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Research area: Process objectives
Paper and paperboard production // Papermaking

Key words:
Retention, Retention aids, Retention mechanisms

Title: "Micropolymer systems" Development of physico-chemical models for micropolymer retention systems for independent optimisation of retention, drainage and formation and for reduction in drying energy consumption

Background/Problem area

Retention, drainage and formation are principal factors for the efficiency of paper machines. High retention avoids process fluctuation and ensures good raw material yield. Drying energy can be saved by the improved drainage of the paper web, or the machine speed can be increased if the paper machine is limited by its drying capacity. Homogeneous formation of the paper web improves product quality. In particular, the energy savings due to optimisation of the drainage, without deterioration of formation or retention, is of great interest to paper mills in the current energy situation.

Combinations of chemical additives – retention systems – are used to control retention, drainage and formation. If the retention system is varied, all factors – retention, drainage and formation – are influenced at the same time. The factors correlate with each other based on the phenomenon of flocculation.

A promising approach is the use of micropolymers to partially decouple the factors mentioned above. Micropolymers are highly cross-linked polymers with anionic functional groups. The branched three-dimensional polymeric structures possess a large surface area and a high anionic charge density. Due to their structure, they can interact efficiently with other suspension components. Similar to inorganic microparticles, they form small flocs. Besides the positive qualities of inorganic microparticles (surface load, small size, and three-dimensional structure), micropolymers exhibit additional advantages: adaptable polymer chain, high and variable charge density. Due to these qualities, the use of micropolymers as an additional component in a microparticle retention system is obvious.

Objectives/Research results

The aim of the research project is to achieve an independent adjustment of retention, drainage and formation by microparticle retention systems with an additional micropolymer component ("micropolymer system"). Therefore, physico-chemical models are to be developed for micropolymer systems. The following objectives are to be achieved:

- Savings of drying energy by improved drainage,
- Reduction in process fluctuations and lower raw material losses due to higher retention,
- High product quality due to optimum sheet formation.

In the research project, the effects of the components of micropolymer systems on retention, drainage and formation were examined and evaluated. The components of the micropolymer system were characterized in terms of their size and charge. The flocculation behaviour of the retention system components was examined using the FRBM method. Using a model SC-paper formulation as an example, fibre zeta potential, retention and drainage behaviour were measured in laboratory scale.

In a paper mill, a process analysis was performed and laboratory trials with the used stock were carried out with different additive dosages. The vacuum-driven drainability and the formation of the produced lab sheets were measured. The additive preparation and the dosage parameters were optimized in order to get results comparable to process conditions.

Based on the results, potential retention mechanisms were postulated and evaluated to be able to optimise micropolymer systems systematically. Effects under different boundary conditions, application possibilities and limits of micropolymer systems will be demonstrated.

Application/Economic benefits

The transfer of the results to practise opens up different possible applications:

- Choice of new retention systems, suitable for the paper grade and process conditions,
- Optimisation of existing retention systems,
- Independent optimisation of retention, drainage and formation.

As a result of this knowledge transfer in practise, it is possible to improve the economic efficiency of paper producing SMEs by reducing energy costs, improving the machine availability due to process stability, and increasing product quality.

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Remarks

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