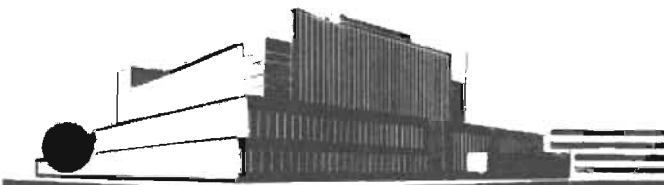
SULFATE PULPING OF ALLIGATOR JUNIPER

December 1961

No. 2219



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FOREST SERVICE
In Cooperation with the University of Wisconsin

SULFATE PULPING OF ALLIGATOR JUNIPER

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Summary

Alligator juniper sulfate pulp was low in yield and strength. It had a high bleach requirement. The pulp possibly could be used for corrugating or container boards or in combination with other softwoods for various products.

Introduction

Juniper represents a utilization opportunity in the Southwest. Before the possibilities of its use in the pulp and paper industry could be evaluated, its suitability for producing paper pulp had to be determined.

Alligator juniper (Juniperus deppeana Steud., formerly J. pachyphloea Torr.) from the Sitgreaves National Forest in Arizona was evaluated for sulfate pulping by determining (1) certain physical and chemical properties of the wood, (2) sulfate pulping characteristics over a yield range of 70 to 36 percent, and (3) properties of the sulfate pulps.

Wood Properties

Physical properties of representative samples from sections of split juniper logs showed that the wood had a rather slow rate of growth and a fairly high density of 29 pounds per cubic foot (table 1). The chemical properties indicated that juniper might be generally unfavorable for pulping. The high lignin content and large amounts of extractives predicated low pulp yields. The pentosan content was lower than that normally found in softwood pulpwoods.

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[1] Maintained at Madison, Wis., in cooperation with the University of Wisconsin.

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Pulping

The quantity of chemical required to produce a sulfate pulp from juniper was about the same as that for other softwoods. The amount of screening rejects was satisfactorily low. The wood gave low yields of fully cooked sulfate pulp--less than 40 percent (table 2). These pulps had a high lignin content, and their high permanganate numbers indicated poor bleaching qualities. The amount of chemicals required to bleach these juniper pulps to a high brightness was estimated to be about twice that of conventional bleachable pulps produced by the same cooking conditions.

Two pulps were cooked under the same conditions to yields above 50 percent to compare hot and cold fiberizing of softened chips in a disk mill. The pulp that was fiberized hot at 75° C. before washing had a little lower yield and nearly twice the folding endurance of the pulp that was cooled, washed, and fiberized cold at room temperature. A pulp made in the high-yield range of 71 percent had about one-half the strength of the fully cooked sulfate pulp (table 3).

Pulp Strength

The strength of juniper sulfate pulp was fair (table 3). It was higher than is generally obtained from hardwood sulfate pulps and below that obtainable from softwood sulfate pulps. Pulps in this intermediate strength range are usually bleached and used in white papers. The juniper pulp, however, had poor bleaching qualities. In the unbleached condition, it was too weak for use in the best grade of bag or wrapping papers. The pulp made in a yield of 71 percent was strong enough for corrugating board medium, but its soft texture indicated the board would probably not have the required crush resistance.

Juniper sulfate pulp might be used for making a certain type of board often used as an inner liner in corrugated boxes; high strength and quality are not required for this product. The greatest use of juniper pulp, however, would probably be in mixtures or blends with other softwood pulps.

Table 1.--Physical tests and chemical analysis on alligator juniper

Item	Shipment No. 3397
Physical tests:[1]	
Rate of growth.....rings per in.	25.1
Specific gravity[2].....:	0.47
Density[2].....lb. per cu. ft.	29.3
Heartwood by volume.....percent	61.0
Chemical analysis:[3]	
Lignin.....percent	34.4
Holocellulose.....percent	57.4
Alpha-cellulose.....percent	39.7
Pentosans.....percent	4.5
Solubility in:	
Alcohol-benzene.....percent	6.6
Ether.....percent	2.2
1 percent sodium hydroxide.....percent	16.1
Hot water.....percent	3.3
Ash.....percent	0.3

[1] Made from disks cut from 6 sections of split logs (average diameter approximately 11.5 inches).

