ICAR-CIRCOT NANOCELLULOSE PILOT PLANT
[Eco-Friendly & Energy-Efficient Production Technology]

नैनोसेल्युलोस पायलट प्लांट
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Nanocellulose Pilot Plant
(National Agricultural Innovation Project, ICAR)
ICAR-Central Institute for Research on Cotton Technology, Mumbai

NCC

Nano Crystalline Cellulose

NFC

Nano Fibrillated Cellulose
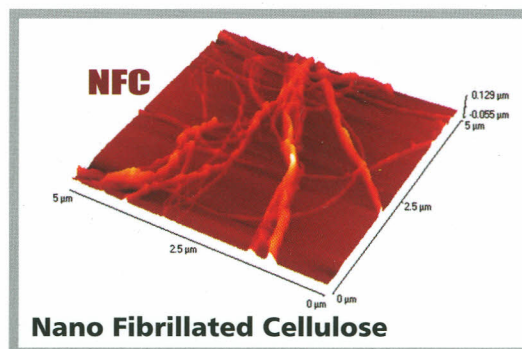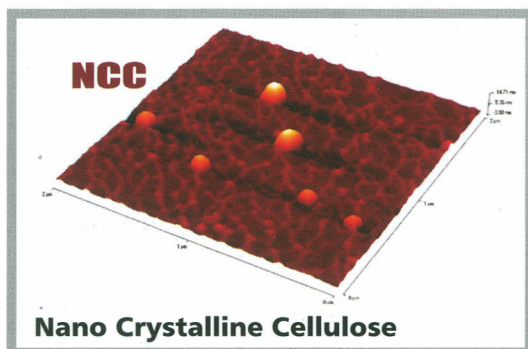
ICAR-CENTRAL INSTITUTE FOR RESEARCH ON COTTON TECHNOLOGY (CIRCOT)
(Ministry of Agriculture, Govt. of India)
Adenwala Road, Matunga, Mumbai 400019.

ISO 9001:2008

MAKE IN INDIA

NANOCELLULOSE

Cellulose, the most abundant natural polymer on Earth, is a linear polymer of ß-(1,4)-D-glucose units. Cellulose forms the structural backbone of plant system. Nanocellulose refers to cellulose polymer broken down to the nano-size range (1 nm = 10^{-9} m). The major attraction of nanocellulose is its high mechanical strength (Tensile strength: 1 to 10 GPa; Young's modulus : 100 - 130 GPa), more specific surface area (50 - 200 m^2/g), bio-degradability and novel optical properties. Cotton, bacterial cellulose, agro-biomass and woody biomass are the major raw materials for production of nanocellulose. Depending on the dimensions, nanocellulose is classified as Nano Crystalline Cellulose (NCC, aspect ratio < 10) and Nano Fibrillated Cellulose (NFC, aspect ratio > 10). The intrinsic architecture (crystalline structure with hydrogen bonding) of cellulose makes it highly energy demanding for conversion into nanocellulose. Conventionally, it is produced by concentrated acid hydrolysis (64% sulphuric acid) of cellulosic materials. Later on, mechanical processing has taken over the production system though with very high energy consumption level. To circumvent this, various pre-treatments (chemical, biological and mechanical) are being evolved.

ICAR-CIRCOT'S EXPERTISE

CIRCOT has developed and patented three novel processes for production of nanocellulose from cotton fibres and linters. Subsequently, based on the inputs gained through Entrepreneurship development programme and on the suggestions of the expert committee, ICAR-CIRCOT established a unique nanocellulose pilot plant that can produce nanocellulose (10 kg per shift of 8 hr) from cotton linters, cotton wastes & bagasse which is first of its kind in India. This was supported by ICAR through NAIP under component 1 in Business Planning and Development Unit (BPD).
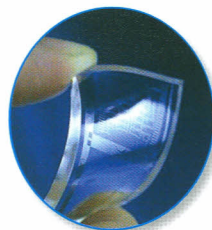
NANOCELLULOSE APPLICATIONS

Virus filtration
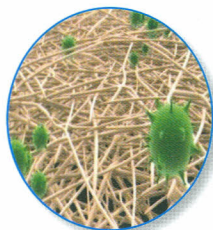
Emulsion / dispersion stabilizer

Liquid crystal display

Non-caloric food thickeners

Targeted drug delivery

**Fillers in Cement**

Fillers in Film

Paper coating & furnish additives

ICAR-CIRCOT'S TECHNOLOGY

Mechanical process is commercially feasible for nanocellulose production. Its very high energy requirement makes it commercially non-viable for long-spread usage. At ICAR-CIRCOT, novel processes for pre-treatment of cellulosic biomass were evolved and patented that could reduce the energy requirement in nanocellulose production to the tune of 40 % (by enzyme) and 35% (by chemicals). The granted Indian patent number is 266707 dated 12/04/2010 and other two Indian patent applications include 3012/MUM/2009 dated 30.12.2009 & 797/MUM/2012 dated 26.03.2012.

