

Short bleaching sequences: Hydrogen peroxide in the EPO oxidative extraction stage

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Addition of small quantities of hydrogen peroxide in the first oxidative extraction (EO) stage increases pulp brightness and delignification after the chlorination and extraction stages (1-5). For pulps bleached to the same final brightness, the consumption of oxidizing agents in the final bleaching stages is lower for pulps treated with an EPO oxidative extraction stage (2).

This report examines the effect of using hydrogen peroxide in the oxidative extraction stage of a short bleaching sequence. Results for pulp properties and chlorine dioxide consumption were obtained using the following three-stage bleaching sequences: (CD)(EO)D and (CD)(EPO)D.

Experimental conditions

Tests were carried out using an unbleached laboratory pulp of "de-structured" chips (*Eucalyptus* spp.). "Deconstructing" is achieved by subjecting wood chips to compression in a cylinder press. The radial compression produced by the cylinders causes tangential breaks in the wood, considerably increasing the surface area of the chips. Pulp kappa number was 19.6, and viscosity was 1255 cm³/g. The chlorination stage was performed in a glass reactor with agitation. Oxidative extraction was performed in a specially designed pressurized laboratory reactor. The final chlorine dioxide stage was performed in polyethylene bags. Laboratory conditions for the various stages of the two

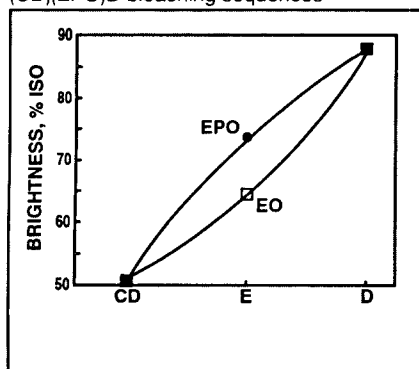
I. Laboratory bleaching conditions

	CD	EO	EPO	D
Consistency, % moisture-free pulp	3.5	10	10	10
Temperature, °C	50	65	65	75
Time, min	45	90	90	240
Cl ₂ /ClO ₂ ratio, %	75/25	...	...	...
O ₂ , kg/cm ² gauge	...	4	4	...
Cl ₂ , % on moisture-free pulp	3.6	...	...	...
NaOH, % on moisture-free pulp	...	0.7	0.7	...
H ₂ O ₂ , % on moisture-free pulp	...	...	0.4	...
ClO ₂ (as active Cl ₂), % on moisture-free pulp				
(CD)(EO)D	1.2	...	...	2.2
(CD)(EPO)D	1.2	...	...	1.4

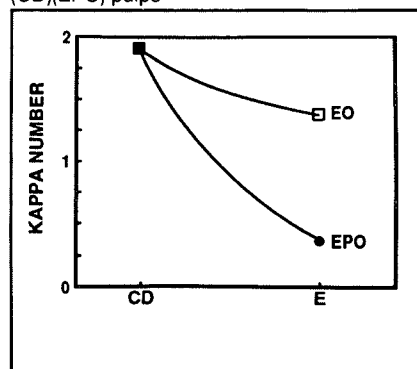
II. Comparison of results for (CD)(EO)D and (CD)(EPO)D bleaching sequences

	Kappa no.	Viscosity, cm ³ /g	ClO ₂ consumption in last stage (as active Cl ₂), % on moisture-free pulp	Brightness, % ISO
(CD)(EO)D				
CD	1.91	1070	...	50.7
EO	1.36	1030	...	64.6
D	...	1015	2.12	88.0
(CD)(EPO)D				
CD	1.91	1070	...	50.7
EPO	0.69	980	...	73.6
D	...	970	1.34	88.0

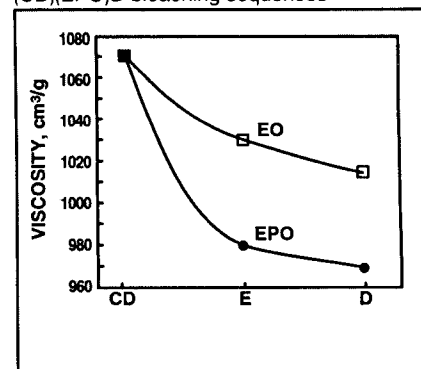
1. Pulp brightness after (CD)(EO)D and (CD)(EPO)D bleaching sequences



2. "CE" kappa number for (CD)(EO) and (CD)(EPO) pulps



3. Pulp viscosity after (CD)(EO)D and (CD)(EPO)D bleaching sequences

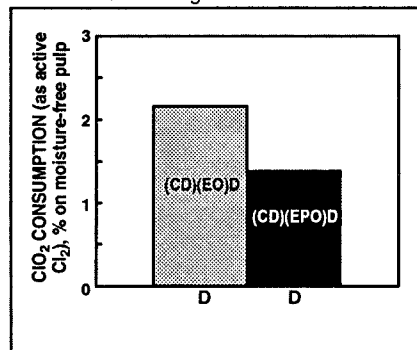


bleaching sequences are shown in Table I.

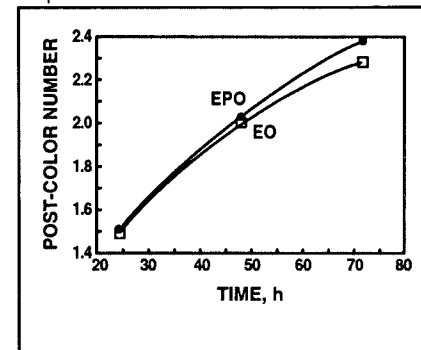
Results

Table II shows that addition of hydrogen peroxide to the oxidative extraction stage significantly reduced pulp kappa number and increased pulp brightness. Evolution of brightness is illustrated in Fig. 1. Results for kappa number are presented in Fig. 2. Pulp viscosity dropped moderately for the pulp treated with hydrogen peroxide, as seen in Fig. 3.

4. Chlorine dioxide consumption in D stage for (CD)(EO)D and (CD)(EPO)D pulps bleached to final brightness of 88% ISO



5. Brightness reversion (post-color number) after (CD)(EO)D and (CD)(EPO)D bleaching sequences



Both pulps were bleached to the same final brightness of 88% ISO. Figure 4 shows that at the same final brightness, chlorine dioxide consumption in the final bleaching stage was substantially lower for the bleaching sequence with the EPO oxidative extraction stage.

Brightness reversion (post-color number) increased slightly for the pulp bleached with an EPO stage, as seen in Fig. 5.

Conclusion

Oxidative extraction is enhanced by the addition of small amounts of hydrogen peroxide. Following the extraction stage, the pulp treated with hydrogen peroxide showed higher brightness and improved delignification. Oxidative extraction with hydrogen also reduced consumption of chlorine dioxide in the final bleaching stage. A final brightness of 88% ISO was achieved using 0.78% less chlorine dioxide (as active chlorine) in the final bleaching stage, a 37% reduction in chlorine dioxide consumption.

Addition of hydrogen peroxide to the oxidative extraction stage had no practical influence on either pulp viscosity or brightness reversion. □

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