

Woody Notes in Perfumery: Cedarwood and Cedarwood Derivatives Part

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Cedarwood is an important perfume material in the woody odor tonality. It finds application in various types of fragrances. The oil is also used to obtain cedarwood derivatives. The term “cedar” is derived from Latin (*cedrus*), Greek (*kédros*), Old English (*ceder*) and French (*cedre*). Cedarwood trees were appreciated in antiquity. The wood was imported to Egypt for various uses. Cedarwood oil was obtained by primitive distillation in ancient India.

Origin

There are several varieties of evergreen trees of the genera *Cedrus* and *Juniperus*. Among them are:

- *Juniperus mexicanus* Schiede (fam. Cupressaceae), also known as Texas cedar. This tree grows in central and western Texas and Central America.
- *Juniperus virginiana* L. (fam. Cupressaceae), also known as red cedar. The principal growing regions are Virginia and North Carolina.
- *Juniperus atlantica* Manetti (fam. Pinaceae), also called Atlas cedar. This tree is native to the Atlas mountains of Morocco, and Algeria.
- *Cypressus funebris* Endl. This tree is found in China, and is thus called Chinese cedar.
- *Cedrus deodara* (Roxb.) Loud (fam. Pinaceae), which is native to the Himalayan Mountain region.

Mode of Production, Yield, Oil Type

Various types of cedarwood oils are used in perfumery. These include: Cedarwood Texas (ex. *Juniperus mexicana*); Cedarwood Virginia (ex. *Juniperus virginiana* L.); Cedarwood Atlas (ex. *Cedrus atlantica* Manetti); Cedarwood Chinese (ex. *Cypressus funebris*, Endl.); and Cedarwood Himalayan (ex. *Cedrus deodara*), which has been recently advertised in trade literature. Steam distillation is used to produce the above cedarwood oils. Cedarwood Texas oil is produced from heartwood and wood shavings. The rectified (redistilled oil) is almost colorless and of a lasting balsamic woody odor.

The yield of the crude oil is 1.8 percent to 2.3 percent, while that of the rectified oil is 15 percent to 20 percent less.¹ Cedarwood Virginia oil is produced from the timber

waste, sawdust and shavings. The yield ranges from 2 percent to 2.5 percent.² The oil is available in regular or distilled. The color of the regular oil is yellow to orange, while the redistilled oil is almost colorless.

Cedarwood Atlas oil is produced in Morocco. It is of a light-brown color and has a lasting balsamic, woody odor. It is also available as an absolute. The yield of the regular oil is 3 percent to 5 percent.³ Chinese cedarwood oil is a more recent oil. Cedarwood oil Himalayan from India is new to the industry.

Chemical Composition

According to Guenther, it was known in the late 1950s that Virginia cedarwood oil contains about 80 percent cedrene, 3 percent to 14 percent of cedrol and a small amount of cedrenol. The cedrol occurs in crystalline and liquid form, identical chemically.⁴ Cedrene was first isolated by Walter in 1841. In the same year, Walter observed cedrol in cedarwood oil. In the beginning of the 20th century, Semmler and Mayer first noted the sesquiterpene alcohol cedrenol. In the 1940s, Naves et al. reported that cedrene consists of several isomers, the chief components of which are α - and β -cedrene. Despite the work of terpene-chemistry researchers Semmler, Treibs, Ruzicka, Plattner and their collaborators, the structural formulas of cedrene, cedrol and cedrenol could not be definitely established, notes Guenther in the 1950s.⁵

The chemical composition of Atlas cedarwood was first investigated in the beginning of this century by Grimal, who identified d-cadinene, and also noted p-methyl-3-tetrahydroacetophenone in the oil, which was identified by Pfau and Plattner in the 1930s. This ketone is not present in the wood, but originates on steam distillation of the wood. The chief constituents found by the same researchers were α - and γ -atlantone.⁶ In 1953, Stork and Breslow first synthesized dl-cedrol and dl-cedrene, and in 1955 achieved the total synthesis of cedrol and cedrene. Technological advances permitted Runeberg to report in 1960 the achievement of analysis of cedarwood Virginia oil by using gas and column chromatography, which showed that the sesquiterpene fraction was mainly a mixture of α -cedrene and thujopsene, the latter reported in cedarwood

for the first time. Several minor constituents, not previously separated, were also found. They were cuparene, widdrol and curcumene.⁷

