



SUNPAP Newsletter 4
Scale-up Nano particles in Modern Papermaking

15.8.2011

Welcome to SUNPAP

Welcome to our fourth SUNPAP newsletter. This is at the same time an invitation letter to join our 1st public SUNPAP workshop on 5th of October, 2011. The event will take place at VTT, Espoo, Finland.

Our aim now is to give you an overview of the work done during the two first years in the project. The results will be presented in the workshop. SUNPAP, Scale-up Nano particles in Modern Papermaking, is a new Large-scale Integrating Project in the European Community's 7th Framework Programme under the NMP program. The project is divided in four different modules, which have strong synergy and are well integrated with each others.



The **Module 1** is concentrated on sustainability evaluation of the whole value chain and it is coordinated by Katja Bergroth from Pöyry Management Consulting Oy. The whole value chain includes market needs, sustainability assessments and recyclability and biodegradability studies. The general aim is to direct the research to more sustainable use of materials and production technologies in modern paper/board making. Preliminary starting point of market studies is where and for what NFC could be used in different paper and paperboard applications. The other part of the work has concentrated on the screening phase of the sustainability assessments. The 1st phase screening of nano enhanced new products delivered initial sustainability assessments of all cases being under evaluation during this research project. The sustainability analysis included environmental, economic and social aspects.



The heart of the project is the **Module 2** where we are scaling up the production of native and functionalized nano fibril celluloses. Tiemo Arndt from PTS (Papiertechnische Stiftung) coordinates the work. Optimal pulp raw material and pre-treatment conditions for energy effective NFC preparation were studied. The experimental trials with different chemical, enzymatic and mechanical pre-treatment processes were carried out. The produced micro and nano fibril celluloses were analysed not only with commonly used low shear viscosity, SEM, TEM, and AFM methods but other methods were also studied. Our target is to develop novel, fast and cheap quality assurance tools. The tested and recommended methods are: NanoSight, based on illumination with a laser beam, Dynamic light scattering (DLS), Field-flow fractionation (FFF) and mechanical fractionation with Rotating fractionation unit. Different routes to produce functionalized nano fibril celluloses are also studied. Different chemicals and inorganic nanoparticles were used in order to create suitable properties for novel functionalities.



In **Module 3** the research and demonstration studies focuses on industrial paper/board product applications with different end-uses. This module is coordinated by Anders Wigsten from Stora Enso, one of our big industrial partners. The industrial product targets for the five different end-use applications were set and studied at this stage mainly in laboratory scale. The products were studied using native or modified nano fibril cellulose in order to increase strength or give new functional features to the end products. The novel 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. Novel surface treatment methods are also studied. With the foam coating method a thin, uniform coating layer of special-purpose particles can be applied.



Module 4 is dealing with the health and safety issues in nano fibril cellulose production, applications and end products, which will be studied in cooperation with all other modules. This module is coordinated by Atte von Wright from BioSafe - Special Laboratory Services Ltd, one of our SME partners. Cellulose as such is recognized as safe natural material, but the characteristics of NFC differ from those of bulk cellulose. The preliminary results show that they have not caused any marked safety concerns. 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 test organism is used to investigate potential systemic effects and neurotoxicity.

In the behalf of the whole project consortium we all in the management of SUNPAP project welcome you warmly to our first public workshop. You receive detailed information about the results and have possibilities to network with our researchers. Due to the limited amount of places registration is however needed.



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The project is co-ordinated by VTT Technical Research Centre of Finland (VTT), Finland. Please visit our public web pages <http://sunpap.vtt.fi>. The registration link, workshop presentations (after the workshop), project public reports, newsletters and all scientific papers are available there.