COST Action FP1405

Active and intelligent fibre-based packaging – innovation and market introduction

Characterisation of NFC-/xylan-based hydrogels and aerogels reinforced by tannic acid

Presenter

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Objectives

- Study the interactions in the ternary system (Nanofibrillated cellulose + xylan + tannic acid) by conducting viscosity and rheological measurements on hydrogel and its components.

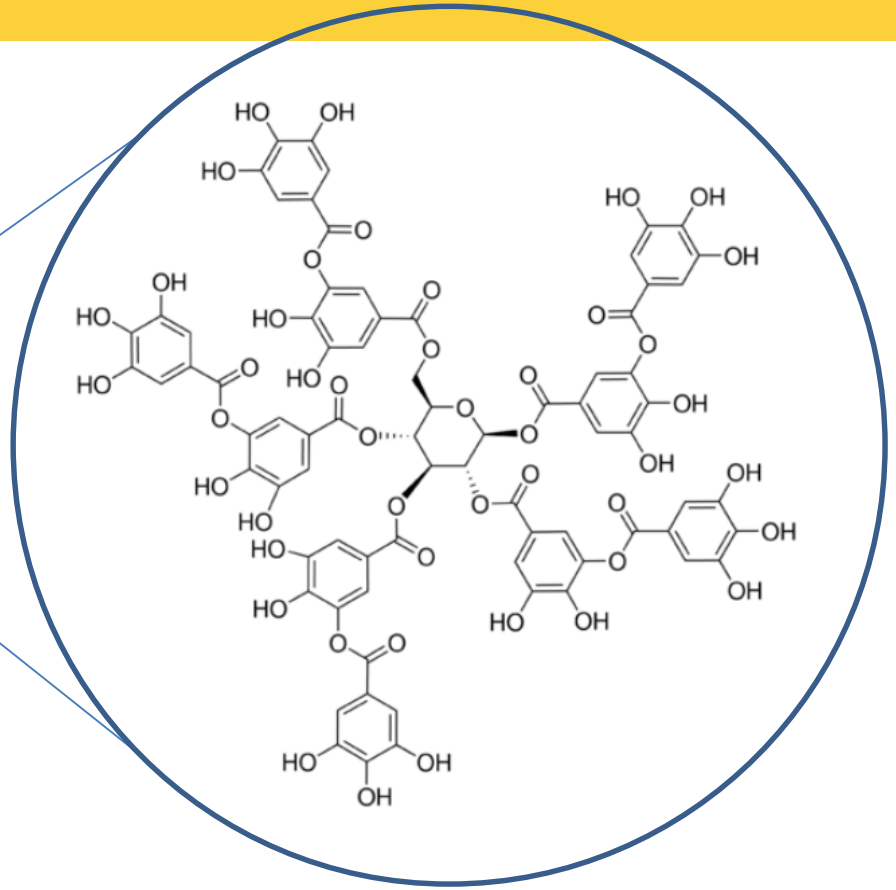
- Examine the internal structure of aerogels with Scanning Electron Microscopy (SEM)

Material and Methods

Where does tannic acid come from?

