# Institute of Paper Science and Technology

# Technology Transfer Fact Sheet

# $D_0^R$ Bleaching Technology

## ACHIEVE BRIGHTNESS TARGETS AND MINIMIZE ENVIRONMENTAL IMPACT WITHOUT EXPENSIVE CAPITAL EQUIPMENT

It is often desirable or necessary to retrofit an existing bleach plant to achieve pulp brightness targets and/or meet environmental regulations. The high capital cost to install new bleach towers and washers has forced the industry to look for methods to achieve these goals with technologies that utilize existing equipment. The Pulping and Bleaching Unit at IPST has developed a simple modified delignification process – referred to as *Rapid $D_0$* (or $D_0^R$) – that meets these requirements with lower bleach chemical demand than the alternatives (see Figure 1).

## Project Description

$D_0^R$ is effectively a very fast $D_0$ stage for delignification of either softwood or hardwood kraft pulp. Mill trials confirmed that most of the reduction in kappa number in the $D_0^R$ stage occurs very quickly – on the order of one minute (Figure 2).

The $D_0^R$ stage requires a moderate kappa factor between 0.12 and 0.20. Process operating conditions include a moderately high temperature between 50°C and 70°C at the one-minute retention time. Equipment requirements are limited to a high-shear mixer and a small retention tube. No bleaching tower is required, making this a low capital-cost stage that can be easily installed in most bleach plants.

Figure 1. Researcher in IPST's Pulping and Bleaching Unit optimizing $D_0^R$ stage operating conditions.

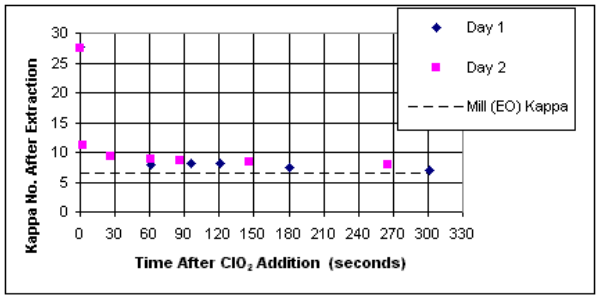


Figure 2. $D_0^R$ mill trial results. Samples collected after $D_0$ mixer. Kappa factor 0.16 on softwood.

## Applications

Adding a $D_0^R$ stage is a viable option in a variety of situations. For example, it may be attractive to convert a 3-stage $D_0(EPO)D_1$ bleach plant to a virtual $D_0^R(EPO)(D_1/E_2/D_2)$ 5-stage plant (Figure 3).

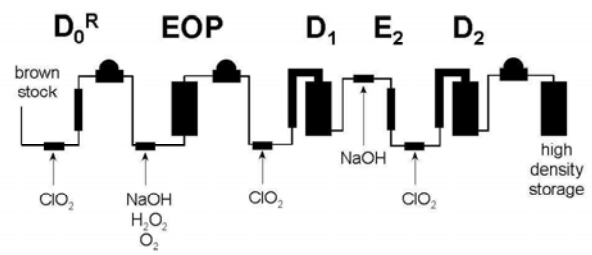


Figure 3. Flow diagram illustrating ECF production in a virtual 5-stage plant. IPST's $D_0^R$ stage leads the proposed sequence of $D_0^R(EPO)(D_1/E_2/D_2)$.

The proposed sequence begins with the $D_0^R$ stage and the existing first-stage bleach washer. The $D_0^R$ stage is followed by a conventional (EPO) stage in the complete retrofit sequence proposed. This (EPO) stage is followed by the revised sequence $(D_1/E_2/D_2)$, a form of Simplified Bleaching originally introduced in the 1970s. In this final sequence, the original $D_0$ tower becomes the $D_1$ tower. A mini-$E_2$ stage, consisting only of a mixer and small retention tube, follows the $D_1$ tower with no interstage washing. Converting the old $D_1$ stage to the $D_2$ stage completes the sequence.

## Benefits

Significant savings are achieved on capital equipment costs. Compliance with environmental regulations is accomplished by displacing the use of chlorine and hypochlorite in the bleach plant. Laboratory work indicates that the proposed $D_0^R(EPO)(D_1/E_2/D_2)$ sequence reduces the amount of $ClO_2$ required to achieve the same brightness as the standard $D_0(EPO)D_1$ sequence. Total chemical costs and AOX levels are also reduced, reversion is decreased, and a small improvement in tear is realized at a given tensile strength (e.g., see Figure 4).

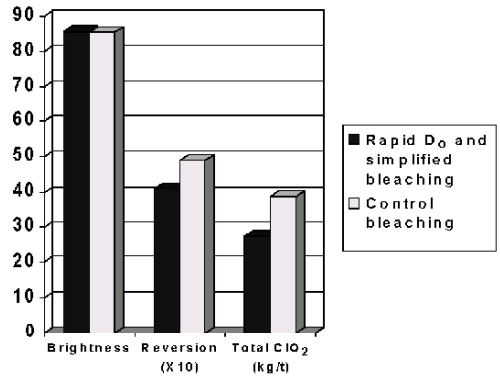


Figure 4. Laboratory results of $D_0^R(EPO)(D_1/E_2/D_2)$ versus $D_0(EPO)D_1$ bleaching of softwood. The modified sequence gives equal brightness with less reversion and much lower $ClO_2$ demand.

## Progress

$D_0^R$ technology has been applied successfully in a mill trial. A full-scale $D_0^R$ stage is scheduled for start-up in 2001 at a BSKP mill.

## For additional information, please contact:

Charles Courchene
chuck.courchene@ipst.edu

Institute of Paper Science and Technology
500 10th St., NW
Atlanta, GA 30318-5794
Phone: 404 894-5700
Fax: 404 894-IPST

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