



# Value-Added Oil from Eastern Redcedar

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The volatile or essential oils and their derivatives from plants are used extensively for their aromatic properties as flavorings in food, beverage products as well as fragrance in the cosmetic industry. Various plants are used as a major source of essential oils in the U.S. Eastern redcedar (*Juniperus virginiana* L.), an invasive species in Oklahoma and surrounding states is also an important source of essential oil. This fact sheet summarizes oil chemistry and its extraction method from eastern redcedar wood.

It is well known that oil from eastern redcedar has long been used in a very broad range of products due to its unique properties, including: a pesticide to repel moths from clothing, fungicide in houses on pets or their bedding to repel fleas, as disinfectants, and a clearing agent for microscope sections. The U.S. production of cedarwood oil in 1995 was reported to be 1,640 tons based on the data from Food Agricultural Organization (FAO), there is no current available data for production capacity in the U.S.

Generally mixed fine particles from various parts of the tree is the main source of material used to produce the oil. Sapwood contains very little oil up to 0.5 percent or less in contrast to heartwood. Typically heartwood of eastern redcedar trees has around 3.0 percent to 3.7 percent (w/w) oil. Based on previous studies presented in the reference list the highest oil content found in heartwood as 3.8 percent (w/w). Chemical structure of the oil is quite complex and varies depending on the part of the trees used in the extraction process. In general, thujopsene, cedrol, alpha cedrene, beta cedrene, and widdrol are the main components found in the oil. Oil from wood and needles also has different percentage of the above chemicals. Major component found in eastern redcedar oil is presented in Table 1.

**Table 1. Chemical components in eastern redcedar oil as %(w/w).**

Chemicals	Heartwood	Sapwood	Needles
Alpha-cedrene	35.0	18.1	5.1
Beta-cedrene	5.7	3.9	1.1
Thujopsene	30.0	41.8	5.4
Cuprene	2.0	-	-
Cedrol	12.0	10.4	9.6
Widdrol	2.0	-	-

(From Adams, Dunford et al, Payne et al.)

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Currently, oil is recovered by several methods for laboratory and commercial uses such as steam distillation, continuous partial pressure, solvent extraction and super critical fluid extraction.

Today the steam distillation method is the most widely used to extract redcedar oil. Primitive use of the steam distillation technique for various applications goes back to 3000 BC. Persian physician Avicenna (980 to 1337 AD) is credited improving the steam distillation method without using a cooling condenser. Steam distillation of essential oil was not practiced efficiently until discovery of cooling condenser around 11th century. The principle feature of the steam distillation is that steam vaporizes the volatile substances which are insoluble or slightly soluble in water.

A typical batch type distillation unit has two parts, the heating tank and the cooling section. Material which is not suitable for lumber production such as small logs and branches are

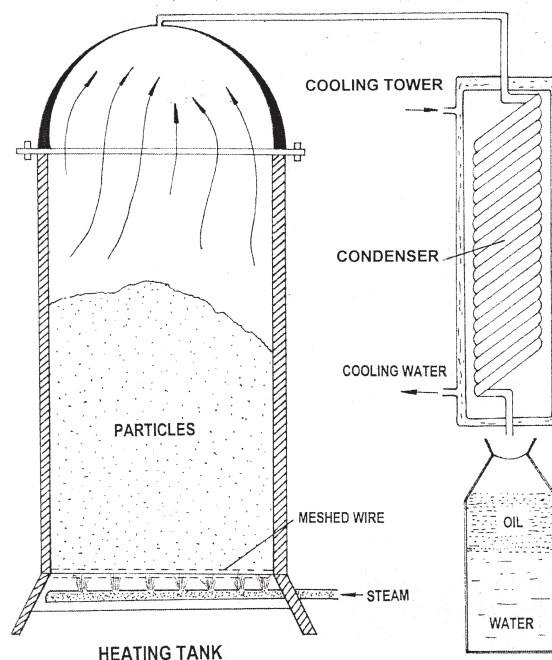


Figure 1.

fed into a chipper. The chipper could feed the material into a hammermill for further particle size reduction. Fine particles with size ranging from 0.098-inch to 0.19-inch (0.25-mm to 0.5-mm) are located in a tank equipped with a steam source. Wood is contacted with superheated steam from the boiler. The material is softened by the hot steam going through the load and oil simply diffuse from the particles and is carried out along with the steam. Finally the steam and oil goes through a cooling unit known as a condenser. The condenser is a tank with continuous circulating cold water so that the oil can be separated from the water. It is reported the oil yield from eastern redcedar wood ranges from 1 percent to 3.5 percent depending on the ratio of the heartwood to sapwood. Figure 1 illustrates a schematic of a typical distillation unit. Continuous distillation method is also used by several commercial manufacturers in the Southern states. It is claimed that the continuous method is less expensive and more productive than the batch method large capacity production.

Detailed information eastern redcedar oil and its process can also be obtained from following literature:

- Aromatic Cedar Association. [www.redcedar.org](http://www.redcedar.org)
- Adams, R.P. 1987. Investigation of Juniperus species of the United States for new sources of cedarwood oil. *Economic Botany*. 41(1)48-54.
- Dunford, N., S. Hiziroglu, and R. Holcomb. 2007. Effect of age on the distribution of oil in eastern redcedar tree segments. *Bioresource Technology*. Elsevier Science. 98(14):2636-2640.
- Payne, K.W. R. Wittwer, S. Anderson, E.J. Eisenbraun. 1999. Use of a modified abderhalden apparatus for comparing laboratory and industrial method of isolating eastern redcedar essential oil. *Forest Products Journal*. 49(7/8)90-92.

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