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THE INFLUENCE OF SUBSTRATE ON CHARACTERISTICS OF RECYCLED FIBERS

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Abstract: The recycled fibers are important source for the production of printing papers. The article presents the influence of different substrates printed in offset with model inks on handsheet brightness and ashes after disintegration and flotation.
The investigation results show that the greatest handsheet brightness after flotation is on the coated paper. The brightness is smaller when the uncoated papers containing wood pulp were used for recycling and when the prints were made with inks based on vegetable oil and when they were aging.
Key words: ashes, brightness, deinking flotation, model ink, printing substrates

1. INTRODUCTION

The recycled fibers are more and more important source for the production of printing papers. The recycling process includes detachment of ink from fibers, removal of detached ink from pulp and water clarification for reuse and disposal of removed ink and stickies. Mechanical, chemical and thermal forces are utilized to detach ink from the fibers (Law, K.N. et al, 1997; Moss, C. 1997). The detached ink is removed from the stock by processes screening, cleaning, flotation and washing.
The removal efficiency of a process will depend on ink or toner particle size, shape and density. In general, the large size particles, greater than 150 □m will be efficiently removed by screens, particles from 25 to 150 □m will be removed by cleaners and flotation and particles less than 25 □m will be removed by washers (Thompson B. 1997).

Flotation system consists of an aqueous phase, two solid phases to be separated from each other and a source of air bubbles. In the flotation cell the air bubbles rise through the paper slurry and selectively attach to ink particles. The air bubbles carry ink particles to the surface where they are caught up into froth and removed.

Flotation is effective when one phase is hydrophobic and susceptible to attachment to the air bubbles, while the second phase is hydrophilic.
This work shows the influence of different printing substrates printed in offset printing technique with model inks on the efficiency of flotation, content of ashes and brightness of handsheets.

Apart from the theoretical aspect of explanation of the printing substrate influence on basic mechanisms of alkaline deinking flotation, it is interesting in the application conditions, i.e. in the production of recycled papers for the needs of printing industry.

2. EXPERIMENTAL

The prints were made on Heidelberg sheet fed offset printing machine. The same test form was used on the printing form and the surface coverage was about 45%. The model ink with following composition: pigment 16%, resin 45,5%, mineral oil 5,5% and conventional ink with composition: pigment 16%, resin 51,5% mineral oil 27,5% and vegetable oil 5% were used.

Coated paper on both sides with the layer of mineral pigment and binding medium, on which coating was applied in special process, was used for printing. Such paper had completely smooth surface on which printing ink adhered. Except that, the machine coated paper was also used, on which the surface coating was applied during production, by means of additional equipment on the papermaking machine. Uncoated papers containing wood pulp as well as those without wood pulp were used in the investigations.
Some of the prints were aged for three months and after that the deinking flotation was made.

The alkaline chemical deinking process was used for the prints recycling, as shown in figure 1:

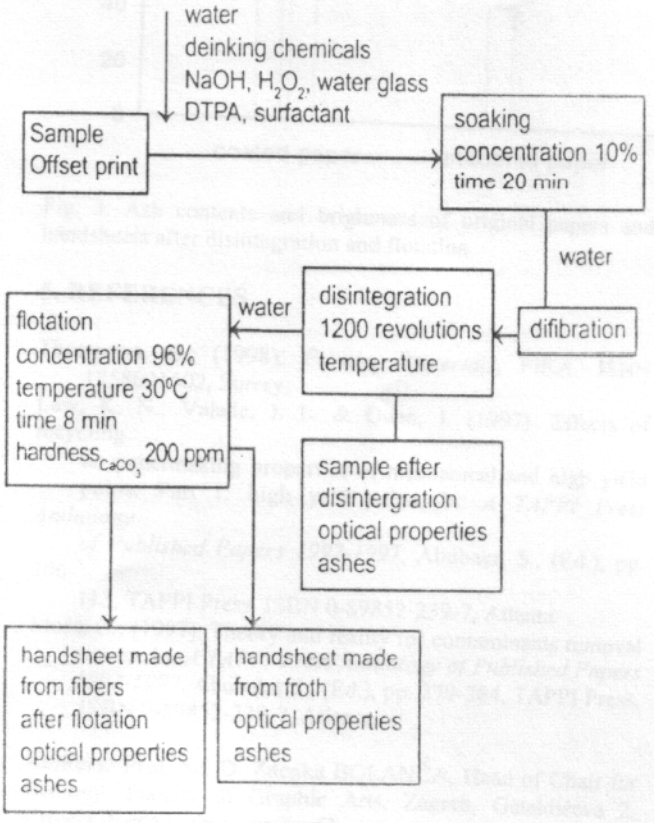

Fig. 1. Schematic presentation of the print recycling flow

Handsheets were made according to TAPPI standard method T 205. Brightness was determined by using the standard method ISO 2469.