Chinese sumac (rhus chinensis), Photo: Kristine Paulus

Gallnuts

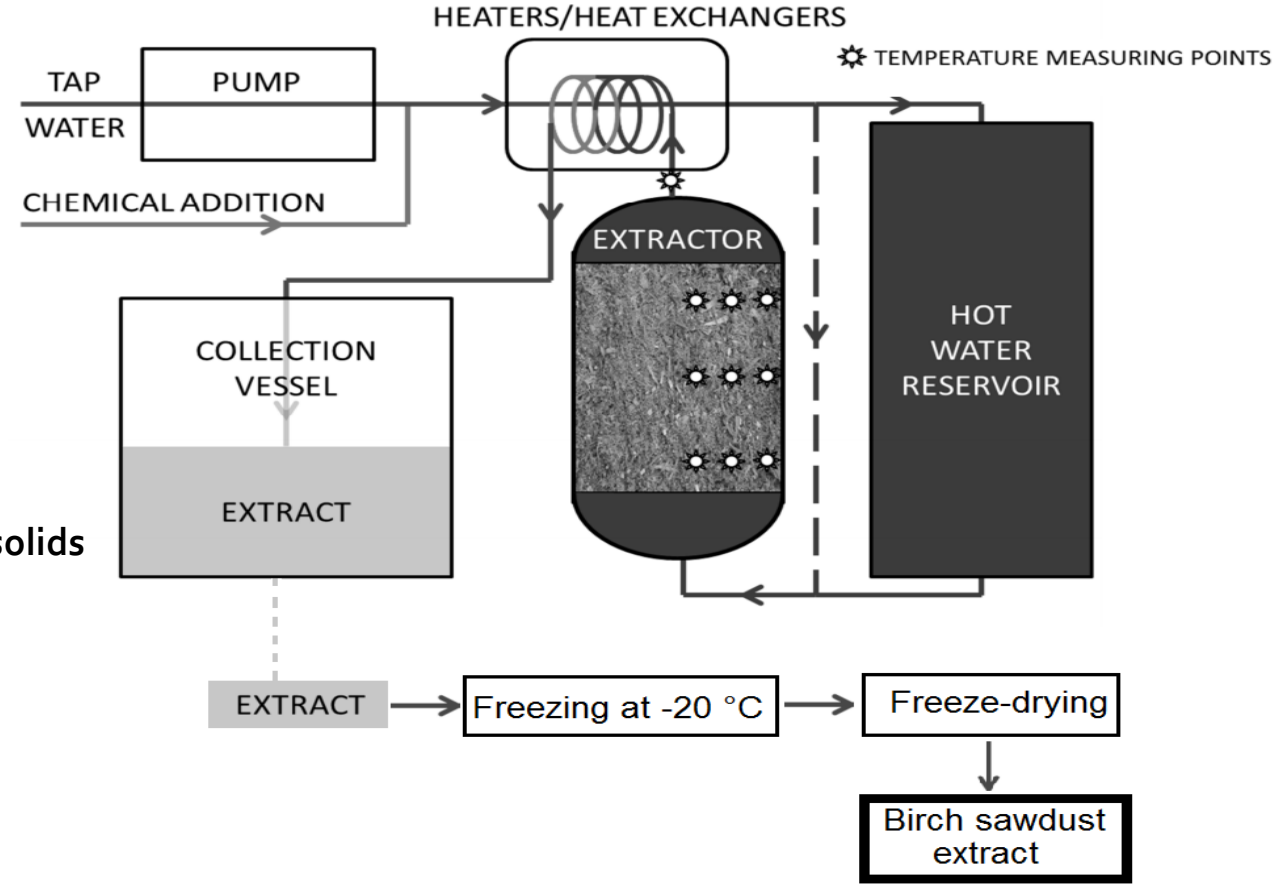


Tannic acid (TA)
A.C.S. reagent Sigma-Aldrich

Material and Methods

Birch xylan extraction

Birch sawdust extract was obtained from birch sawdust by pressurized hot water extraction (PHWE, pilot scale).