In 1967, Wenninger and collaborators reported finding in cedarwood oil Virginia β -elemene, α - and β -humulene, caryophyllene, an "accorene," valencene, two cuprenenes, and cuparene, in addition to previously reported constituents.⁸ In 1971, Kitchens, Dorsky and Kaiser reported the results of their study of Virginia and Texas cedarwood oil

composition.⁹ The main components were: α -cedrene, β -cedrene, thujopsene, cedrol and widdrol. They occur in both oils, but in different percentages: the amount of β -cedrene and cedrol is higher in the Virginia oil, and thujopsene is higher in the Texas oil. Among minor sesquiterpene components of cedarwood oil Texas, the following were reported: β -chamigrene, widdrene, isowiddrene, α -chamigrene, widdrene isomer, cuparenene 2, cuparenene 4 and cuparene.

In 1980, Lawrence isolated and identified several components of Virginia and Texas cedarwood oils using infrared spectroscopy.¹⁰ The results can be seen in Table 1 prepared by the author of this article.

Thus, Lawrence confirmed that the percentage of cedrol was higher in the Virginia oil, while that of thujopsene was significantly higher in the Texas oil. He also found that the amounts of caryophyllene and γ -eudesmol were almost double in the Virginia oil.

In 1985, Baslas and Saxena reported the following components of cedarwood, besides α -cedrene (79.5 percent), cedrol (12 percent) and cedrenol (0.95 percent): α -pinene (0.60 percent); limonene (0.25 percent); β -pinene epoxide (0.35 percent); limonene epoxide (0.10 percent); β -thujone (0.25 percent); methoxy acetophenone (0.20 percent); p-anisaldehyde (0.32 percent); menthol (0.10 percent); neoiso menthol (0.15 percent); α -terpineol (0.25 percent); thymol (0.55 percent); carvacrol (0.34 percent); eugenol (0.26 percent); ethyl vanillin (0.15 percent); bisabolene epoxide I (0.15 percent); bisabolene epoxide II (0.35 percent); methyl naphthyl ketone (0.30 percent); and pseudocedrol (10.90 percent).¹¹

The analysis was performed using TLC, and the authors stated that the constituents were confirmed by CO-TLC, refractive index and spectroscopy. Lawrence believes that the description of the above analysis is "an inaccurate and misleading publication." From the perfumer's point of view, it would be interesting to compound such a cedarwood oil and see the olfactory effect of such unusual minor components.

In 1986, Srinivas confirmed the presence of four components of cedarwood oil.¹² They were:

α -cedrene (25.15-25.20)>25 percent

β -cedrene (6.07-6.36)>6 percent

cedrol (19.70-23.97)~20-24 percent

thujopsene (20.10-26.97)~20-27 percent

In 1988, R. ter Heide et al. reported that a cedrol and hydrocarbon-free fraction of Virginia cedarwood oil, rich in oxygenated compounds, contains the following constituents: 8-cedren-2-ol; caryolan-1-ol; a sesquiterpene alcohol; betulenal; funebrenal; thujopsenol; chamigrenal; cedran-9-one; 8-cedren-3-one; 8-cedrene-10-one; nootkatone; 2-methyl-6 (4'-methylphenyl)-heptan-2-ol-3-one; and a sesquiterpene ketone.¹³

Results of the analysis of the chemical composition of cedarwood oil Texas, Virginia and Chinese, done by Adams, were reported in 1991.¹⁴ The main difference was in the cedrol, widdrol and thujopsene percentages. Virginia and Texas oils had comparable amounts of cedrol, while the Chinese oil had a much lower percentage. However, the Chinese oil had a larger amount of widdrol, which was about equal in both the Virginia and Texas oils. Thujopsene was higher in the Chinese oil.

