



**NMP3 - CT - 2004 - 500311**

**Sustainpack**

**Innovation and sustainable Development in the Fibre Based Packaging Value Chain**

Instrument: **IP**

**D5.14 Dispersion method for nanocellulose and nanostarch in matrix**

Due date of deliverable: **November 05** (month 18)

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Start date of project: **2004-06-01**

Duration: **4 years**

Organisation name of lead contractor for this deliverable: **KTH**

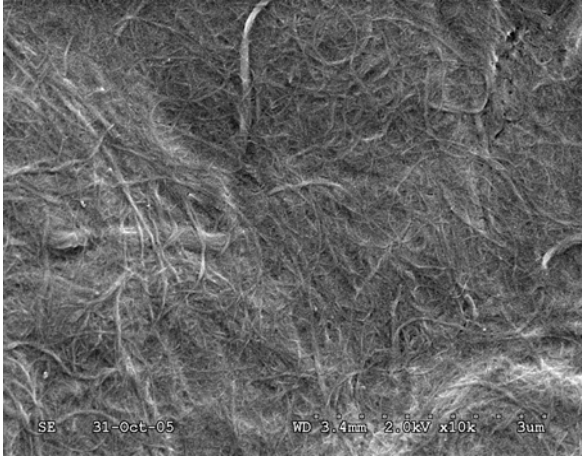
<b>Project co-funded by the European Commission within the Sixth Framework Programme (2002-2006)</b>		
<b>Dissemination Level</b>		
<b>PU</b>	Public	X
<b>PP</b>	Restricted to other programme participants (including the Commission	
<b>RE</b>	Restricted to a group specified by the consortium (including the Commission	
<b>CO</b>	Confidential, only for members of the consortium (including the Commission Services)	

At this stage of our work, starch was used as matrix (D5.11). The cellulosic material consists on the chemically unmodified microfibrillated cellulose (D5.12). Dispersion of the cellulosic nanometric fillers into the matrix is one of the most important parameter to control in the objective to achieve high performance composites.

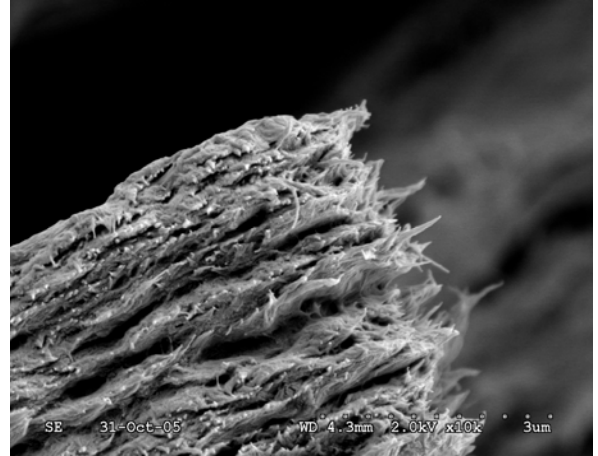
Our strategy here consists on using the unmodified microfibrillated cellulose. This allows having good dispersion in water. The suspension of MFC is produced at the concentration of 2% and is stable at the used concentration (about 1% wt/wt). For the prepared composites based starch and MFC, water was used as medium. When the suspension of MFC is added to the gelatinized starch, the dispersion is performed by alternating high speed mechanical mixing for 15min (10000 rpm using an Ultra-Turrax mixer) and long-time magnetic stirring (2 days at 600 rpm).

Biocomposites were prepared by solvent-casting technique (30°C for one week). This simple procedure was sufficient to achieve good dispersion of MFC and to prepare highly homogeneous biocomposites. Indeed, the morphology of these composites explored by SEM shows a good dispersion of MFC. At higher MFC content MFC seems to preserve the planar organization in presence of starch (Figure 1). This organization is related to the rheological properties of MFC in the initial suspension, the MFC-starch interactions and the film processing technique. The solvent-casting technique is used in this step of our work as simple method to check the feasibility of introducing high amount of MFC (more than 40%) in starch matrix, to demonstrate the positive effect of MFC on properties and to extract some information about the compatibility between MFC and starch.

In order to lower the amount of water during the mixing step and to use new processing techniques, high concentration MFC will be used and the dispersion will be done mechanically in high power Brabender mixer. The dispersion will be done simultaneously with the gelatinization of starch. This method will be tested in coordination with our partner in Girona where similar experiences were already done.



(a)



(b)

Figure 1: SEM observation of biocomposite structures. Surface (a) and section (b) of the film