20% solids

Temperature, **around 160 ˚C**

Wood-water ration, **1:16**

Flow rate, **20 L/min**

Extraction time, **60 min**

Source: Kilpeläinen et al., 2014

Material and Methods

- **Nanofibrillated cellulose (NFC)**

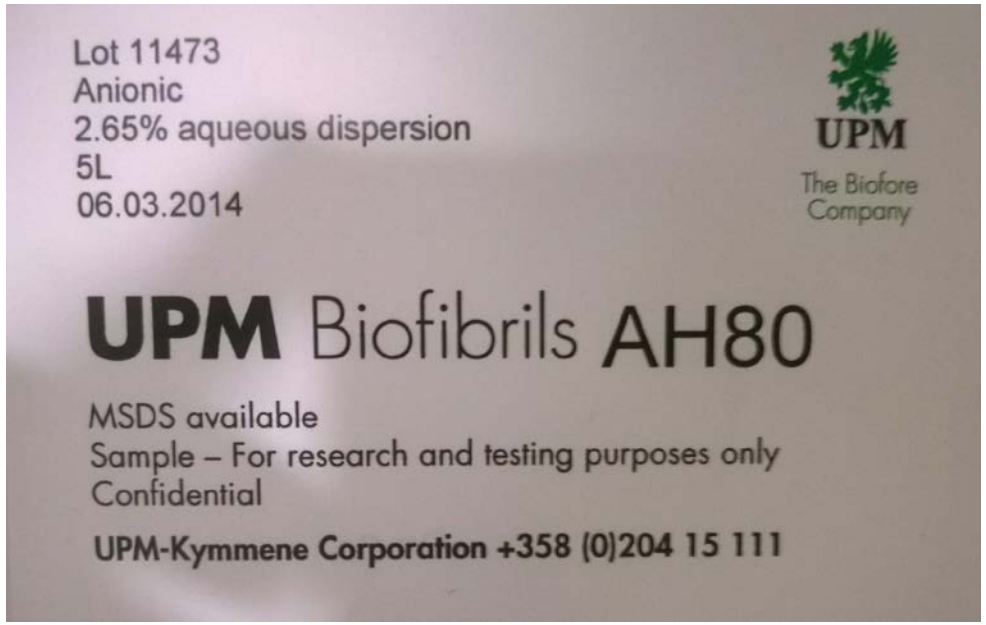
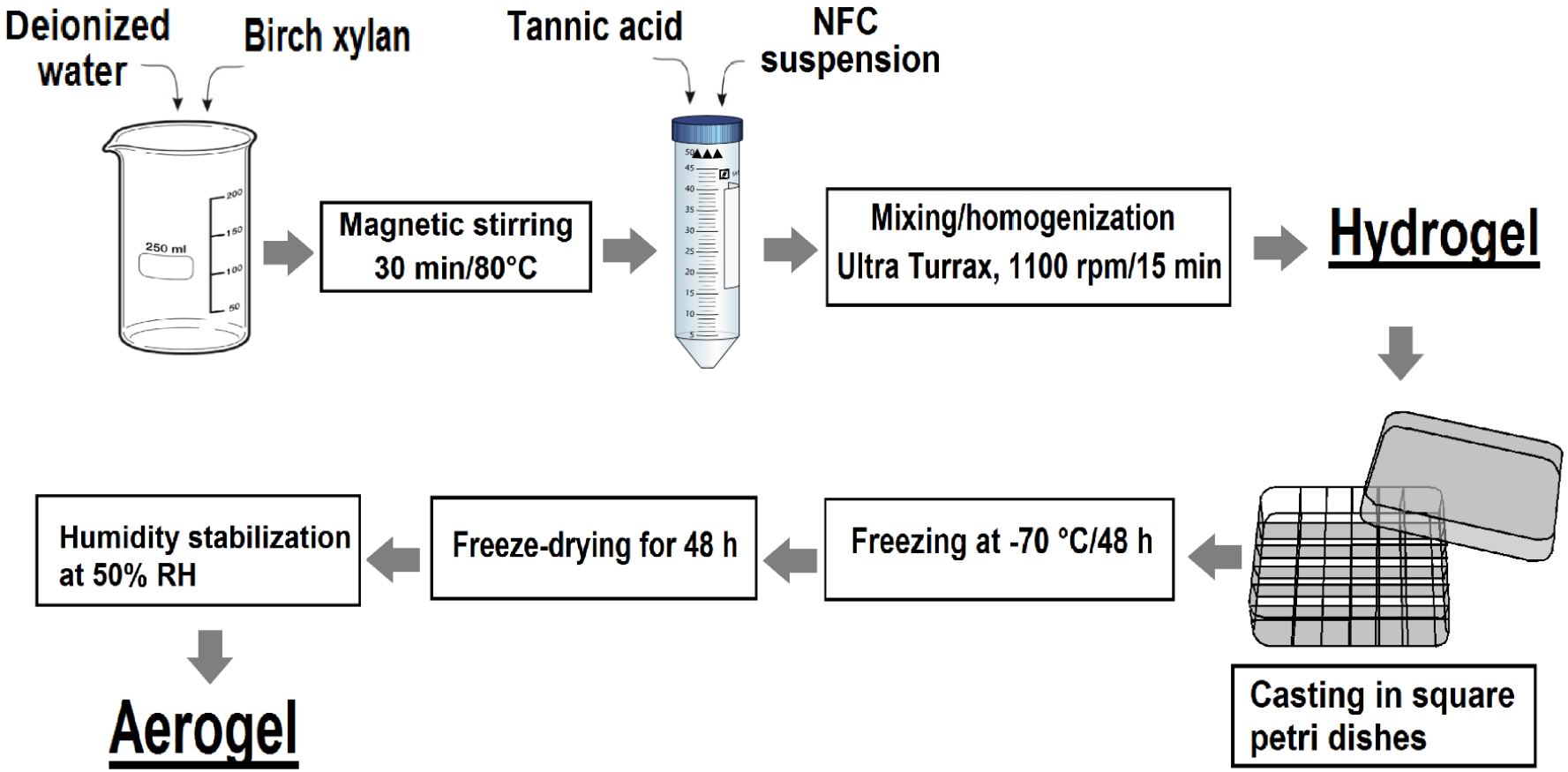