In 1997, Shu and Lawrence compared major and minor ones of four different cedarwood oil types.¹⁵ The results

Table 1. Comparative component percentage of Virginia and Texas cedarwood oils

| Component | Virginia cedarwood (percent) | Texas cedarwood (percent) |
|--------------------|---------------------------------|------------------------------|
| α -pinene | 0.3-0.5 | 0.2-0.3 |
| α -cedrene | 18.2-30.9 | 23.7-24.5 |
| caryophyllene | 2.5-2.8 | 0.5-0.6 |
| β -cedrene | 4.6-8.9 | 5.5-5.8 |
| thujopsene | 14.6-15.6 | 30.3-34.7 |
| cedrol | 21.6-30.6 | 14.5-17.6 |
| γ -eudesmol | 4.1-6.3 | 2.3-2.6 |

showed that the Virginia and Chinese oils had about the same amount of α -cedrene. Both Virginia and Texas oils had similar percentages of cedrol, which was the lowest in the Chinese oil, followed by the Atlanta cedarwood (ex *Chamaecyparissus thyoides* L.). The Texas oil had the largest amount of thujopsene, followed by the Chinese and Atlanta oils. The Virginia oil had the least amount.

The Virginia oil was found to contain the highest percentage of widdrol, followed by the Atlanta oil, Texas oil and Chinese oil.

In 1997, an analysis of six selected components of Virginia cedarwood oil: α -pinene, α -cedrene, β -cedrene, thujopsene, cedrol and widdrol was done by Coleman and Lawrence.¹⁶ GC-based methods were used, which included different headspace methods. A table of the comparative results was shown and an interpretation given.

Cedarwood Derivatives and Isolates

Various cedarwood derivatives are obtained from cedarwood oil. They can be further treated by esterification, epoxidation or acetylation. Some of these possess woody cedar notes with musk or amber tones. In others, the ambergris note is dominating. Some of them have cedar-vetiver or cedar-sandalwood odor tonalities. Most of these derivatives are used per se in various types of fragrances, but some are incorporated in perfume specialties.

Let us look at several examples:

- Cedrol distilled is obtained from cedarwood oil by vacuum distillation. It is a mixture of alcohols and ketones, available in several grades, depending on the percentage of the alcohols. The higher grade is of a pale yellow color and typically contains 65 percent to 70 percent cedrol.
- Cedrol crystals are obtained by the vacuum distillation and crystallization of the cedrol cuts. It is 90 percent cedrol, minimum, and has a balsamic, sweet cedar and sandalwood odor.
- Cedryl acetate is obtained by esterification of the crude cedarwood oil or the cedrol distilled. Several grades are manufactured, depending on the percentages of acetates and hydrocarbons. It is a pale-yellow to yellow liquid or semi-solid.
- Cedryl acetate crystals are obtained by the crystallization of cuts from the vacuum distillation of cedryl

acetate. The white crystals have a woody, powdery odor.

- Cedryl methyl ether is of a diffusive ambergris, woody odor tonality. It can be identified as a colorless to pale-yellow liquid.
- Cedrenol is richer in liquid cedrols and ketones than cedrol distilled. A colorless to pale-yellow liquid of a tenacious, dry, sweet, woody cedar odor.
- Cedrenyl acetate is obtained by esterification of cedrenol. It is a colorless to pale-yellow liquid of a long-lasting woody, cedar and vetiver odor tonality.
- Cedrenyl acetate crystals are a purer grade of cedrenyl acetate. It is a white crystalline solid and has a more refined woody, cedar, vetiver dry odor than the liquid form.
- Cedrenyl formate is a colorless to pale-yellow liquid of a dry woody, amber odor.
- α -Cedrene epoxide is obtained by epoxidation of α -cedrene. It has a woody cedar, sandalwood, patchouli and ambergris odor tonality, and is a colorless to pale-yellow liquid.
- Acetyl cedrene is a mixture of ketones derived from the acetylation of cedarwood hydrocarbons. It is available in several grades. A colorless to pale-yellow liquid of a diffusive woody cedar odor of great tenacity with a hint of amber and musk.
- Methyl cedrenyl ketone has a woody, vetiver, musk and leather odor.

There are also different types of aroma chemicals possessing woody odors with powdery, amber, musk or spicy overtones. Some of these are available as specialties. Here are a few examples.

