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**Research area: Process aims**

Paper and paperboard production // Stock preparation

**Key words:**

Annual plants, recovered paper, virgin fibres, strength properties, ultrasonic, ultrasound

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**TITLE: Sonication of natural fibres and agro-waste for production and up-grading of papermaking pulps and biogas****Background/Problem area**

Agro-waste is a specific type of biomass produced as by-product from agriculture. Agro-waste includes several types of materials like straw - rice, wheat, barley, oat, maize -, corn cobs, cotton and maize stover, rice husk etc., and are based on annual plants. Agro-waste/annual plants have an economic potential for energy conversion and pulp production. The use of annual plants for pulp production have some advantages like lower lignin content or the high annual yields per hectare, despite a constant supply of raw material to the mill and storage capacity are still some issues to be analysed.

The use of ultrasound has long been practiced successfully in many industries, e.g. disintegration of biological, non-destructive testing or ultrasonic cleaning. Ultrasound causes different effects, whereby the most interesting phenomenon during treatment of fluids or suspensions are acoustic cavitations. This project includes a new approach based on the progress in ultrasound technology made in the past five years – high power ultrasound technology.

For graphic and especially packaging papers strength properties are the key criterion, which is why the strength potential and especially bonding power of single fibres is of major importance. Usually refining is employed to increase the strength and bulk of paper by increasing the swelling capacity of fibres and bonding-active contact areas between them. As compared to other stock preparation processes, refining is the most energy-intensive sub-process. High-power ultrasound technology has the potential to improve the traditional refining process with regard to the development of fibre properties without affecting the fibre length and by means of less energy.

**Objectives/Research results**

The objective of this research project is to develop a process principle for producing pulps for paper manufacturing from annual plants, including agro-waste, utilising high-power ultrasonic pulping technology and to influence by means of Ultrasound the pulps used in papermaking to develop the desired fibre properties. Further valorisation of by-products and other residues will be investigated in a biorefinery approach. Environmental and logistic aspects will also be considered.

Paper properties that are important for corrugated base paper – for example short span compression strength (SCT) or strength in z-direction (Scott-Bond) - will be increased by adding wheat straw, rice straw or slightly refined flax to the conventional raw material recovered paper (grades 1.02, 1.04).

Overall objectives are to achieve more energy and resource efficient processes and to broaden the fibre supply to the paper industry, while making value out of materials which are traditionally wasted or neglected. One key technological component of the project will be the investigation of operational parameters (design of reactors, of Ultrasound sources, of process parameters) that allow the production by Ultrasound of fibres technically and economically valuable for the paper industry. Another essential technological module will be the investigation of the potential of high-power Ultrasound technology in the up-grading of cellulosic fibres traditionally used by the paper industry. Here wood cellulose and recovered paper will be considered. Key success indicators will be specific energy consumption and strength performance of the treated fibres.

Ultrasonication of fibre suspensions including recovered paper (grades 1.02, 1.04) can increase the paper strength by up to 14% with a limited increase in drainage resistance, limited fibre shortening and specific energy consumption of less than 50 kWh/t.

**Application/Economic benefits**

The concept of this project is to investigate a zero-waste production of pulps from annual plants and agro-waste by targeted application of new and more efficient ultrasound technology. Due to the dispersion of these raw materials over relatively large territories, the industrial application will require rather small production units, and is therefore typically relevant for SMEs. The objectives are avoiding future bottlenecks in the supply of low-cost fibres for papermaking (focus on annual plants / agro-waste available in large quantities, as alternatives to wood or recovered paper used as raw materials) and possible new applications for fibres obtained from annual plants / agro-waste in other industries.

Established stock preparation and -treatment technologies (fibre treatment by mechanical contact – beating/refining) have little room for improvement regarding quality and energy savings. Exploring the potential of high-power ultrasound treatment in this respect is a key objective of SONOPULP.

**Period of time: 01.01.2010 – 30.06.2012**

**Remarks**

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