3. RESULTS AND DISCUSSION

Figure 2 presents brightness before and after deinking flotation of prints made on different substrates and inks of different formulation. In all cases the increase of brightness was obvious after flotation of prints. The greatest brightness after flotation was obtained with prints made on coated paper and the smaller one on the machine coated paper. Smaller brightness can be seen on uncoated papers, specially on those containing wood pulp. The brightness of handsheet after flotation is influenced by the aging process but also by the ink composition, which was used in printing. In this way greater brightness of heandsheet will be obtained and after aging of three months for prints made with ink based on vegetable oil.

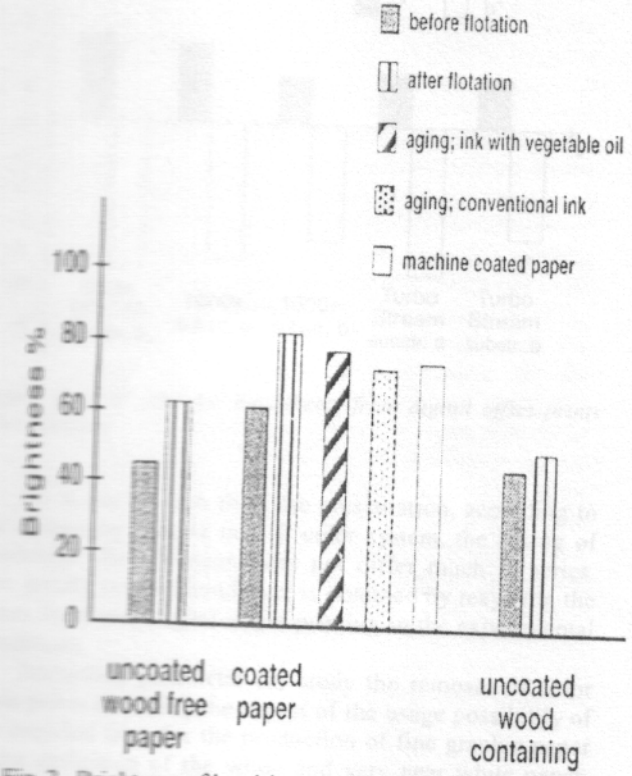

Fig. 2. Brightness of handsheet made from prints of different kind of substrates

Greater brightness of handsheet after deinking of prints made on coated paper corresponds to greater efficiency of flotation. It could be probably explained by the fact, that with uncoated papers, the absorption of the ink in the fiber network was possible, which influences flotability. Except that, the ink composition could be responsible for additional influence on the decrease of brightness, i.e. on the drying mechanism. Offset inks, which have greater mass of vegetable oil in their composition, will use partly oxidation while drying, which will cause network and better adherence of pigment onto the printing substrate, and which will decrease the efficiency of flotation. The problem will be more expressed by aging of prints as it can be seen in figure 2.

Figure 3 presents the ashes quantity of the original paper and handsheets after disintegration and flotation of coated and uncoated papers and their brightness.

The results show a certain trend of brightness increase with the increase of ashes, which can be explained by the combination of several possible mechanisms, beginning from the ashes retention, i.e. fillers in the deinked pulp, by removing the ink in the disintegration and flotation phase and by the influence of the bleaching process.

4. CONCLUSIONS

The results of the investigation show that the brightness of the recycled fibers is in the function of numerous factors, beginning from the kind and way of coating application on the substrate, as well as of chemical composition of original paper, up to the ink characteristics and print aging.

Except the contribution to the theoretical explanation of the problem, the results are interesting in application and practice and require further investigations.

The continuation of investigations should be directed towards discovering the optimal combinations of printing substrates, ink and printing technique, with the aim of more efficient recycling and more qualitative production of printing paper, as well as higher environment quality.

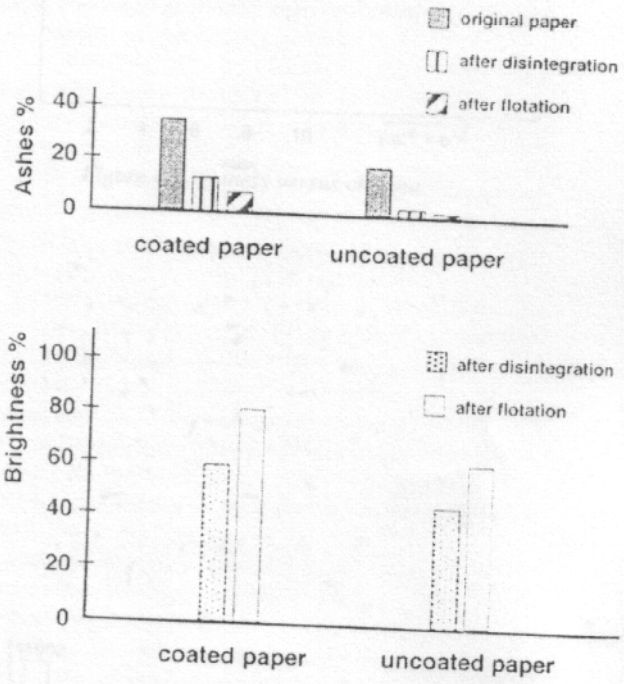

Fig. 3. Ash contents and brightness of original papers and handsheets after disintegration and flotation

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