THROUGH AIR DRYING - THE INFLUENCE OF FORMATION AND PULP TYPE ON NON-UNIFORM DRYING AND AIR FLOW
ARON TYSÉN

CONTACT INFORMATION
Mail: aron.tysen@innventia.com
Tel: +46 8 676 74 97

BIOGRAPHY
Aron Tysén is employed as a postgraduate researcher at Innventia, Stockholm. His work incorporates knowledge from different sources into the continuing understanding of the correlation between fibre morphology, formation and energy efficiency. Aron Tysén obtained a Master of Science in Materials Design and Engineering at KTH in 2011.
ABSTRACT

The removal of water is an integral part of tissue production. Through air drying (TAD) is used for premium tissue grade products. Improved product properties are obtained at the price of high energy demand. A better understanding of the TAD process may lower energy demand.

The objective of the work in this thesis was to investigate the influence of formation, grammage, and pulp type on drying and air flow through sheets. A method was developed, based on infrared thermography, to determine local drying time of laboratory sheets on a sub mm-scale, while monitoring air flow and pressure drop of the TAD process. Samples with good and bad formation and samples from different pulp types with grammages ranging between 15 and 60 g/m² were evaluated.

Modified permeability was used to evaluate air flow characteristics. Samples with lower grammages had significantly higher modified permeability. The permeability decreased as the grammage increased and approached a constant value for the highest grammages. The grammage-dependency at lower grammages was considered to be either an effect of a change in pore structure or an edge effect at the sheet surfaces. When comparing the permeability obtained for the different pulp types, it was found to be linearly decreasing with sheet density and increasing with the fibre wall thickness.

Almost all samples had a linear relationship between the amount of removed water and drying time. Thus, the area-specific drying rate was similar for most samples. A mass-specific drying rate was introduced, which for low grammages was independent of the modified permeability, i.e. the flow through the fibre network at a given grammage, of the different pulps. However, for higher grammages, the mass-specific drying rate became dependent on the modified permeability to an increasing extent. Despite a large variation in local grammage, i.e. formation, only relatively small differences in drying time non-uniformity were observed.

In conclusion, the properties of sheets, with a grammage typical for the industrial TAD-process for tissue manufacturing, differed significantly in terms of modified permeability and mass-specific drying rate, from those of sheets with higher grammages.

ISBN nr: 978-91-7063-585-4
LIST OF PUBLICATIONS

Publications Included in the Licentiate Thesis


Other publications


MAIN SUPERVISOR
AND EXAMINER

Lars Nilsson
Professor at
Karlstad University

ASSISTANT SUPERVISOR - HANNES VOMHOFF
Research Manager at Innventia

ABOUT KARLSTAD UNIVERSITY

As one of the youngest universities in Sweden, we hope to be more adventurous in challenging the established and exploring the unknown.

Our ambition is to contribute to the development of knowledge at international, regional and individual levels. Thanks to our openness, creativity and multidisciplinary, we have already attained a significant level of academic achievement. All our education and research is underpinned by a close dialogue with private companies and public organizations.

16 000 students and 1 200 employees make the University an inspiring place to work and study. We offer approximately 40 Bachelor’s degree programs, 30 Master's level degree programs and 900 courses in the humanities and fine arts, social and economic sciences, natural sciences, engineering and technology, health care and teacher training.
VIPP INDUSTRIAL GRADUATE SCHOOL
A PARTNERSHIP OF 14 COMPANIES IN THE PAPER AND PULP INDUSTRY AND KARLSTAD UNIVERSITY

VIPP stands for values created in fibre based processes and products and is a unique partnership in Swedish higher education. This is a long-term project financed by the Knowledge Foundation and the partner companies. The partnership was launched in 2011 and presently 18 doctoral students are busy with as many research projects. Three strong industrial graduate school environments:

- pulp, paper and graphic technology
- environment and energy
- service innovation and customer satisfaction

Here the disciplines of chemistry, chemical engineering, environmental and energy systems, physics, mechanical and materials engineering and the Service Research Center (CTF) at Karlstad University are collaborating.

The doctoral students share their time between Karlstad University and their respective company. Their academic supervisors and industrial mentors participate actively throughout the whole process.

BOARD
Louise Törnefalk Svanqvist, Resultat Effekt AB, Chair
Erik Sundström, SP Technical Research Institute of Sweden
Ivica Crnkovic, Mälardalen University
Niclas Andersson, BTG Instruments AB
Eva Söfting, BillerudKorsnäs AB
Patrik Larsson, Karlstad University
Thomas Nilsson, Karlstad University