# BASIC FIBER AND CHEMICAL PROPERTIES OF WESTERN JUNIPER

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## INTRODUCTION

Western juniper (*Juniperus occidentalis*) has either never had basic fiber dimensions and chemical compositions measured, or these findings have never been published. Nothing was uncovered in a literature search, and this type of information is basic when searching for utilization options.

Log cross sections were obtained by Larry Swan, Resource Specialist, Winema National Forest, Klamath Falls, OR, and shipped to Forest Products Laboratory for this limited investigation. Samples were identified as Bonanza, Lost River, and Running Y.

## PROCEDURES

### Fiber (tracheids) length and diameter measurements

Two samples were taken from each log cross section; one from near the center between growth rings 5 and 10, and the other from within five growth rings of the bark. These samples were separated into individual fibers by standard maceration techniques using Jeffries solution. Fiber samples were placed on microscopic slides, and fiber lengths and diameters were measured using a procedure described by Quirk (J.T. Quirk, "Semiautomated Recording of Wood Cell Dimensions", Forest Science 27(2):336-338 (1981)).

### Lignin and carbohydrate analysis

Two samples were also taken from each log cross section; one from near the center, and the other from near the bark. Each sample was Wiley milled to pass a 20-mesh screen and vacuum dried at 45 degrees C. Lignin content was determined using a procedure described by Effland (M.J. Effland, "Modified procedure to determine acid-insoluble lignin in wood and pulp", Tappi Journal 60(10):143-144 (1977)). Carbohydrate contents were determined by a procedure described by Davis (M.W. Davis, "Rapid modified method for compositional carbohydrate analysis of lignocellulosics by HPAEC/PAD", J Wood Chem & Technology, accepted for publication (1998)).

## RESULTS

Fiber length of western juniper is about the same as other junipers. It is shorter than most softwoods and longer than most hardwoods, but closer to hardwoods than softwoods (see Table). Fiber diameters are smaller than most softwoods, and about the same as hardwoods.

Lignin content is much higher than all softwoods and hardwoods. Extractive content, hemicellulose content, and cellulose content are lower than most temperate softwoods and hardwoods.

## CONCLUSIONS

Western juniper might be acceptable for hardboard, MDF, and other reconstituted panel products. The small fiber diameter and short fiber length might yield a pulp that produces a smoother paper surface, which is

important for printing and writing papers. However, the short fiber length, high lignin content, and low cellulose content appear undesirable for chemical pulping and production of high strength papers.

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Properties of Western Juniper vs. Other Common Species*

| Species | Density ($lbs/ft^3$) | Fiber/Vessel length (mm) | Fiber dia. (mm) | Alpha cellulose (%) | lignin (%) |
|---|---|---|---|---|---|
| western juniper | 31.0 | 1.60 | 0.012-0.031 | 38.6 | 35.5 |
| eastern redcedar | 32.9 | 2.15 | 0.020-0.030 | ? | ? |
| ponderosa pine | 28.0 | 3.60 | 0.035-0.060 | 45.0(1) | 25.1(1) |
| lodgepole pine | 24.0 | 3.50 | 0.035-0.055 | 47.3(2) | 25.9(2) |
| Douglas-fir (coastal) | 34.0 | 4.50 | 0.035-0.055 | 52.6(3) | 28.0(3) |
| white fir | 22.0 | 3.50 | 0.035-0.050 | 49.1(4) | 27.8(4) |
| western hemlock | 24.0 | 4.00 | 0.030-0.050 | 50.0(5) | 29.9(5) |
| red alder | 25.0 | 1.20/ 0.85 | ? | 44.0(6) | 24.1(6) |
| sugar maple | 44.0 | 0.92/ 0.41 | ? | 49.2(7) | 21.5(7) |
| Northern red oak | 44.0 | 1.32/ 0.42 | ? | 46.0(8) | 23.9(8) |

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Table created by Scott Leavengood, Oregon State University Extension Agent. Fiber length, diameter, cellulose, and lignin data for western juniper from G.C. Myers, A. Wiedenhoeft, and M.W. Davis, USDA Forest Service-Forest Products Laboratory. Density data for western juniper from Dr. Ed Burke, University of Montana.

Fiber length, diameter, cellulose, and lignin data for other species from *Essentials of Pulping and Papermaking* by C.J. Biermann, 1993, Academic Press publishers, San Diego, CA. Density data from *The Wood Handbook: Wood as and Engineering Material*, Ag Handbook #72, 1989, USDA Forest Service, Forest Products Laboratory, Madison, WI.

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* all properties reported at 12% MC
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1. 4.9", 1.9% heartwood

2. Montana, sound, 7.4", little decay

3. Oakridge, OR, second-growth, residues

4. California

5. Washington

6. Washington, 7.8"

7. Michigan

8. Michigan, 5.9"
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