ENVIRONMENTAL FOOTPRINT COMPARISON TOOL

A tool for understanding environmental decisions related to the pulp and paper industry

WOOD USE

EFFECTS OF DECREASED RELEASE OF CHLORINATED COMPOUNDS ON LAND AND WOOD USE

Effects of Pulping on Wood Requirements

Reducing the environmental impact of pulp bleaching has focused attention on reducing the lignin content (as measured by kappa number) of brownstock pulps so that less work remains to be done in the bleach plant. The basic advantage of pre-bleaching kappa number reduction technologies is that more of the lignin is dissolved, captured, and combusted in the recovery furnace and less is discharged from the bleach plant.

Kappa number reduction prior to bleaching can be achieved by extended cooking and/or the use of oxygen delignification technologies (NCASI 2003). The extent to which extended cooking can be practiced has been constrained by pulp yield and quality requirements, but has been increased by a number of modifications to kraft pulping technology (McDonough 1992). Oxygen delignification involves reacting the cooked and washed pulp with oxygen under alkaline conditions. Further lignin removals of 50% and greater can be accomplished, but are limited due to potential for loss of pulp strength.

There are numerous possible variations in the application of these technologies, either individually or in sequence. Each seeks to compensate for one or more disadvantages of the other, yield being among them. At the risk of oversimplification, oxygen delignification is more selective (i.e., toward lignin removal) than conventional bleaching which, in turn, is more selective than pulping (McCubbin 1997). The importance of selectivity to pulp yield is illustrated in Figure C13.

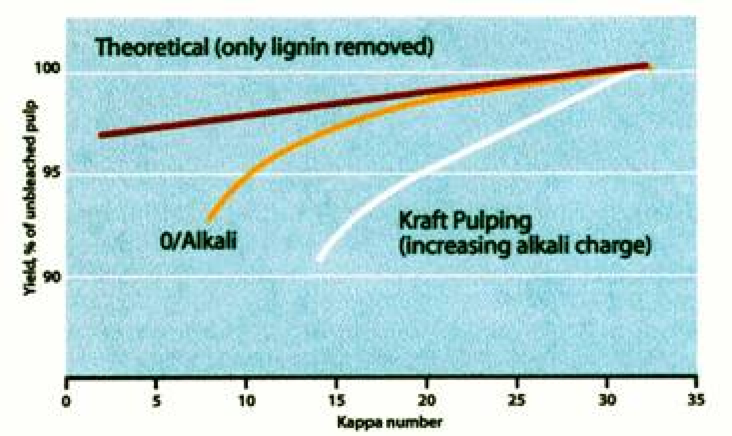

Figure C13. Yield Loss Related to Kappa Number for Different Delignification Approaches (Source: Saldivia 2002)

The diagram displays yield loss as delignification proceeds beyond the kappa associated commonly with conventional pulping. The greater selectivity of oxygen extends delignification without the loss of fiber that accompanies doing so with conventional pulping practice. Yet oxygen delignification also reaches a point where fiber loss accelerates as delignification progresses. The art lies in optimizing the deployment of pulping and other delignification approaches in ways that reduce fiber loss, preserve pulp properties and reach kappa number levels suitable for the bleaching sequence that follows.

Modified cooking procedures have been used to obtain softwood kraft pulps with low kappa numbers, and reports claim good strength retention even down to a kappa number of 10 in some cases. This low kappa number enables TCF bleaching sequences to reach high brightness levels (Fleming and Sloan 1994). However, the potential yield loss suffered in achieving such low kappa numbers compared to conventional values of 25-30 can be significant. Options for maximizing pulp yield while delignifying to low kappa number include pulping to 25-30 kappa number, followed by two-stage oxygen delignification (Axegård et al. 2003).

References

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