



Session 7	Scale-up of novel biomaterials and processes, powered by INN-PRESSME
Pitch Title	Enhancing Cellulose Nanocrystal Production: A Pilot Line (PL2) Approach within the EU INNPRESSME Project
Company	RISE
Speaker	Shubhankar Bhattacharyya
Keywords feedstock	Pulp, fiber sludge, cellulose,
Keywords technology	Hydrolysis, nanocellulose, cellulose modification, surface modification, biomaterial
Keywords End-Product	Nanocellulose, nanocrystal, nanomaterial, biopolymer, wood fibers, CNC, NCC

Abstract:

The rising demand for high-performance biobased materials with customized mechanical and physical properties makes cellulose nanocrystal (CNC) one of the most attractive nanomaterials for a various of applications. Acid hydrolysis is the most effective way to dissolve amorphous or less organized regions of celluloses leading to formation of CNCs as an aqueous suspension. However, production of CNCs from cellulosic raw materials with high yield and concentration at the pilot scale remains a challenging task in current process development research. Isolation of CNCs from cellulosic biomass involves multiple unit operations, and the high surface charges on CNCs adds more difficulties to the scale up process, particularly at the pilot scale. At the beginning of the development, CNC concentration in suspension from the process was very low 2.5%. Thus, it was necessary to develop the process to achieve CNC with higher concentration for application in various test cases, such as in the packaging market: Test Case 1 - bio-based adhesive smart labels for food and cosmetics, and Test Case 2 - fiber-based heat-sealable stand-up pouches with high barrier performance. For the energy market, Test Case 7 focused on bio-based ultracapacitors. After further process development within INN-PRESSME project, RISE pilot (PL2) facility managed to accomplish CNCs at concentrations as high as 6.5%. Additionally, the pilot scale capacity increased up to 10kg/day from bleached pulp. To make the process more cost effective, the CNC pilot scale up process was also tested by utilizing side streams from regional pulp and paper industry. The pilot line infrastructure (PL2) has also been upgraded for flexible use, allowing it to process several types of biomasses and accommodate numerous cellulose modifications processes.