



NANOPARTICULES POLYSACCHARIDES POUR APPLICATIONS NANOCOMPOSITES

Alain Dufresne



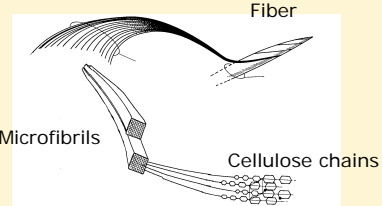
OBJECTIF

Préparation de nanoparticules à partir de **ressources renouvelables** (cellulose, chitine, amidon) présentant différentes morphologies et facteurs de forme pour **applications nanocomposites**.

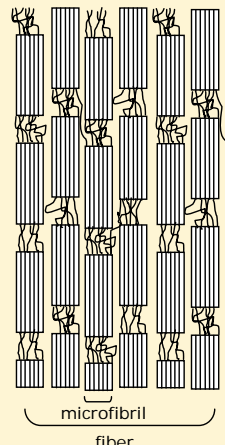
INTÉRÊT

Amélioration notable des **propriétés mécaniques** (résistance, module, stabilité dimensionnelle).
Diminution de la **perméabilité aux gaz et à l'eau**.
Augmentation de la **stabilité thermique**.

CELLULOSE AND CHITIN WHISKERS



Fiber
Microfibrils
Cellulose chains



microfibril
fiber

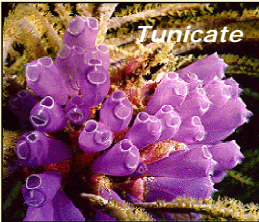
Bleaching treatment (NaOH)

Bleached material (Cellulose or Chitin)

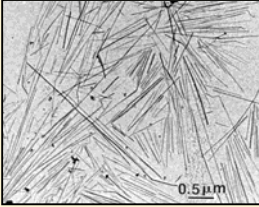
Disintegration in water

Hydrolysis treatment (H₂SO₄)


Neutralization, washing, sonication



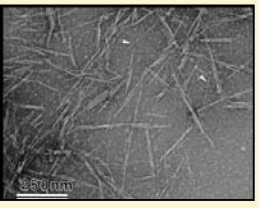
Tunicate




L = 0.5-2 μm ;
d = 15 nm; L/d = 67



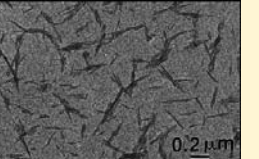
Wheat straw




L = 150-300 nm
d = 5 nm; L/d = 45



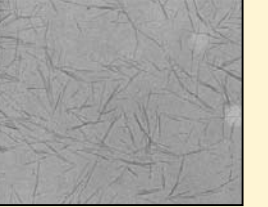
Cotton




L = 100-200 nm
d = 15 nm; L/d = 10



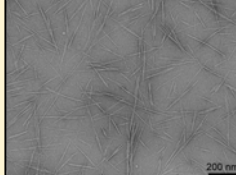
Sugar Beet




L = 210 nm
d = 5 nm; L/d = 42



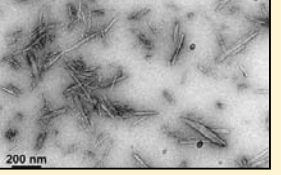
Sisal



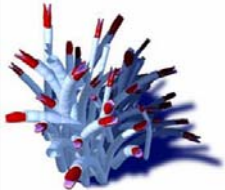

L = 250 nm
d = 4 nm; L/d = 63



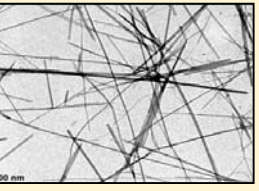
Squid pen



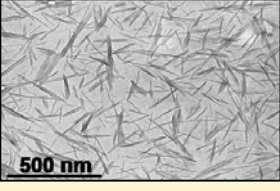
L = 50-300 nm
d = 10 nm; L/d = 15


Red crab



L = 0.5-10 μm
d = 18 nm; L/d = 120



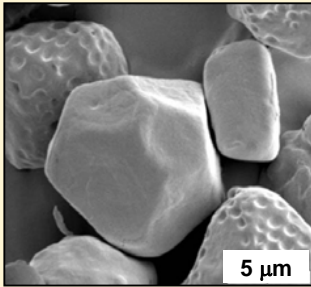
L = 100-300 nm
d = 15 nm; L/d = 16



M.A.S. Azizi Samir, F. Alloin, A. Dufresne, "A Review of Recent Research into Cellulosic Whiskers, their Properties and their Application in Nanocomposite Field", *Biomacromolecules*, 6, 612-626 (2005)

