A Study on the Disintegration of Wet-strength Paper

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ABSTRACT

Among the wet-strength papers, the melamin-formaldehyde resin strengthened fruit-shielding bag paper is known to be more difficult to recover and reuse. In general, wet-strength papers need to be treated with high temperature and strong alkali cooking before fibrillizing in a pulper. The purpose is to recover the fibers contained therein. In this study, methods of applying acid and alkaline conditions together with sodium hypochlorite, potassium hydrogen monosulfate, and sodium persulfate as repulping aid chemicals were tried in order to ascertain the necessary conditions for treating the wet-strength paper. Furthermore, literature search was conducted to find catalyst of the repulping aids for experimentation. When sodium hypochlorite, potassium hydrogen monosulfate, or sodium persulfate was singly applied, the fiber recovery all fell < 40%. In order to increase fiber recovery rate, catalysts were added in conjunction with repulping aid chemicals. The combinations included the following: sodium hypochlorite-ethanol; potassium hydrogen monosulfate-ferric sulfate; sodium persulfate-magnesium sulfate. The hope was to enhance fiber recovery rate from treating melamin-formaldehyde wet-strength paper. The results indicated that the best conditions of catalyst-assisted repulping fiber recovery rates were at a dose ratio of 5: 1 for repulping aids to catalysts; repulping aids to o.d. wet-strength pulp equaled 5%. Henceforth, the sodium hypochlorite system produced fiber recovery of 62.4% at 85°C, and pH 11. When temperature increased to 90°C, however, the yield decreased to 57.0%. This was deemed that sodium hypochlorite reacted too violently at the higher temperature causing increases to fines content. The best conditions of potassium hydrogen monosulfate system yielded 82.4% of fibers at 90°C and pH 3. At the same optimal conditions, sodium persulfate system yielded 83.3% fibers. Both persulfate repulping aids produced less fines content. In particular, sodium persulfate w/wo magnesium sulfate increased fiber yield from 36.5% to 83.3%, a gain of 46.8% and represented the best change effected by catalyst. Evaluations of factorial analysis indicated that after catalyst addition, the temperature exerted the most influence. In tests of temperature variation, after catalyst addition, repulping with potassium hydrogen monosulfate or sodium persulfate fiber yields showed marked increases between 75 and 80°C. For the former, a fiber yield gain of 29.5% was observed between the 2 temperature levels. And for the latter, the fiber yield gain was 43.6% for the temperature levels. In the sodium hypochlorite case, with catalyst addition, significant change occurred only at temperature levels between 80 and 85°C, with a gain of 23.3% in fiber yield observed for conditions of 85°Cover that of 80°C. When biotic enzymes were applied as repulping aids, with fruit beg paper, and at treatment temperature of 55°C and pH 5, the Enzyme 8111 produced 3.9%; Enzyme 8631 produced 3.3%; and Enzyme 8655 produced 3.6% of accepted fibers. When paper lunch box board was the raw material and at 2% pulp consistency and enzyme dose of 15%, Enzyme 8111, 8631, and 8666 produced respectively 28.5%, 29.6% and 28.8% more accepted fiber than those without the enzymes. When tetrapak for liquid packaging was the raw material, adding Enzyme 8111 and 8820 increased accepted fiber yield respectively 6.0% and 3.5% than those without the enzymes. In subsequent handsheet property evaluation results, the group using potassium hydrogen monosulfate as repulping aid appeared to have better paper tensile strength than those of sodium persulfate group which in turn was better than the sodium hypochlorite group. The tensile indices of the handsheets tended to decrease with increasing treatment temperature; whereas the closer to neutral pH, the better the tensile performance of the handsheets.

Keywords : wet-strength paper、pulp fibrillation、repulping aids、catalysts、fiber yields、total yields

Table of Contents

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