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Evaluation of Blown Down Alaska Spruce and Hemlock Trees for Pulp

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Abstract

Chips from Alaska hemlock and spruce trees blown down more than 10 years produced usable grades of viscose pulp. Yields of pulp from both species were about 2 percent lower for blowdown material than for control trees. Ash content was slightly higher in the pulp manufactured from blowdown timber than in pulp from control trees.

Keywords: Residues, pulp manufacture, mill residues, Alaska, wood utilization, blowdown.

Introduction

Wind damage to Sitka spruce and western hemlock trees is common in the coastal forests of southeast Alaska. Approximately 27 percent of trees lost to timber production are broken or uprooted by wind (Harris 1974). Exceptionally severe storms sweep through the area about every 8 years. In the Thanksgiving day storm of 1968, for example, more than a billion board feet of commercial sawtimber was blown down by hurricane-force winds.

This study examined the quality of pulp produced from mill residues generated from blowdown spruce and hemlock logs. Pulp producers and forest managers should find this information useful in evaluating blowdown timber as a raw material.

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Methods

Log Selection

Study logs were selected from trees blown down in 1968, and during the years 1974 through 1976. Live trees were also selected for a control. All sample trees were from the Tongass National Forest. The study logs were divided into 5 categories (table 1) by species and blowdown date. Age of the blowdown was determined from local records and on-the-ground observations.

The higher percent of defect (table 1) in the older blowdown is the result of log scale deductions made for sap decay. Sap decay is caused by fungi that enter the logs through insect galleries and wood exposed by breakage. At the time of sampling, trees in the older blowdown category (1968) had lost all fine branches in crowns and were covered with 1 to 2 inches (25 to 51 mm) of forest litter. Hemlock seedlings, 2 to 3 years old, were growing from the surface of some 1968 blowdown.

Table 1--Number of logs and scale information by log category

Log category	Years since blowdown	Logs	Scaling[1] defect		Average scaling diameter	
		Number	Percent		Inches	Millimeters
Hemlock, 1968	11	49	32		12	305
Hemlock, 1974-76	3-5	153	19		14	355
Hemlock, live	--	77	10		11	280
Spruce, 1974-76	3-5	50	16		14	355
Spruce, live	--	25	4		11	280

[1]Defect based on a long-log Scribner scale taken by USDA Forest Service check scalers.

Harvesting and Processing

Blowdown trees and the control trees (77 hemlock and 25 spruce) were logged during the summer of 1979, using conventional ground-skidding equipment and following customary industry practices. The logs were stored in water, then towed to a sawmill, where they were sorted by species and blowdown date into five categories (table 1), and sawn into dimension lumber and cants. During sawing, chips produced from the slabs, edgings, and trim ends were sampled periodically. About 60 pounds (27.3 kg) of green chips for each category of blowdown and control logs were sent to the Forest Products Laboratory, in Madison, Wisconsin, to test their suitability for pulp. At the Laboratory, samples were screened and those chips measuring 1/4 inch (6.3 mm) to 1 inch (25 mm) were used for the pulping experiments.

Pulp and Bleaching

The pulping experiments were conducted in a stationary stainless steel digester of 0.8 ft^3 (0.023 m^3) capacity, using cooking liquor with an acid bisulfite magnesium base. The same cooking conditions were used in digesting all chips: liquor-to-wood ratio of 4-to-1, the total sulfur dioxide content was 8.4 percent, the digester pressurized with nitrogen gas to 80 lb/in^2 (550 kPa), and 3 1/4 hours' rise to maximum temperature of 148°C. The time at maximum temperature was varied to yield screened pulps with viscosity of 75 ± 3 cP (mPa s).

Before bleaching, the pulps were screened and cleaned in a centrifuge. Bleaching experiments were conducted with one 0.25 lb (0.11 kg) sample of cleaned viscose pulp from each category of logs. Samples were treated with chlorination, extraction, two stages of hypochlorite, and one stage of sulfur dioxide.

Alkali solubility of the purified pulps was measured at sodium hydroxide concentrations of 10 percent and 18 percent.

Results

Chips from the blowdown trees were 6 to 10 percentage points dryer than the chips from control trees. Dryness did not appear to affect the size of spruce chips. Hemlock chips of acceptable size, however, were 3 percent fewer than the spruce chips. Percent of bark and rot was not determined, but bark made up a large proportion of the material that went through the 1/4-inch (6.3 mm) screen and was rejected. Some bark pieces from both species remained with the accepted material.

The yield of unbleached pulp from both species was about 2 percent lower for the blowdown material than for material from control trees. The blowdown material required slightly longer cooking time to reach the same viscosity as the control material. This may have been caused by the difference in moisture content of the chips.

The pulp was bleached to 93-percent brightness and no difference in pulp from different age categories was observed.

The alpha-cellulose values of the pulp from control trees averaged about 1 percent higher than pulp from blowdown trees; beta-cellulose, however, was lower. There was no difference in gamma-cellulose values. The pulp from blowdown spruce had fewer alcohol benzene solubles than pulp from the control spruce; no difference was noted for hemlock.

Chemical evaluations indicate that chips from blowdown trees show promise as a source of viscose pulp (table 2). The slightly higher ash content in pulp from the older blowdown trees indicates there would be more difficulty in removing the dirt, silica, and other contaminants from the pulp of those trees than pulp from younger blowdown or control trees. The amount of pulp from older blowdown trees used in blends with pulp from trees cut live requires careful control, particularly for pulps used in bleached papers and other products in which contaminants are undesirable.

Table 2--Properties of bleached pulps from 5 categories of logs

Log category	Solubility					Ash	Disperse viscosity[1]	Brightness (Elrepho)	Drainage time (British)
	Alcohol benzene	10-percent cold NaOH, Beta	10-percent cold NaOH, Gamma	18-percent cold NaOH, Alpha	10-percent hot KOH				
	Percent						cP	Percent	Seconds
Hemlock, 1968	0.30	2.9	5.2	91.9	9.0	.32	23.7	93.2	5.1
Hemlock, 1974-76	.32	2.7	5.0	92.3	8.9	.27	25.0	92.6	4.9
Hemlock, live	.31	2.0	5.0	93.0	8.7	.29	24.6	93.5	4.6
Spruce, 1974-76	.35	3.5	5.5	90.9	9.3	.31	23.5	93.2	4.9
Spruce, live	.48	2.6	5.7	91.7	10.8	.27	24.3	93.1	4.7

[1]Two percent concentration in cupriethylenediamine.

Literature Cited

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