Emerging technologies to improve eucalyptus fibers quality

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Abstract

At conventional papermaking process there are two major points to cause critical eucalyptus fibers damages, the conventional mechanical refining and sheet drying by heating transfer techniques. In this presentation we provide an alternative technology to refine eucalyptus fibers by ultrasonic vibrations and drying the paper sheet by microwaving radiation technique, as well. The objective is to provide less fiber damages and improving its paper quality. Besides those both technological procedures we also present an additional technique to increase sheet properties by modifying its fibers surface using dielectric-barrier discharge (DBD). All the experiments were done at laboratory level. Comparing the effects of ultrasonic refining with those of the mechanical refining, it is concluded that the ultrasonic technique provides a good development of the handsheets paper properties, besides causing less deleterious effects on the fibers such as the cutoffs and fines. Thus, under the technological viewpoint, the application of the ultrasound is viable as a refine technology by itself or by combination with conventional mechanical refining. However, this technology has a need for the availability of higher power-loaded equipments that would allow reducing the ultrasonic time of the pulp and saving energy consumption. The application of the microwave radiation as an alternative drying technology for papers. It was carried out at laboratory level in order to compare its effect on the handsheets properties with heating transfer drying technique. The microwave radiation drying allows for a better preservation of the fiber structural properties concerning to their length and width, as well as to the thickness of the cellular wall, compared to the heating transfer drying technique. It was possible due to a heating mechanism related to a specifically excitement of the water molecules promoted by the energy of the microwaves. Concerning to the physical and mechanical properties of the handsheets papers, it was shown that both drying types provided similar effects, except for the softness property that presented higher values when the microwave radiation drying was used. This behavior allows emphasizing the importance for the future studies related to the implantation of the microwave radiation system in the paper industries, mainly the tissue segment, in spite of this technology actually presenting a high cost, compared to the heating transfer drying technique still commercially used. The eucalyptus fiber modification using dielectric-barrier discharge was also carried out at laboratory level. The impact of the various levels of atmospheric dielectric-barrier discharge (DBD) treatment on the surface of eucalyptus fibers at different levels of beating with the objective of enhancing handsheets strength properties. The DBD treatment led to significantly improvements in wet-strength tensile properties, increasing by 2-112%, as function of the dosage of atmospheric plasma applied. Also, using controlled dosages of the DBD treatment, dry-strength tensile could be improved, reaching a 58% increase. In addition, no beaten handsheets sample showed greater increases in strength properties than the beaten samples. Furthermore, increases in wet ability could be observed for specific DBD dosage of treatments. Atomic force microscopy images of the treated handsheets showed that DBD treatment results in surface smoothing of the fibers. In conclusion, DBD treatment was shown to be an effective approach for eucalyptus fiber modification, especially in terms of enhancement of wet-strength properties. In those studies no cost evaluated was done.