

INVESTIGATION AND BENEFITS OF THE USE OF ENZYMES FOR UNBLEACHED KRAFT RECYCLING WET STRENGTH PAPER AT LAB AND INDUSTRIAL SCALE

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ABSTRACT

Recycled fibres especially kraft unbleached pulp with high wet strength resin content used for packaging become increasingly important as raw material in the pulp and paper industry. Although utilization of secondary fibers has environmental and economical advantages to compare with the virgin unbleached pulp. The deterioration of the recycled fibers is mainly due to the irreversible structural changes in the fiber wall caused by drying and added chemical depending on the paper application. In addition to drying fiber morphology is also changed by other mechanical and chemical treatments. Unfortunately, the mechanical effect due to long time of recycled fibres in the pulper added to a heavy chemical treatment have a direct negative impact on the raw material and the process.

For this work, different enzymatic formulations CELODASE 022L with the main composition included cellulases, esterases, hemicellulases, laccases and lipases were investigated to improve the repulping treatment of unbleached kraft paper with wet strength resin. At lab scale, different compositions of the formulations were compared to select one of laccases (Lacc1, Lacc2 and Lacc3) and observe the impact of lipase in the formulation. The effect of the consistency in the pulper was also investigated at 6,6% and 15% to define the best condition for saving energy. Pulp disintegration was made at different times and was evaluated by the determination of fibres rejects by Somerville and by an equipment dedicated for morphology fibres analysis CELOFIBRE during enzymatic treatment and compare with a blank (no enzymes treatment). These results were more significant for Lacc2, by increasing the pulp consistency at 15% in the pulper and combining lipases with CELODASE 022L appeared to decrease the efficiency of enzymes. The results showed a high reduction of energy with the enzymatic treatment and a significant reduction of fines level in the pulper. After the validation of the enzymatic formulation at lab scale, the same formulation was used at industrial scale to compare directly with the standard conditions used in paper mill. The results showed that oxidative agent and soda were totally replaced, the steam consumption was stopped, the time of repulping was decreased from 50 minutes to 30 minutes. The consequences of the use of enzymes were observed on the refining energy power with a reduction of 10% and also with a lower fresh water consumption due to lower conductivity level. By conclusion, enzymes enable to decrease the cost of the treatment with lower energy consumption especially in case of the use of steam to facilitate the disintegration and enable to limit the impact of the chemistry regarding the environment.

Keywords: energy, enzymes, recycling, unbleached kraft paper, wet strength