

# Characterisation

## Newsletter

Number 11, January 2012

### News from PFI

#### Best paper award

A PFI article has been selected as the best paper 2011 in [NPPRJ](#). [Read more...](#)

#### New PhDs

Kando Kalif Janga defended his PhD thesis on December 19<sup>th</sup>, at PFI. The focus of Janga's work was on strong acid decrystallization and saccharification of wood for biofuel and biorefinery applications. Janga's work has been closely connected to the PFI project "[New, innovative pretreatment of Nordic wood for cost-effective fuel-ethanol production](#)". [Read more...](#)

Gallina Rodionova defended her PhD thesis about barrier and mechanical properties of MFC films on December 2<sup>nd</sup>, at PFI. Gallina's work has been closely connected to the PFI project [Sustain Barrier – Novel fibre-based water barrier applications](#). [Read more...](#)

### Bio-energy

A challenge for [biomass](#) as energy carrier is its bulky characteristics, which give high harvesting and transport costs per energy unit. Presently, new pre-treatment processes such as [torrefaction](#) have made it possible to increase the energy density of biomass significantly, and thereby form a platform for cost-efficient production of renewable energy or biofuels from biomass. At PFI, techniques have been established for producing a new type of biomass [pellets](#) with superior energy density, termed torrefied wood pellets. For torrefied pellets of softwood the energy density is typically 6-7 times higher than the energy density of the same feedstock as wood chips. In addition, torrefied wood pellets have improved end-user properties than traditional wood pellets. If produced correctly, torrefied wood pellets have improved durability, storage stability and grindability. In addition, the moisture content is lower. Torrefied pellets are hydrophobic and thereby water repellent. An essential characteristic of pellets is the friction forces exerted during pelleting, as this may wear on the production equipment. Hence, within the [PROFIT-project](#), a technique for analysing friction forces during pelleting at user-defined pelleting conditions has been established at PFI, which is presented in this issue.

### Upcoming events

Advanced Biofuels in a Biorefinery Approach Conference, Copenhagen Feb. 28 – March 1. [Read more...](#)

Int. Nanotechnology Conference for renewable materials, Montreal, Canada, June 4-7 2012. [Read more...](#)

8th Int.I Paper and Coating Chemistry Symposium and the Int. Paper Physics Conference in Stockholm, Sweden, June 10-14, 2012. [Read more...](#)

### Recommended links

PFI:

[www.pfi.no](http://www.pfi.no)

INNVENTIA:

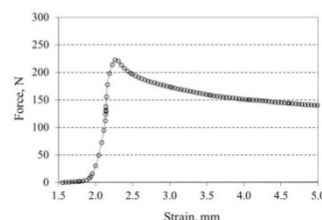
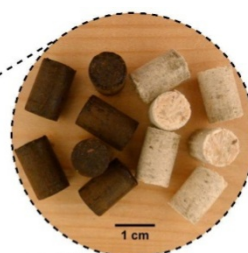
<http://www.innventia.com>

Next issue,  
August 2012

- Energy reduction

### Selected analysis method

### Measurement of friction forces during pelleting



In pellets production low friction forces during pelleting are essential for processability. A technique for analysing friction forces during pelleting at user-defined pelleting conditions has been established at PFI. (Left) Apparatus for making pellets and measuring the corresponding friction forces. (Upper-right) Traditional and torrefied wood pellets of Norway spruce produced at PFI. (Lower-right) Strain-Force curve exemplifying the friction forces.

### Editor

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Paper and Fibre Research Institute





# Characterisation

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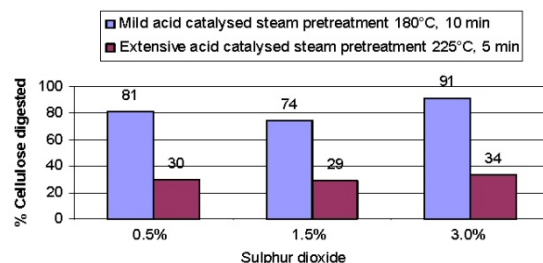
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### Steam pretreatment

## Steam pretreatment of pine (*Pinus patula*) wood residue for the production of reducing sugars

### Abstract

The study explores the production of reducing sugars from *Pinus patula* wood residual chips based on steam pretreatment technology. The severity of the steam pretreatment was altered by using two levels of temperature and time and three levels of sulphure dioxide impregnation. The results show that the efficiency of enzymatic hydrolysis depends on the severity of steam pretreatment. On a given cellulose content, the reducing sugar yield increased from 29% (15.6 g/L) under the mildest steam pretreatment conditions (180 °C, 1.5% SO<sub>2</sub>) to 91% (42.3 g/L) under the most severe steam pretreatment conditions (225 °C, 3% SO<sub>2</sub>). In all cases, the enzymatic hydrolysis yield is dependent on enzyme accessibility to the cellulose chains, as the steam pretreatment severity strongly affects biomass fragmentation.



The figure shows the saccharification yield for *Pinus patula* wood as function of steam pretreatment severity.

Reference: Chacha N., Toven K., Mtui G., Katima J. and Mrema G. *Cellulose Chem. Technol.*, 45 (7-8), 495-501.

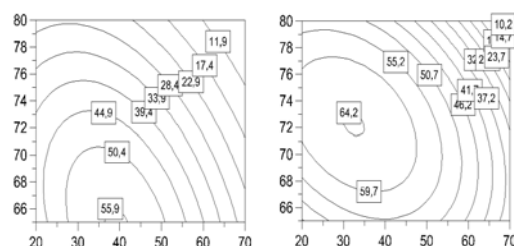
Reproduced from Chacha et al. (2010).

### Decrystallization

## Influence of acid concentration, temperature, and time on decrystallization in two-stage concentrated sulfuric acid hydrolysis of pinewood and aspenwood: A statistical approach

### Abstract

The effects on sugar yields of acid concentration, temperature, and time in the first (decrystallization) stage of a two-stage concentrated sulfuric acid hydrolysis of softwood (Scots pine) and hardwood (aspen) were investigated. The study focused on the multi-variable effects of the decrystallization stage and applied a statistical modeling with Central Composite Face (CCF) design of experiment to systematically study and simulate the effect of decrystallization reaction conditions on hydrolysis products and degradation products. The models were statistically significant and showed that for both aspen and pine, the reaction temperature and acid concentration were the most influential variables on monosaccharides and total sugar yields compared to the reaction time. The interaction between temperature and acid concentration was the most important for both species.



The sugar degradation products were much influenced by the decrystallization temperature on both aspen and pine. The models were validated by a test-set and showed a good agreement between the experimental and predicted values. The optimum predicted total sugar yields were 56 g / 100 g d.w for aspen (74% theoretical) and 64 g / 100 g d.w for pine (91% theoretical).

Reference: Janga K. K., Hägg M.-B. and Moe S.T. *BioResources* 7(1), 391-411.

The figure shows the constant yield contour plots showing the effect of temperature and acid concentration on the total sugar yield at decrystallization time of 60 minutes (left) aspen (right) pine. Reproduced from Janga et al. (2011).

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