Tragacanth.—Precipitate is fairly voluminous in amount and bright yellow in color. Crystal aggregates are moderately large, irregular and with many small interlacing branches. The individual crystals are small, thin and straight.

Our present tests of identity for gums are not entirely satisfactory as in many instances more reliance is placed upon physical characters than upon chemical properties. While the phenylhydrazine reaction fails to give positive results with all gums it is certain enough to be regarded as another link in the chain of confirmatory tests which might be used to establish the identity of an unknown sample.

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OIL OF SANDALWOOD AND ITS ADULTERATION.*

BY AZOR THURSTON.

"A volatile oil distilled from the wood of *Santalum album* Linne (Fam. *Santalaceae*), yielding not less than 90 percent of alcohols, calculated as santalol ($C_{15}H_{26}O$ = 222.21)." U. S. P.

The constants for sandalwood oil are as follows:

Specific gravity at 25° C.	0.965 to 0.980	U. S. P.
Refractive index at 25° C.	1.498 to 1.508	B. P.
Optical rotation in 100 mm. tube at 25° C.	—15° to —20°	U. S. P.
Santalol not less than	90%	U. S. P.
Soluble in 5 volumes 70% alcohol		U. S. P.

The so-called West India sandalwood oil, cedarwood oil, terpineol, chloroform, castor oil and cottonseed oil are used as adulterants for sandalwood oil. Castor oil and cottonseed oil will decrease the optical rotation and reduce its solubility in 70 percent alcohol; cedarwood oil will increase and West India sandalwood oil will decrease its rotation to the left. Any of these adulterants would reduce the percentage of santalol.

The writer has examined a number of samples of commercial sandalwood oil and the results of analysis are as follows:

No.	Sp. gr.	Ref. ind. at 20°C.	Optical rotation at 25°C.	Santalol.	Remarks.
1	0.9687	1.5061	....	92.28	U. S. P. Standard.
2	0.9718	1.5081	—13.3°	88.80	Sol. in 5 vol. 70% alcohol. Below standard in santalol and optical rotation.
†3	0.9757	1.5081	—13.3°	92.9	Sol. in 5 vol. 70% alcohol. Below standard in optical rotation.
†4	0.9666	1.5033	—11.87°	93.7	Insol. in 5 vol. 70% alcohol. Below standard in optical rotation.

* Read before Scientific Section, A. Ph. A., New York meeting, 1919.

† From Capsules

The following formula is used in calculating the santalol:

$$\text{Percentage of santalol} = \frac{A \times 11.11}{B - (A \times 0.021)}$$

In which A is the result obtained by subtracting the number of mils of half-normal sulphuric acid V. S. required in the titration from the number of mils of half-normal alcoholic potassium hydroxide V. S. originally taken, and B is the weight of acetylized oil taken.

No.	Sp. gr.	Ref. ind. at 20°C.	Optical rotation at 25°C.	Santalol.	Remarks.
5.....	0.9426	....	—7.15°	80.18	Below standard in santalol and polarization.
6.....	0.9594	....	—13.45°	84.48	Below standard.
7.....	0.9398	....	—13.6°	67.87	Below standard.
8.....	0.9601	....	—19.58°	70.08	Below standard.
9.....	0.9659	....	—21.0°	76.79	Deficient in santalol.
10.....	0.9725	....	—15.65°	94.07	U. S. P. Standard.
11.....	0.9438	....	—6.25°	96.77	Contained cottonseed oil.
12.....	0.9478	....	—30.17°	41.51	Probably mostly cedarwood oil.
13.....	0.9612	....	—13.44°	84.71	Below standard.
14.....	0.9712	1.5084	—12.33°	93.77	Below standard in optical rotation.
15.....	0.9564	....	—12.69°	80.67	Below standard and insoluble in 5 vol. of 70% alcohol.
16.....	0.9650	....	—17.63°	73.23	Below standard. Not sol. in 5 vol. 70% alcohol.
17.....	0.9644	....	—13.53°	88.52	Below standard. Insol. in 5 vol. 70% alcohol.
18.....	0.9635	1.5082	—16.33°	74.99	Insol. in 5 parts 70% alcohol. Below standard in santalol.
19.....	0.9630	1.4960	—15.20°	91.13	Soluble in 5 parts 70% alcohol. U. S. P. Standard.
20.....	0.9728	1.4952	—16.38°	91.17	Soluble in 5 parts 70% alcohol. U. S. P. Standard.

The fact must not be overlooked that fixed oils when added to sandalwood oil apparently increase the percentage of santalol when the United States Pharmacopoeial method of acetylation and saponification is employed and the calculation of santalol is based upon the formula given above.* This would be equally true with other volatile oils when determining higher alcohols by above method.

The writer employed this method on pure cottonseed oil and used the formula for calculation of santalol and it gave results indicating 96.93 percent santalol.

The absence of fixed oils must be ascertained before the estimation of santalol becomes of any analytical value in determining the purity of the oil under consideration.

Oil of *Santalum album* is properly sold as East India Sandalwood Oil, or simply sandalwood oil. The custom of labeling the oil of *Amyris balsamifera*, "Oil Sandalwood, W. I.," is, according to the Federal Opinion Number 29, misleading, in that confusion with true oil of sandalwood, which is official in the United States Pharmacopoeia, may easily result.

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*See Sample No. 11.

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THE REFRACTIVE INDEX AND OPTICAL ROTATION OF COMMERCIAL VOLATILE OILS.*

BY AZOR THURSTON.

Having had occasion to examine a number of essential oils, the writer has compiled the results of the determinations of the refractive indices of same. They were commercial oils, but pure, so far as could be determined by a partial examination. Care was taken to make the reading of the refractive index at exactly 20° C. It should be understood that slight variations should be expected in the refractive index of different samples of an oil.

The optical rotation of a number of the oils tabulated was determined by the author, but some were compiled from the United States Pharmacopoeia and other reliable sources and have no reference to the particular sample examined—they simply show what the optical rotation of the oil should be.

Oil.	Refractive index at 20° C.	Optical rotation in 100 mm. tube at 25° C.
Allspice (Berries)	1.4975	0° to —4°
Bay	1.4937	—3°
Bergamot	1.4710	+15.3°
Anise	1.4684	+1° to —2°
Cade	1.5037	.....
Cajuput	1.4711	—4° (does not exceed)
Camphor	1.4685	+16.5°
Caraway (Dutch Seed)	1.4884	+70° to +80°
Cassia	1.6073	+1° to —1°
Cedar Leaf	1.4677	+59° 25′
Cedarwood	1.4984	—25° to —40°
Citronella	1.4857	—5° to —21°
Cloves	1.5351	—1° 10′ (does not exceed)
Cloves (Eugenol)	1.4697	Optically inactive
Cubebs	1.4986	—20° to —40°
Erigeron	1.4903	+45° to +55.3°
Eucalyptus	1.4624	—10° to +10°
Eucalyptus (Eucalyptol)	1.4601	Optically inactive
Gingergrass	1.4933	—2° 8′
Hemlock	1.4710	—20° 54′ to —23° 55′
Lavender (Garden)	1.4731	—1° to —10°
Lavender (Technical)	1.4668	.....
Lemon	1.4779	+57° to +64°
Lemongrass	1.4913	+3° to —3°
Mace	1.4832	+10° to +20°

*Read before Scientific Section A. Ph. A., New York meeting, 1919.