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Research area: Process objectives

Paper and paperboard production // Papermaking

Key words:

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Wet strength agents, fluorescence, dynamic simulation

TITLE:

"Dynamic simulation of wet strength agents"

Tracing and dynamic simulation of adsorption and distribution of wet strength agents in the production of wet strength papers to reduce of the additive costs and increase production in accordance to quality

Background/Problem area

Wet strength agents (WSA) strongly dominate the chemical equilibrium of the wet end of a paper machine in the production of wet strength papers. For efficient application, a very high proportion of the additive has to be bound to the fibres and transferred to the paper web. Nevertheless, high dosage decreases the efficiency of WSA and promotes the build-up of undesirable agglomerates, causing paper specks to occur. This means a loss of effective additive and an increase of off-spec production.

The setting of a high wet strength of the paper without the risk of deposits is already difficult under stable production conditions. It is increased by discontinuous effects like fluctuating broke use, web breaks, grade changes and starting-up processes. Especially the production of wet strength papers in SMEs is defined by frequent process changes which complicate the optimal dosage of wet strength agents.

Objectives/Research results

The aim of the research project is to indicate new ways of increasing the effectiveness of wet strength paper production. The accumulation of off-spec production is to be reduced by more rapidly achieving the target values after grade changes, web breaks or machine start-ups. Overdosage of WSA which leads to deposits as well as raising the costs of additives should become avoidable. The following objectives are to be achieved:

A procedure was developed to trace the adsorption of polyamidoamine epichlorhydrin type WSA on a lab scale and in practice. A suitable method for separating pulp fibres from fibre fines was evaluated. Wet strength agents were synthesised with a fluorescence label. Different methods based on fluorescence spectrometry, Kjeldahl nitrogen detection and charge titration were applied to trace the adsorption behaviour of WSA on pulp fibres, fibre fines and fillers.

In typical dosages, the WSA adsorbed completely to the fibre stock. The amount adsorbed on fines was determined; it was markedly higher than the amount adsorbed on the fibre coarse fraction. Further results show the influences of several process steps (e.g. refining, separation/mixing, reallocation of adsorbed WSA) on the amount of adsorbed WSA and paper wet strength. After mixing of WSA loaded fractions, WSA already adsorbed on one fraction migrates to other fractions until the distribution equilibrium is reached. Desorption does not occur within the time scales regarded. The adsorption characteristics allow for describing the behaviour of WSA within the process steps of the paper production by distribution models (adsorptions and separation functions).

The behaviour of the wet strength agents in stock preparation and wet end of a paper machine is dynamically simulated. The distribution models are integrated into a process-wide physical, dynamic simulation model. Scenarios for the static and dynamic optimisation are to indicate the possibilities of simulation.

Application/Economic benefits

The research project aims at optimising of the production process for wet strength papers. The main benefit is to be expected in a reduction of off-spec production against the background of low production volumes and frequent grade changes. Highest priority has been given to the avoidance of web breaks and cleaning shutdowns caused by deposits. The fast adjustment of the demanded wet strength after a change becomes more important, the more frequent grade changes are. A special aspect is the soiling of wires by inactive wet strength agent. This leads beside greater cleaning expenditure, to diminished drainage performance and accordingly to greater consumption of drying energy. For SMEs without their own steam and power stations, this additional consumption leads to add-on costs due to further rising energy prices.

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Remarks

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