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

Key words:
Retention, retention aids, retention mechanisms

Title:

Development of retention systems by using core-shell latices as starting point for the production of innovative, highly filled, functional papers

Background/Problem area

In the production of specialty papers with filler contents up to 85%, fillers have decisive effects on the paper properties. Fillers with their specific characteristics (e.g., sinterability, adsorption capacity, heat storage capacity or electric conductivity) are present as "paper-like" structures and can be processed accordingly. A special challenge is the development of suitable retention systems capable of retaining these filler quantities and holding them in the dry paper structure. Conventional retention systems enable filler contents of more than 50%, but the strength of the resulting paper web is no longer sufficient to withstand the tensile loads in the paper machine.

Adequate tear strength can be achieved by means of elastomeric latex particles lending strength and elasticity to paper coatings, for example. Latex particles with modified surfaces can form bridges between fibres and fillers. Latex particles with an internal multi-layer structure are suitable for new retention systems because their structure provides unlimited possibilities for surface modification.

Objectives/Research results

Aim of this research project was the development of a retention system for highly filled functional papers. Essential component of the recipe of retention components were latex particles fitting into the retention system and acting as strengthening agents. The development of the retention system was developed for two filler systems representing the broad range of filler qualities for highly filled functional papers.

From this retention system, basic knowledge had to be acquired to produce highly filled paper based on filler characteristics, the desired properties of the paper product and process-technological demands. The following results were to be achieved:

- Systematic procedure to arrange retention systems for highly filled papers
- New core-shell latices for use in the paper suspension
- Understanding the mechanisms of retention systems to transfer them to other fillers

In the first step, the retention components and raw materials were defined and procured. Industrially available latices were characterised and suitable retention systems for these latices were optimized by variation of charge, dosage amount, molar mass, chemical constitution and dosage sequence of the different components. Drainage behaviour, retention, formation and strength properties of the produced paper sheets were determined. An analytical centrifuge was used to study the flocculation behaviour of the additives in order to optimize the recipes and the dosage strategy.

New latices synthesized by the project partner were characterized analogous to the standard latices. They were tested in laboratory scale for their retention and flocculation behaviour using the analytical centrifuge. The paper sheets produced were tested for their relevant properties in the same way as samples produced with commercially available latices.

Based on the results, a suitable latex was selected from the newly synthesized types and produced in pilot scale by the project partner. The latex was tested with the optimized retention system on a pilot paper machine with a zeolite-based filler to evaluate the efficiency for the practice of papermaking. The produced papers were tested for their relevant strength and adsorption properties. Finally, the results were transferred to another filler, based on diatomaceous earth, which was also tested on the pilot paper machine.

Application/Economic benefits

The transfer of results into industrial practice opens up various different possible applications:

- It offers latex manufacturers opportunities to develop new products
- Optimisation of existing retention systems and development of new adsorptive papers

The economic efficiency of SMEs in the circle of users of highly filled papers can be improved by new products, energy cost reduction and higher machine availability due to improved process stability and product quality.

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Remarks

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