Research Institute:

PTS München
Heßstr. 134
80797 München

Internet: www.ptspaper.de

Head of the research institute:

Dr. A.-B. Kerkhoff

Project leaders:

Dr. R. Grenz
Tel: 089 / 12146-272 and 089 / 12146-497
Fax: 089 / 12146-36
E-Mail: reinhard.grenz@ptspaper.de

Research area:

Paper and paperboard production // Papermaking

Key words:

Internal sized papers, interactions, chemical additives, sizing agents, retention aids, optical brighteners

Title:

Reduction of the additive costs in the production of internal sized papers by identification, quantification and minimization of the negative interactions of sizing agents with retention aids and optical brighteners

Background/Problem area

Especially for packaging and speciality papers, the degree of sizing is a vital quality parameter, often needed to aquire special product properties. The optimization of synthetic sizing agents and of their application was intensively investigated in the past. Interactions with other (intentionally added or not avoidable) constituents of the paper stock prevent a sustainable optimization of the efficiency of the available sizing agents. Undesired interference reactions displacing the additive at binding sites or side reactions may cause losses of efficiency of the sizing agents and the other additives involved, leading to cost-intensive overdosages, product quality losses (e. g. specks on paper) and production problems (e. g. web breaks, deposits etc.).

Despite the increase in product quality in the last years, the synthetic sizing agents ASA and AKD, whose consumption is continuously rising, are regarded as potential sources of deposits. Interactions with retention agents, optical brightening agents, wet strength agents and defoamers are known. The knowledge regarding the interactions of synthetic sizing agents with other chemical additives or detrimental substances is inadequate yet. A number of effects is empirically known from the practice of papermaking or from experimental studies. The existing approaches are inadequate for the explanation of interactions reducing the efficiency of sizing agents. The in-depth knowledge of the physico-chemical interactions of chemical additives with each other is an indispensable prerequisite for the optimum use of sizing agents and ultimately for the optimization of wet end chemistry.

Objectives/Research results

The project was targeted to a reduction of the additive costs in the production of internal sized papers by identification, quantification and minimization of undesired, negative interactions of sizing agents with selected papermaking additives, like retention aids and optical brighteners. As a first step, sizing agents, retention aids and optical brighteners typically used in papermaking were selected and characterised in terms of relevant chemical and physical-chemical parameters. This was followed by systematic studies to identify possible interactions. To take a closer look at the mechanisms of interactions identified between the sizing and retention aids and optical brighteners, the reactions of these chemical additives were investigated by means of modern analytical methods.

Extensive trials were performed on a pilot paper machine to verify the laboratory results. The laboratory results were confirmed by the pilot trials. The results of the investigations were used to compile a matrix of interactions to be expected among typical representatives of the additive groups considered, providing information about the relevance, extent and, if possible, mechanisms of interactions during combined additive use. To verify the transferability of results into industrial practice, trials were done in a paper mill. The results of the mill trials were used to develop a systematic procedure for identifying possible additive interactions during process analyses in concrete applications.

Application/Economic benefits

The efficiency of sizing will be increased by a reduction of undesired interactions between sizing agents and other additives, leading to decreased additive costs. The saving of 5 % sizing agent alone yields a cost reduction of 88,000 € per year e. g. in a paper mill using 14 kg sizing agent (trade product) per ton of paper or board in a production of 50,000 t per year. Special paper qualities with requested high degrees of sizing can be obtained only after the intended enhancements.

Additionally, deposits caused by undesired interactions may be avoided by targeted selection of chemical additives, having a crucial influence on the paper mill productivity and the paper product quality. A rise in productivity (usually 85 – 92 %) of 0.5 % corresponds to an increase of sales volume of 50,000 € per year in a paper mill producing 50,000 tons per year with a profit margin of 200 € per ton of paper.

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Remarks

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