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Research area: Process aims

Paper and paperboard production // Stock preparation

Key words:

Mixing rules, optimization, cost minimization

Title:
Reduction of the raw material costs by adapted mixture of pulps without unfavourable influences on runnability and product quality

Background/Problem area

The variety of available primary and secondary pulps opens the possibility of manufacturing papers with desired product properties with minimum cost employment by a suitable selection of pulp grades and their mixing proportion. Potentials of cost reduction can be opened by optimized formulations of raw materials of up to 50%. So far this potential is used only rarely. The obligation to the adherence of certain secondary conditions, which result from process runnability and the demanded product properties, proves as the central problem. Expansive preliminary tests and incalculable risks justify a holding on worked but economically not optimized furnishes.

A possibility, in order to minimize pre processing expenses and to calculate risks, software-based design systems offer. So far algorithms for estimation of mechanical and optical paper properties only used unblended pulps. The traditional mass weighted mixing is only suitable for pulp grades which are close in origin. A further deficit consists in a lack of usable methods to identify optimal mixing proportions of pulps under secondary conditions for paper properties, which result from process or customer requirements.

Objectives/Research results

In the context of the suggested research topic it is aimed to expand existing numerical methods for paper properties prediction, so far only valid for pure (unblended) pulp grades, in such a way that they can also be applied on pulp mixtures. Mixing rules will be developed for those fibre morphological and fibre suspension characteristics, which directly influence paper properties. In contrast to traditional mass-weighted mixing of physical paper properties, the mixing problem is attributed to the actual causes.

The results which can be expected promise a more precise modelling of mixing phenomena. Based on the newly developed relations between number and proportions of mixed pulp grades and resulting paper properties mathematical optimization methods will be applied. For up to 3 different pulp grades their composition can be optimized in such a way that under given paper property limits either the totally costs are minimal (cost minimization) or for a given function of paper properties the minimum or maximum of the function turns up (property optimization).

Application/Economic benefits

The benefit of the application of mathematical paper property prediction tools for paper industry, including the methods of the cost minimizing and/or characteristic optimization for pulp mixtures, cannot be estimated quantitatively due to fact that there are only limited information available world wide on how such methods are used. The potentials of cost reduction can be characterized however as follows: The conceived mathematical methods for the cost minimization or property optimization open the possibility of calculating optimal boundaries for mixing portions before any experimental trials start.

Experiences of the PTS prove that an optimization of pulp formulations, based on experiments, binds substantial personnel capacities. A reduction of the test runs around 50% by computer-aided simulation, will involve an reduction in expenditures of at least 10 T€. The price clearance for comparable fibrous materials (up to 100€/t for virgin fibres) can be used, if consequences of partial or complete exchange of the more expensive by the cheaper fibrous material can be calculated in shortest time reliably. The necessary algorithms will be supplied by the project.

Finally the use of waste paper is a mixing problem as a whole because waste paper is a mix of different pulp grades. Mixing rules will help to find optimal formulations of different waste paper grades and if necessary of virgin fibres.

Project period: 01.02.2006 – 31.01.2008

Remarks

The research project IGF 14694 BR is being funded by the German Federal Ministry of Economics and Technology BMWi.