

# Public defence of a Doctoral Thesis in Chemical Engineering

## The influence of pulp type and hot-pressing conditions on paper strength development

**Tove Joelsson**

Faculty of Science Technology and Media

FSCN research centre

Mid Sweden University

### Abstract

The hot-pressing technology has proven to have the potential for manufacturing of strong, wet stable paper materials based on eco-friendly renewable and recyclable lignocellulose. The purpose of this work was to study how the pulp characteristics and the hot-pressing conditions affect the dry and wet strength properties of paper. The results showed that dry strength can increase up to 150% for high yield pulp (HYP) based sheets at pressing temperatures well above the softening temperature of lignin. The increase in dry strength was linearly correlated with density up to 200°C. The maximum dry tensile strength obtained was 70 kNm/kg at 200°C pressing temperature and the corresponding value for a lignin-rich kraft pulp was about 130 kNm/kg, an increase of 30%. The wet tensile strength for paper based on HYP increase from 2 to 28 kNm/kg and for paper based on unbleached kraft pulp from 5 up to 60 kNm/kg in the temperature interval 20-270°C. The increase in wet strength independently of pulp grade seemed to be exponential to the pressing temperature with the steepest slope above 150°C. The ratio wet/dry strength was about 35-60% for all lignin containing pulp grades indicating that a significant wet strength was reached.



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**Place** Campus Sundsvall, lecture hall N109 and online in zoom

**Supervisor** Professor Per Engstrand, Mid Sweden University

**Opponent** Professor Tom Lindström, Innventia AB/KTH

### Exam committee

Dr. Lars Johansson, Lead scientist, Fibre Technology and Application, RISE PFI, Trondheim  
Professor Samuel Schabel, Technische Universität Darmstadt  
Professor Monica Ek, KTH