

Oxygen Delignification Process Chemistry for Acacia (2006)

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Abstract: Oxygen delignification has been widely used for lignin removal before bleaching and has become one of the dominant post-kraft pulping delignification technologies. Oxygen delignification has become an increasingly important delignification technology for extending kraft pulping because environmental regulatory pressures have come to the fore over the past decade. A series of laboratory oxygen delignification were performed in this study at constant oxygen pressure and consistency to study the response of the pulp to the different process parameters, i.e. reaction temperature, reaction time, soda addition, and mechanical pretreatment, to the zero span tensile strength loss. A pre O₂ Acacia mangium kraft pulp was used in this study. The basic chemistry of the oxygen delignified pulps was under study including fiber charge, celluloses/hemicelluloses, and hexenuronic acid. The fiber structure such as curl, kink, fines, and fiber length were also discussed. Mechanically pretreated pulp followed by oxygen delignification was found to increase pulp dry zero span tensile strength and tensile index. Applying mechanical pretreatment for 10 seconds followed by oxygen delignification increased tensile index and dry zero span tensile strength by 6 and 14 % respectively, at conditions described in this study. Oxygen delignification selectivity was observed to decrease by increasing the soda charge. The pulp viscosity and wet zero span tensile index decreased by applying mechanical pretreatment prior to oxygen delignification.

Another series of oxygen delignification were performed to study how the process parameters including reaction time, temperature and soda charge affected to dry zero span tensile strength, tensile index and Kappa number of mechanically pretreated pulp. A Yates' algorithm was used to analyze the results. Oxygen delignification reaction temperature and soda charge were found to significantly affect to pulp dry zero span tensile strength and tensile index. On the other hand, Kappa number reduction was affected mainly by reaction temperature. These results suggested that oxygen delignification soda charge can be reduced to maintain Kappa number reduction at certain level while improving pulp zero span tensile strength and tensile index. NaOH charge can be reduced as much as 50 % by applying mechanical pretreatment to obtain the same level of selectivity at the oxygen delignification conditions described in this study.

A new Acacia mangium and mixed hardwood (MHW) kraft pulps of recent production were studied to evaluate different pretreatment methods prior to oxygen delignification on the selectivity improvement and extractive removal. Mechanical pretreatment prior to oxygen delignification promoted a better selectivity for both Acacia mangium and MHW pulps. MHW kraft pulp did not show a significant extractive removal in all pretreatment methods during oxygen delignification. This was probably due to a low extractive content of pre O₂ MHW kraft pulp to begin with. A dramatic extractive removal occurred on the Acacia mangium pulp that was pretreated with ultrasonic. The ultrasonic pretreatment followed by filtering induced the best extractive removal among the other three methods. Ultrasonic and mechanical pretreatments did not create fines formation.