VIPP VALUES CREATED IN
FIBRE-BASED PROCESSES
AND PRODUCTS

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PROCESS MODELLING BASED ON DATA FROM AN EVAPORATION AND A CTMP PROCESS

ANALYSIS OF ENERGY EFFICIENCY AND PROCESS VARIABILITY

The manufacture of pulp and paper is an energy intensive process configured of several unit processes that shape a network of flows of wood chips, chemical pulp, mechanical pulp, board, steam and other important components. Improved energy efficiency supports sustainability of the process and the products. With the purpose of monitoring and controlling, information from multiple process and quality variables is continuously collected in the process data system. This data may be of time-varying nature and the variability might potentially span from seasonal to time-wise shorter variations and there are in some cases a need for predicting certain properties. By applying models based on process data there is a potential to increase the knowledge of the process characteristics, investigate the applicability of predictive models and identify optimization opportunities. Based on data from an evaporation and a CTMP plant, process models have been developed with the aim of improving the energy efficiency and studying process variability. The novelty of this thesis is twofold: it studies the application of a dynamic model to the chemi-thermomechanical pulping process (Paper 1) and applies a Pinch analysis to the evaporation system (Paper 2).

The main objective of Paper 1 was to study systematic variations in process data from a conical disc refiner and pulp data regarding applicability of a dynamic model for predicting purposes. The results showed that autocovariances for freeness were either non-existent or that only a few were significant. Several of the refiner variables indicated systematic variations for some longer sequences: for some shorter sequences, however, the autocovariance function was similar to that of a white Gaussian signal, generating a low predicting ability of the freeness model for the specific process data.

Paper 2 aimed at studying energy efficiency methods for the evaporation system via a number of heat recovery cases, using condensates for lowering the steam consumption. This paper identified seasonal variations in the potential excess of energy (higher in warmer weather and lower, or even non-existent, in colder) and provided suggestions as to how this energy may be used in a thermodynamically optimal way, involving one case in which the CTMP-liquor was pre-heated.

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Knowledge Foundation

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BANANAS ARE SOME OF THE WORST FOOD WASTE CULPRITS

A study done at Karlstad University shows that seven products account for almost half the fruit and vegetables wasted by retailers. Potentially, food waste can be drastically limited by focusing on these products.

- Retailers may profit by allocating more staff hours to measures that lead to reduced fruit and vegetable waste, thereby saving money and the environment, says Lisa Mattsson, doctoral student at Vipp Industrial Graduate School.

Today food waste involves not only wasted natural resources, but also financial losses. A growing population means that all actors in society – business, government agencies and citizens – have to handle food better to decrease the amounts that are wasted.

A few products account for half of the waste costs
Less food is wasted in retail than in households, but retailers also waste large amounts of food each year. In this study, the fruit and vegetable waste of three large retailers was analysed based on quantity, economic costs and the impact on the climate. The results show that seven categories of fruit and vegetable account for most of the waste as regards quantity, costs and the impact on the climate. These seven products are bananas, apples, tomatoes, salad, sweet peppers, pears and grapes. Together, these products account for almost 50% of what food waste cost the retailers. Focusing on decreasing the waste of these products could therefore potentially have great effects.

Waste reduction strategies are profitable
Most of the costs associated with food waste, around 85%, are related to the products themselves. The cost of waste management, such as emptying and removing waste, amounts to around 6%, while the staff hours spent removing products from the shelves, recording waste and disposing of products represent another 9% of the total cost. Since staff hours are a relatively small part in comparison to the cost of the products themselves, increasing staff hours to reduce food waste has much potential. A cost-benefit analysis showed that the costs incurred to double the amount of time staff spend on waste reduction measures, would be the equivalent of a 10% reduction in fruit and vegetable waste.

The study on the waste of fruit and vegetables by retailers was published online in the journal Resources, Conservation and Recycling. The authors are Lisa Mattsson, Helén Williams, and Jonas Berghel, researchers at Karlstad University. For further information, contact Lisa Mattsson, Department of Environmental and Energy Systems, Karlstad University, +46702 48 42 87 or lisa.mattsson@kau.se

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VIPP INDUSTRIAL GRADUATE SCHOOL SPRING MEETING IN SÄFFLE

The Spring meeting 2017 took place on 24-25 April hosted by BTG Instruments AB in Säffle. The industrial graduate school VIPP has been active for six years and currently 12 doctoral students are involved in research projects on processes, energy, the environment and service development in some of Sweden's major basic industries.

The meeting was introduced with a doctoral student workshop, an opportunity for the students to network and take advantage of VIPP's multi-disciplinary breadth.

Research presentations and study visits
The second day included a number of presentations of doctoral students' work-in-progress. There was also a presentation of BTG Instruments AB, and tour of the company, as well as tours of Nordic Paper and UMV Coating Systems AB, which are also located in Säffle.

Co-production between industry and academia
VIPP, short for values created in fibre-based processes and products, is a unique institution in the Swedish education landscape, with the aim to strengthen the university's research environments and provide professional development to industry.

The industrial graduate school VIPP is a partnership between the disciplines chemical engineering, chemistry, energy- and environmental systems, physics, mechanical- and materials engineering and CTF, Center of Service Research, at Karlstad University and a number of companies in the Swedish and Finnish forest industry. The project is financed by the partnership companies, the KK-Foundation and Karlstad University.

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