratory.

Contact: Siqun Wang swang@utk.edu

University of Tokyo (Japan)

7-3-1 Hongo, Bunkyo Tokyo 113-8654, Japan +81 3 3812 2111 http://www.u-tokyo.ac.jp

The University of Tokyo was established in 1877 as the first national university in Japan. The Department of Biomaterial Sciences conducts extensive research in nanocellulose characterization, preparation, performance, and applications under the direction of Dr. Akira Isogai.

Contact:

aisogai@mail.ecc.u-tokyo.ac.jp

University of Toronto (Canada)

Centre for Biocomposites and Biomaterials Processing
33 Willcocks Street
Toronto, Ontario M5S 3B3
Canada
1-416-978-5480
http://forestry.utoronto.ca/centre-for-biocomposites-and-biomaterials-processing/

University of Waterloo (Canada)

200 University Avenue West Waterloo, Ontario N2L 3G1 Canada +1 519 888 4567 www.uwaterloo.ca/

USDA Forest Service, Forest Products Laboratory (U.S.)

One Gifford Pinchot Drive Madison, WI 53726 608-231-9200 https://www.fpl.fs.usda.gov/

In 1910, the US Forest Service, Forest Products Laboratory (FPL) was established in Madison, Wisconsin. In August 2012, the US Department of Agriculture (USDA) Forest Service Forest Products Laboratory (FPL) unveiled a \$1.7 million production facility for renewable, forest-based nanomaterials. This facility was the first of its kind in the United States. The FPL pilot plant produces CNC and TEMPO-based CNF with weekly production capacity of 30 kg or 5 kg, respectively.

Contact:

https://www.fpl.fs.usda.gov/contact/index.php

Virginia Polytechnic Institute and State University (U.S.)

800 Washington Street, SW Blacksburg, VA 24061 U.S.A. 540-231-6000 https://vt.edu/



VTT Technical Research Centre (Finland)

PO Box 1000 FI-02044 VTT +358 20 722 111 www.vtt.fi

VTT can make various MFC and CNF grades for application testing. These grades can be produced from customer's raw materials with varying degrees of fibrillation (coarse, medium, fine fibre size) including specific aseptic grades for cosmetic and pharmaceutical applications. VTT produces tailor-made samples for R&D purposes from lab to pilot scale using standard equipment such as Masuko grinders and microfluidizers, unmodified, chemically modified, and enzymatically aided, up to 20 kg/day. VTT's services include semi-pilot scale nanocellulose barrier coating concept and MFC film pilot line, which are available for confidential customer projects.

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