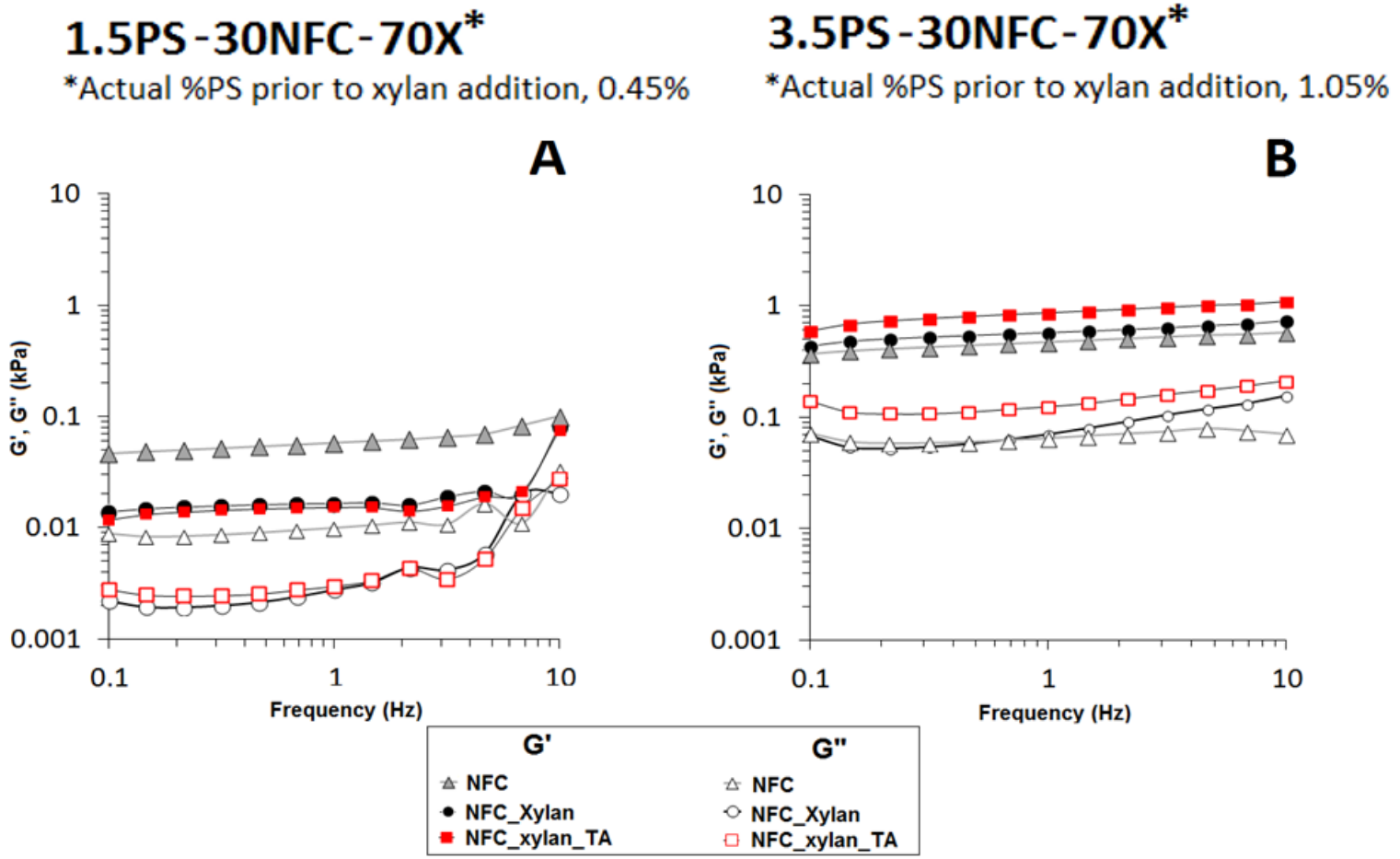
Photo: Innventia

Material and Methods



Results

Viscoelastic properties (hydrogels –> NFC + PHWE xylan + TA)