A. Dufresne, "Comparing the mechanical properties of high performances polymer nanocomposites from biological sources", *Journal of Nanoscience and Nanotechnology*, 6, 2, 322-330 (2006)

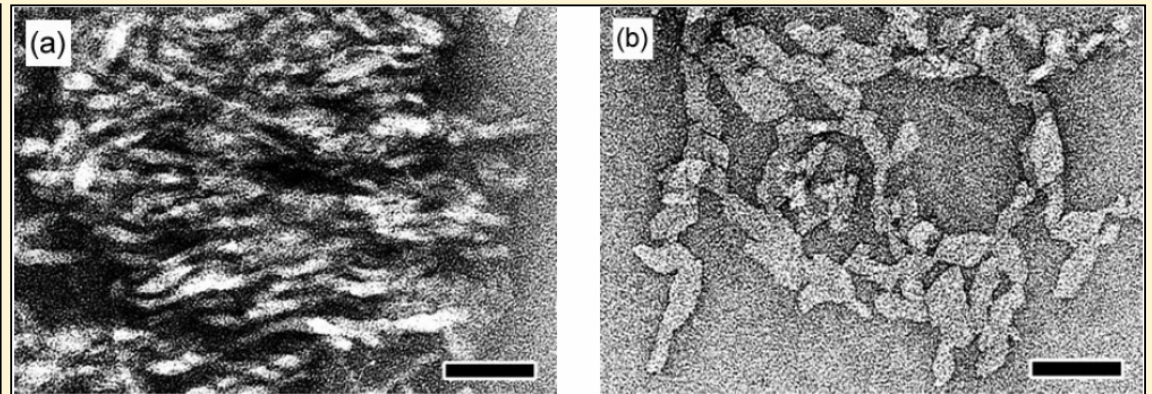
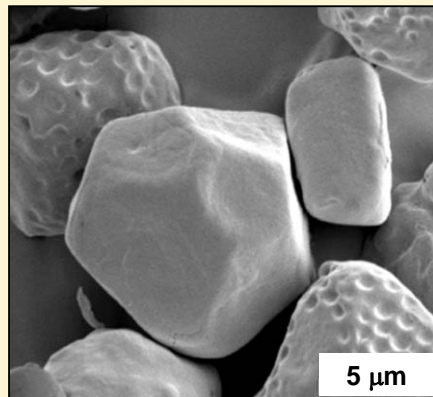
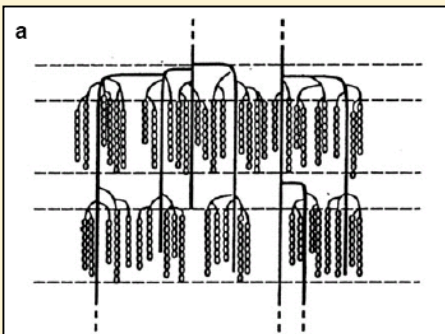
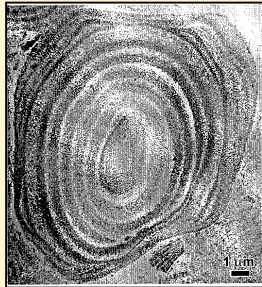
STARCH NANOCRYSTALS



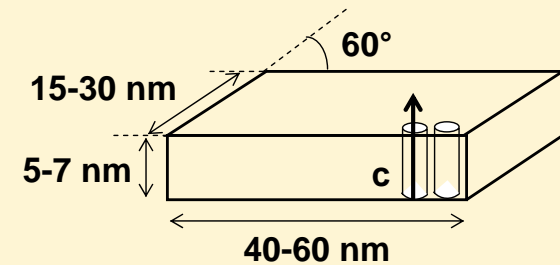
Native starch granules + H₂SO₄

Continuous stirring on a platform in a thermo-stated atmosphere

Neutralization, washing, chloroform, storage at 4°C



Scale bars : 50 nm



J.L. Putaux, S. Molina-Boisseau, T. Momaour, A. Dufresne, "Platelet nanocrystals resulting from the disruption of waxy maize starch granules by acid hydrolysis", *Biomacromolecules*, 4, 1198-1202 (2003).

H. Angellier, L. Choisnard, S. Molina-Boisseau, P. Ozil, A. Dufresne, "Optimization of the preparation of aqueous suspensions of waxy maize starch nanocrystals using a response surface methodology", *Biomacromolecules*, 5, 4, 1545-1551 (2004).

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