

# Press release

25 March 2021

## Industrial application of pretreatments for obtaining high quality cellulose nanofibrils

On March 19, 2021, Gabriel Banvillet defended a doctoral thesis from the Université Grenoble Alpes prepared under the supervision of Julien Bras, Associate Professor HDR, and of the Professor Naceur Belgacem, and the co-supervision of Denis Curtil, Research Engineer (Grenoble INP-Pagora/LGP2).

Gabriel Banvillet presented the results of his research entitled *Industrial application of pretreatments for obtaining high quality cellulose nanofibrils*. The development of biobased materials with a wide range of properties has become a key issue in today's society, to move towards a durable bioeconomy. In this context, cellulose nanofibrils (CNF) are very promising, due to their interesting mechanical, optical, rheological and barrier properties.

However, several technological challenges still restrain their cost-efficient production at the industrial scale, such as the toxicity issues of the cellulose pretreatments or the high energy consumption of the mechanical fibrillation processes. This project in collaboration with Arjowiggins (scientific contact: Gaël Depres) via a CIFRE-ANRT funding aims at developing innovative pretreatments and optimize several mechanical fibrillation processes, with an objective of producing high quality CNF at the industrial scale.

First, three pretreatments were studied, involving a coupled alkaline and enzymatic treatment, the adsorption of a polyelectrolyte, and in situ enzymatic hydrolysis at high solid content during fibrillation by twin-screw extrusion. Then, a disk refining process was optimized for CNF production, for the implementation of these pretreatments at the pilot scale. Several industrial trials with a specific tracing paper refining line also underlined the relevance of this process for large scale CNF production, leading to a significant decrease of energy consumption compared to conventional processes. Finally, disk refining was combined with twin-screw extrusion, ultra-fine grinding and homogenization, respectively. This strategy enabled to overcome the limitation of CNF quality encountered with the use of refining alone.

The results of this project contribute to the knowledge on pretreatments and processes for cellulose nanofibrils production, and are a step towards their efficient production at industrial scale.

**Contacts LGP2** Julien.Bras@grenoble-inp.fr – Naceur.Belgacem@grenoble-inp.fr - Logo logo-lgp2.eps

---

**Grenoble INP-Pagora, the international school of paper, print media and biomaterials.** The school is Quality, Safety & Environment certified and part of Grenoble INP, an engineering and management institute geared towards training “engineers who are creative, responsible and committed to a sustainable world”. It trains engineers for the sectors of green chemistry, paper, printing, packaging, biomaterials and printed electronics. Its wide range of courses, pedagogical expertise and strong partnerships with industry allow it to continuously tailor its training to the needs of businesses and to the 60 graduates it produces each year, thus enabling them to embark upon stimulating careers in France and abroad. Grenoble INP-Pagora also develops international training: it offers a 2<sup>nd</sup> year engineering course, international semesters and a Biorefinery & Biomaterials Masters, taught in English. The innovative research performed by its LGP2 laboratory helps to improve processes and create products that meet all the latest requirements, notably those linked to the environment. These various activities ensure that the training offered is up to date with the latest scientific and technological advances. [pagora.grenoble-inp.fr](https://pagora.grenoble-inp.fr)

**The Laboratory of Pulp and Paper Science and Graphic Arts (LGP2)** is a joint research unit (UMR 5518) run by the CNRS, Grenoble INP and the AGEFPI. It conducts its scientific activities in conjunction with the academic community of Grenoble Alpes University. LGP2 comprises three teams: *Biorefinery: chemistry and eco-processes* – *Multiscale biobased materials* – *Surface functionalization through printing processes*. Their research strives to meet society's expectations when it comes to sustainable development (green chemistry, clean processes, recycling, biobased materials, renewable energy) and traceability & safety (functional materials, smart paper and packaging). [pagora.grenoble-inp.fr/lgp2](https://pagora.grenoble-inp.fr/lgp2)