Results

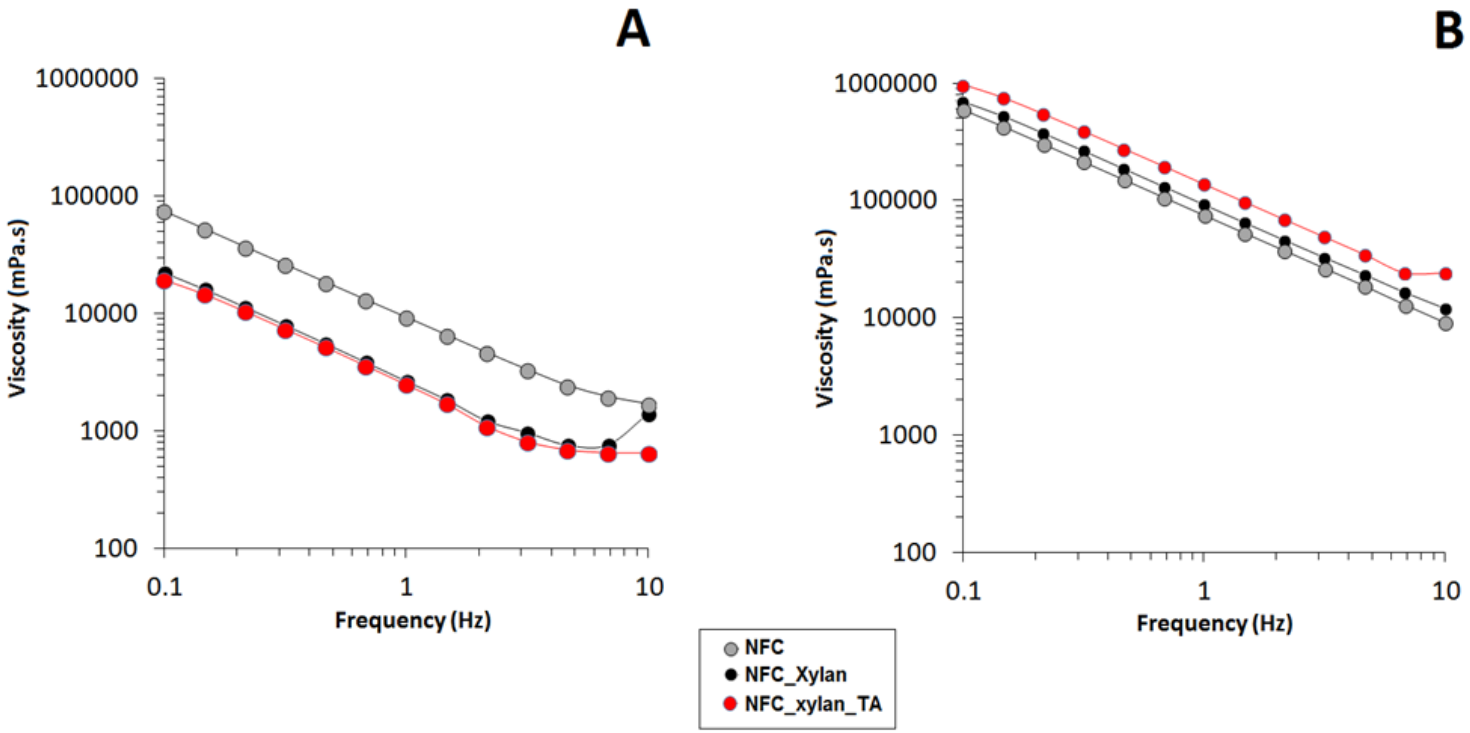
Viscosity measurement – (hydrogels –> NFC + PHWE xylan + TA)