[2] Moisture-free weight and green volume.

[3] Made on a sample of chips used for pulping. Percentages based on moisture-free wood.

Table 2.--Conditions and results for sulfate pulping of alligator juniper

Digestion No.	Active alkali charged[1,2]	Cooking time at 170° C.	Yield[2]			Unbleached pulp	
			Screened pulp	Screenings	Total	Permanganate number	Lignin content
	Percent	Hours	Percent	Percent	Percent		Percent
3213X	7.8	0.5	.....	.....	[3]70.6	.....	.....
3214X	11.7	1.5	.....	.....	[4]53.6	.....	.....
3215X	11.7	1.5	.....	.....	[3]55.3	.....	.....
3266X	13.7	1.5	38.5	8.3	46.8	38.3	15.9
3267X	15.6	1.5	39.0	1.4	40.4	37.0	7.9
3272X	17.6	1.5	37.9	1.0	38.9	36.8	7.2
3273X	19.5	1.5	37.0	.5	37.5	34.0	5.9
3276X	19.5	2.5	35.2	.3	35.5	28.8	4.3
3274X	21.5	1.5	35.6	.4	36.0	31.4	4.5

[1] Digestions were made in steam-jacketed, cylindrical, tumbling digesters of 0.8-cubic-foot capacity, heated indirectly with steam. Constant cooking conditions were: Liquor-to-wood ratio, 4 to 1; sulfidity based on active alkali, 25.5 percent; and time to 170° C, 1.5 hours.

[2] Moisture-free wood basis.

[3] Cooled, washed, and fiberized cold at room temperature.

[4] Fiberized hot at 75° C. before washing.

Table 3.--Strength and other physical characteristics[1] of alligator juniper sulfate pulps

Digestion No.	Beating time	Freeness (Canadian Standard)	Bursting strength	Tearing resistance	Folding endurance (MIT)	Breaking length	Sheet density
	Min.	Ml.	Pts. per lb. per rm.^{2}	G. per lb. per rm.^{2}	Double folds	Meters	G. per cc.
3213X	(3)	600	0.29	1.01	6	2,700	0.41
		450	.39	.91	14	3,400	.48
		250	.43	.74	24	4,000	.54
3214X	(3)	600	.72	1.60	290	4,900	.57
		450	.96	1.26	810	6,600	.69
		250	.98	.90	1,450	7,600	.82
3215X	(3)	600	.80	1.37	390	5,500	.60
		450	.89	1.17	580	6,300	.68
		250	.95	.95	710	7,300	.78
3266X	24	600	.96	1.60	800	6,200	.58
	47	450	1.19	1.22	1,330	7,600	.75
	74	250	1.23	.97	1,880	9,200	.87
3267X	14	600	1.03	1.96	1,070	6,300	.68
	34	450	1.16	1.45	1,660	7,800	.83
	64	250	1.24	1.23	2,250	9,200	.90

Table 3.--Strength and other physical characteristics[1] of alligator juniper sulfate pulps (Cont.)

Digestion No.	Beating time	Freeness (Canadian Standard)	Bursting strength	Tearing resistance	Folding endurance (MIT)	Breaking length	Sheet density
	Min.	Ml.	Pts. per lb. per rm.[2]	G. per lb. per rm.[2]	Double folds	Meters	G. per cc.
3272X	9	600	0.82	1.85	620	5,300	0.55
	30	450	1.14	1.53	1,540	7,500	.77
	56	250	1.18	1.18	1,720	8,500	.90
3273X	8	600	.72	1.90	670	5,200	.66
	28	450	1.08	1.45	1,270	6,900	.81
	54	250	1.14	1.07	1,620	8,500	.91
3276X	6	600	.58	1.51	250	4,200	.57
	26	450	.97	1.36	870	6,500	.79
	50	250	1.01	1.00	1,430	7,600	.93
3274X	7	600	.60	1.65	180	4,400	.65
	26	450	.97	1.42	750	6,900	.81
	54	250	1.03	1.07	1,010	7,800	.91

[1] Values are interpolated from beater test curves.

[2] Ream size of 500 sheets, 25 by 40 inches.

[3] Softened chips fiberized in a disk mill before beating.