PROCESS SEQUENCE
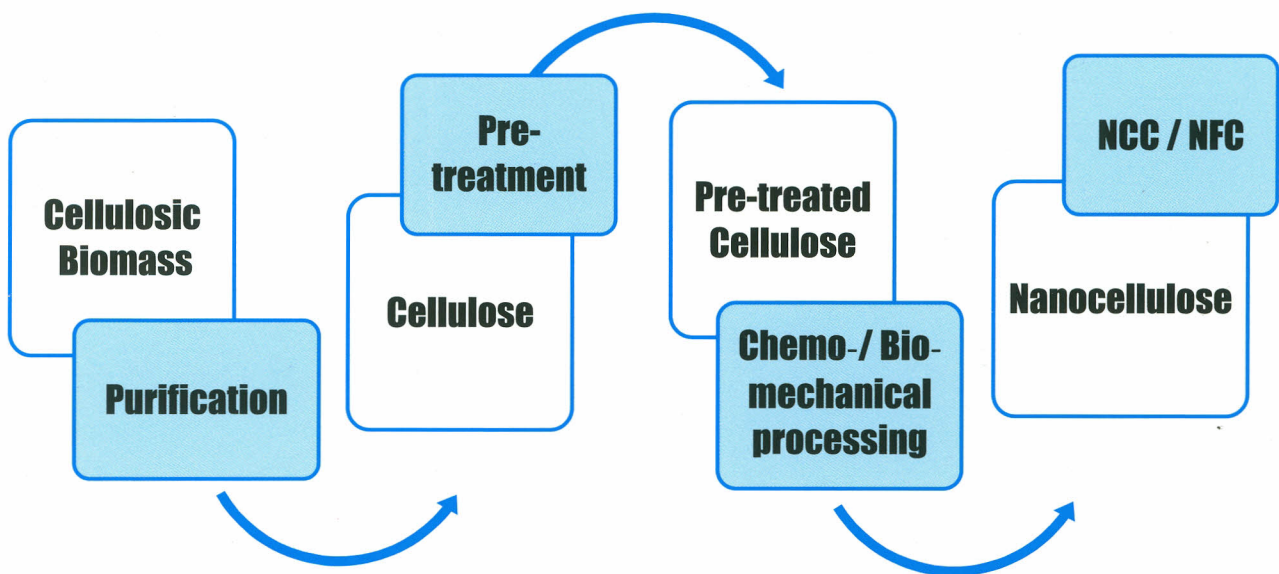
OBJECTIVES OF NANOCELLULOSE PILOT PLANT

- ✓ To validate the nanocellulose production technology of ICAR-CIRCOT and its continuous improvement

- ✓ To demonstrate the ICAR-CIRCOT's nanocellulose production technology to various stakeholders and technology licensing

- ✓ To act as an incubation unit for entreprenuers / industrialists to develop efficient methodologies for custom-designed nanocellulose

- ✓ To support researchers, entrepreneurs and industrialists for development of nanocellulose based products

Reactor

PILOT PLANT AT A GLANCE

- First pilot plant in India producing nanocellulose
- Seamless integration of all unit operations for maximising production efficiency.

Refiner

Pulper

Nanocellulose
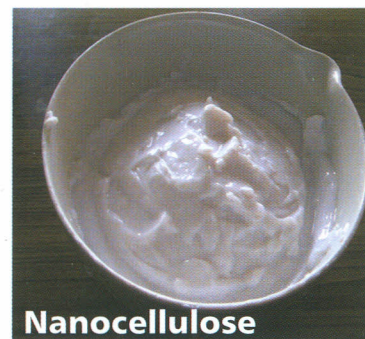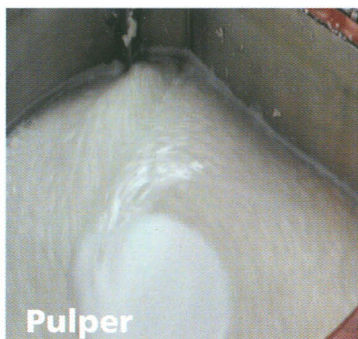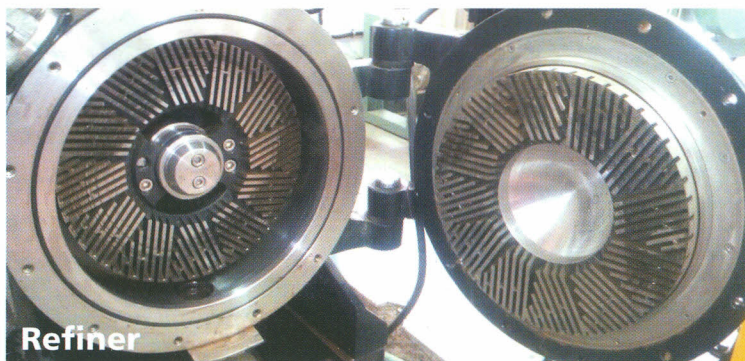
Production capacity	10 kg per shift of 8 hr
Raw materials	Any cellulosic biomass
Products	NFC or NCC (in suspension or dry form)

FOR BUSINESS ENQUIRIES

Er. Ashok Kumar Bharimalla

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