1.5PS-30NFC-70X*

*Actual %PS prior to xylan addition, 0.45%

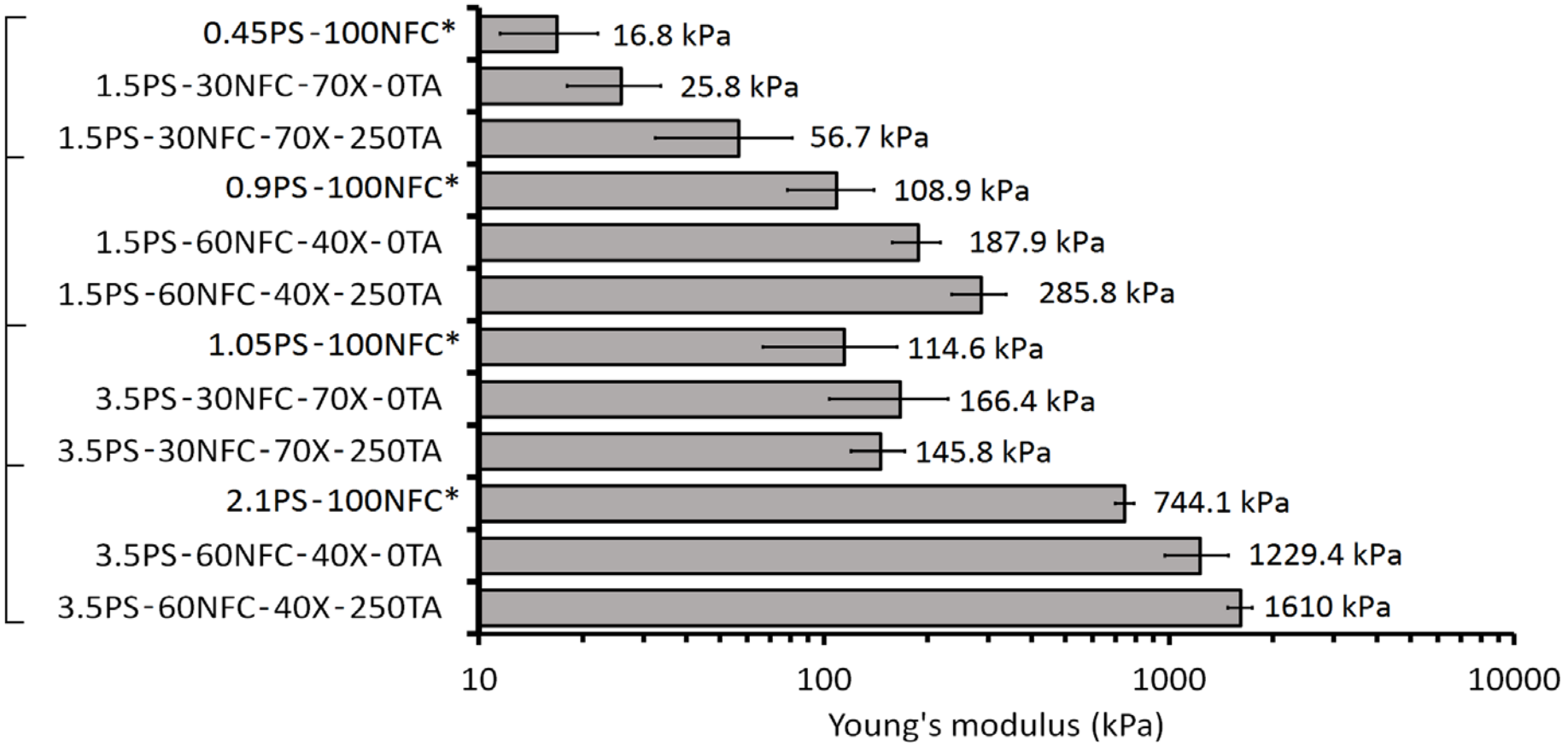
3.5PS-30NFC-70X*

*Actual %PS prior to xylan addition, 1.05%



Results

Compression test – (Aerogels –> NFC + PHWE xylan + TA)



