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Scale-up Nano particles in Modern Papermaking

Welcome to SUNPAP

Welcome to the third SUNPAP newsletter. Our aim is to up-date you with our public results in the project. Scale-Up Nano Particles in Modern Papermaking (SUNPAP) is a large-scale integrating project in the European Community's 7th Framework Programme under the NMP programme. It is co-ordinated by VTT Technical Research Centre of Finland (VTT), Finland.

Traditional paper and board products are based on sustainable production. They are made mainly from renewable materials and can be recycled several times. In today's high-quality products, however, oil-based additives and binders, which are not renewable and biodegradable, are very commonly used. The ultimate goal of SUNPAP project is to create new fibre-based paper and packaging products, which can be recycled and will further reduce landfill waste. Moreover the target is to provide radical product performance improvements, new efficient manufacturing methods and the introduction of new added value functionalities. The SUNPAP project is an industry driven project with the aims of piloting and commercialising the most feasible products within as short time frame as possible.

The sustainability part deals with the whole value chain including market needs, sustainability assessments, and recyclability and biodegradability studies. The sustainability analysis includes environmental, economic and social aspects. The preliminary analyses of the product value chains were calculated in order to direct the project and researchers to use more sustainable methods and to focus the work on sustainable product and process solutions.

Nanocellulose is used in various forms to an ever greater extent in industrial applications, because it is obtained from renewable raw materials. The first aim of the research work into cellulose-based nano material production was to identify optimal pulp raw material and pre-treatment conditions for energy-efficient nano fibrillar cellulose (NFC) preparation. In the experimental work different chemical, enzymatic and mechanical pre-treatment processes have been used to produce successfully NFC from commercial chemical pulps. The Figure shows the quality of the NFC produced in the project.

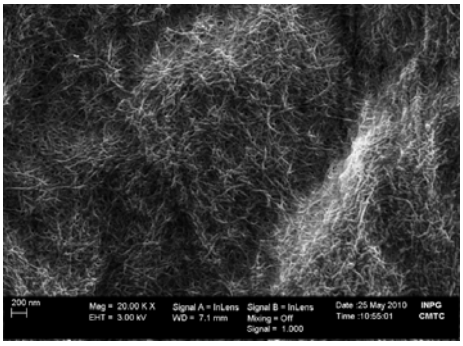


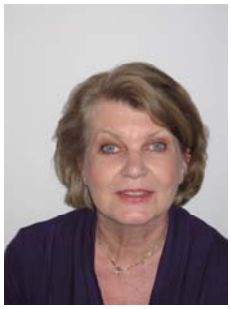
Figure. SEM examination of NFC suspension obtained with enzymatically pre-treated dissolving pulp.

The main target in the NFC production part is now to scale up the technologies to produce natural or functionalized NFC for different applications. The quality of NFC is optimized for

different current and novel industrial paper and board products. PTS continues the work with the new process to be able to demonstrate energy-efficient production of optimal NFC in large scale.

The paper and board applications in five end-use areas are studied by using native or modified NFC to increase the strength of or give new functional features to the end products. From several different functional routes at this stage two look promising and these studies will already be continued with the scale-up experiments. The NFC-based products under development lay the foundations for revolutionising existing papermaking processes and developing new processes making the use of NFC possible. The use of NFC at the wet end is studied to determine whether its strength can be increased in combination with a new product design and, if so, how this could be done. Synthetic binders will be partly replaced by NFC in the coating of paper surfaces to influence the traditional coating layer properties as required for specific purposes. VTT in Finland is developing foam coating as a new surface application method for fibre-based webs in the KCL's pilot plant together with several SUNPAP partners. The foam coating under development will apply a thin, uniform coating layer of special-purpose particles.

The health and safety issues of NFC production, application and end products are studied in cooperation with all research partners. At the same time, the impacts of the products on recycling behaviour must also be taken into consideration. Cellulose as such is considered a safe natural material, but the characteristics of NFC differ from those of cellulose. The testing methodology suggested for the risk assessment of NFC includes in vitro cytotoxicity and immunotoxicity tests to give an indication of whether NFC will cause cellular damage and whether systemic effects are likely. In addition, a nematode model-based test organism is used to investigate potential systemic effects and neurotoxicity. As exposure to NFC is likely to be through inhalation, an inhalatory toxicity study on animals is planned to be included. This ensures that new packaging, and graphic and specialty papers will be able to be produced in an even more sustainable way in Europe in the future.



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The SUNPAP project has public web pages http://sunpap.vtt.fi. The project public reports, newsletters and all scientific papers are available there.