*%PS prior to the addition of xylan

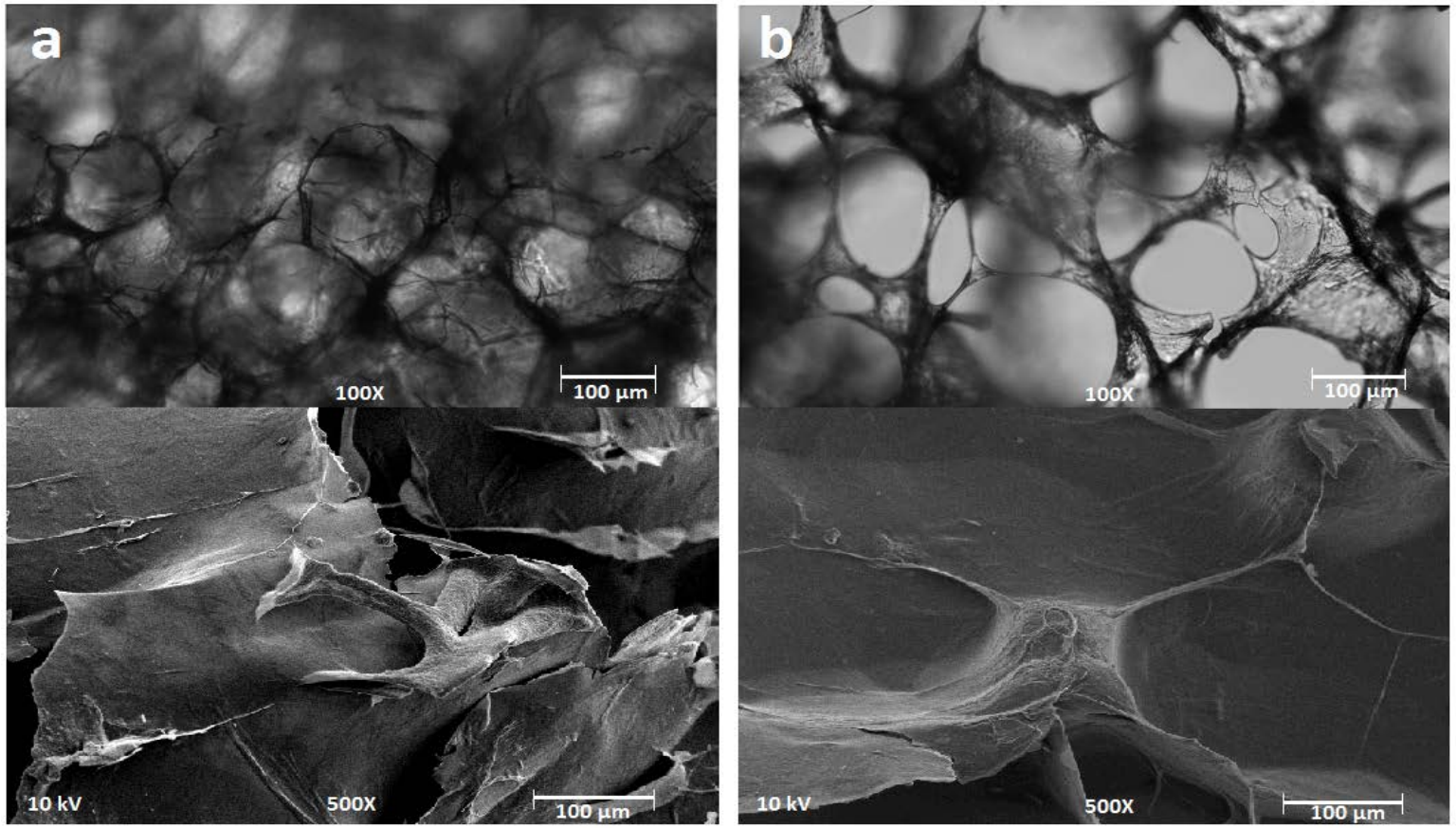
Results

SEM

1.5% total polysaccharide content, 40% xylan, 60% NFC

Without TA

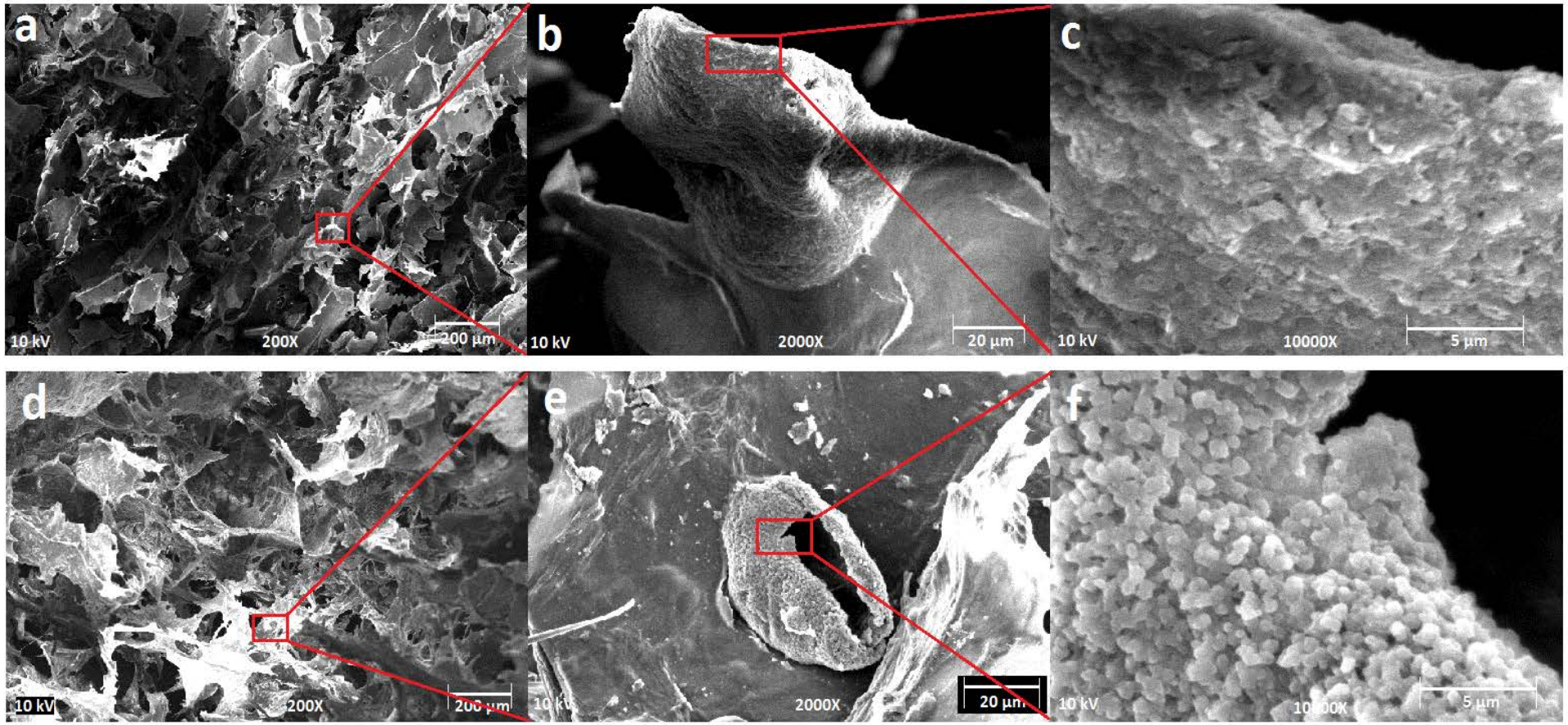
TA



Results

SEM

3.5% total polysaccharide content, 70% xylan, 30% NFC



Conclusions

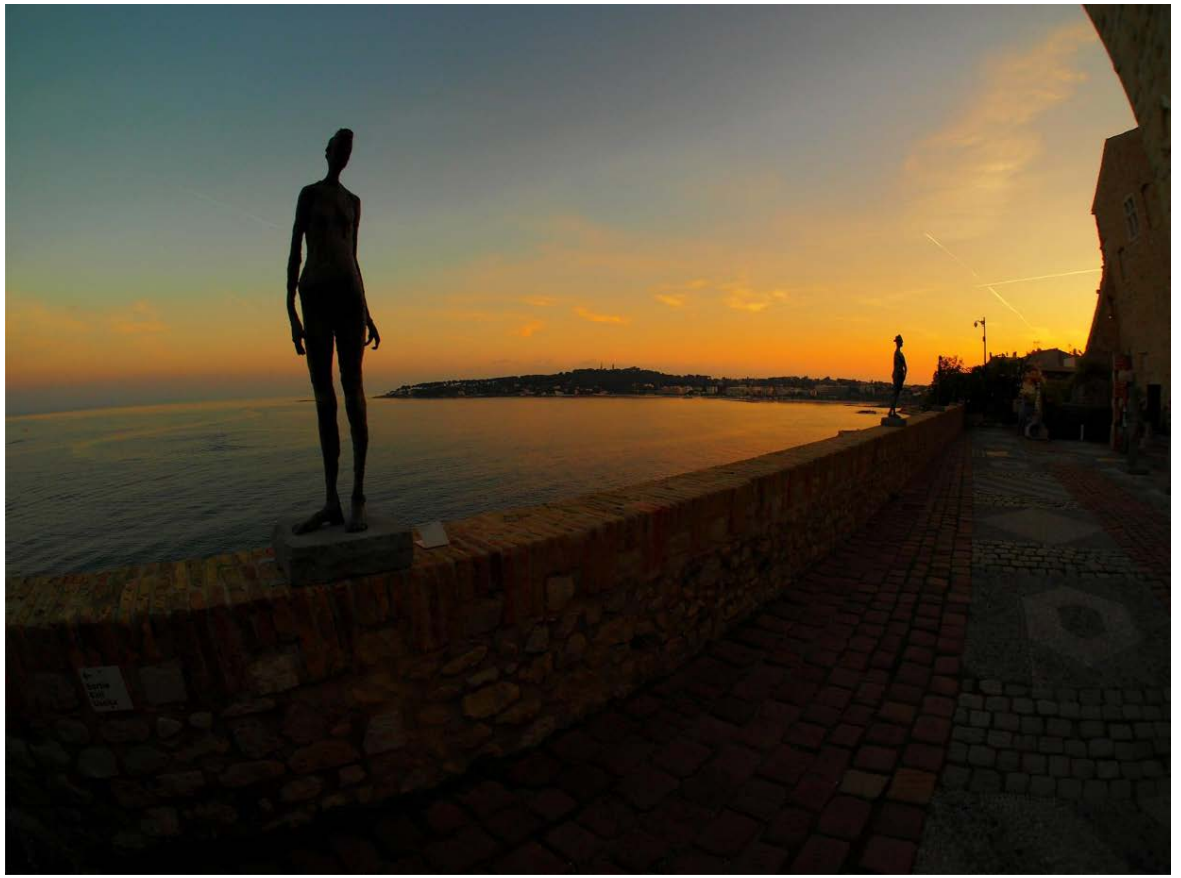
- There is considerable evidence suggesting that **xylan and TA form complexes** thereby altering the type of interaction with NFC.
- The **total content of polysaccharide is a key parameter** affecting the way xylan-TA complexes interact with NFC.
- The **sharp differences in the morphology of aerogels with or without TA** gave hints on the degree of interaction between xylan-TA complexes and NFC

References

Kilpeläinen, P.O., Hautala, S.S., Byman, O.O., Tanner, L.J., Korpinen, R.I., Lillandt, M.K-J., Pranovich, A.V., Kitunen, V.H., Willför, S.M., Ilvesniemi, H.S. 2014. Pressurized hot water flow-through extraction system scale up from laboratory to pilot scale. Green Chemistry, 16, 3186-3194.

Park, J. W. 2000. Surimi and surimi seafood. New York: Marcel Dekker, Inc.

Photos from my time in Antibes…



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THANK YOU!