Compounds Synthesized from the Terpene Isolongifolene¹⁷

- The formate fraction comprised of a mixture of aldehydes which have a cedarwood, vetiver odor of great tenacity with amber and clary sage dry-out.
- The acetate esters have a strong cedar, vetiver odor.
- The saponified mixture of formates and acetates gave corresponding alcohols. The distilled product in each case have an odor reminiscent of cedrol.

Trimethylcyclodecatriene possesses a tenacious woody, cedar and powdery note.

Cyclododecyl methyl ether has a cedarwood and musk odor tonality.

Methyl (methyl ethyl) bicyclo octenyl ethanone (three main isomers) possesses a woody, cedar odor with hints of balsam and amber.

Isolongifolene epoxide is a colorless to pale liquid of a woody, spicy odor with a hint of amber.

Application

The wood itself was used in ancient times for various purposes, such as painted statuettes, mummy portraits and coffins.

Today, cedarwood lining is used in chest and cedarwood blocks in closets, because the odor of the material is known to repel moths and mildew.

Cedarwood oil and/or its derivatives find application in various types of women's and men's fragrances, as well as in cosmetics, soap and household perfume. We shall discuss this subject in the second part of this article, which is forthcoming.

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Cedarwood and Derivatives in Perfume Compounds, Part II

by Danute Pajaujis Anonis

In the previous article on cedarwood (Perfumer & Flavorist magazine, May/June 2001), we discussed different cedarwood oil types and various cedarwood derivatives. In this article, we will look at the use of cedarwood and its derivatives, as well as specialties in various types of fragrances.

Cedarwood has a tenacious, balsamic, sweet, woody odor. It enhances the lasting power of natural and synthetic fixatives and also intensifies their odor. The oil improves upon aging when kept in airtight containers protected from light. Cedarwood has points in common with the odors of oakmoss and fougère and, to a lesser extent, with tea rose and citrus fruit and leaf odors.

Cedarwood oil is used in various types of women and men's fragrances, including eau de parfum and toilet water. It also finds application in cosmetic fragrances (lipstick, cream, powder, and so forth) and in soap fragrances, as well as in various household product perfumes.

Powdered cedarwood was a component of a pine type of incense powder produced in the United States, along with other odor types. These incense powders were in vogue up until the mid-1930s.¹ Cedarwood perfume compounds, per se, have not been developed, except for tobacco aromatization and mosquito repelling compositions, nor have cedarwood imitations been built. However, cedarwood plays a role in sandalwood, patchouli and vetiver imitations.

Here are a few examples of earlier formulas:

Sandalwood Synthetic

| | |
|----------------|------------|
| Santalol | 400 |
| Balsam copaiba | 300 |
| Cedarwood | <u>300</u> |
| | 1,000 |

Vetiver Synthetic

| | |
|----------------|------------|
| Vetiver | 450 |
| Cedarwood | 350 |
| Balsam copaiba | <u>200</u> |
| | 1,000 |

In the past, cedarwood and/or its derivatives were also used in various specialties, including Cedrenon (obtained from cedarwood Florida, with a pleasant non-intrusive yet

long-lasting woody odor), and Cedarome (containing cedrenol, of a woody, powdery character). Let us now take a look at few conventional fragrance types containing cedarwood or its derivatives.

Chypre I²

| | |
|---------------------|-----------|
| Oakmoss resinoid | 50 |
| Bergamot | 225 |
| Vetiver bourbon | 75 |
| Lavender | 50 |
| Cedarwood | 70 |
| Patchouli | 10 |
| Clove | 35 |
| Jasmine synthetic | 100 |
| Rose synthetic | 80 |
| Isobutyl salicylate | 70 |
| Cinnamic alcohol | 50 |
| Heliotropin | 100 |
| Coumarin | 50 |
| Resinoid tonka | 20 |
| Aldehyde C-12 (MNA) | <u>15</u> |
| | 1,000 |

Perfume Oil No. 298³ [Dans la Nuit (Worth) Type]

| | |
|---------------------|-----------|
| Methyl ionone | 350 |
| Vetiver | 50 |
| Cedarwood | 60 |
| Orange bitter | 100 |
| Neroli synthetic | 40 |
| Tonka liquid | 35 |
| Heliotropin | 70 |
| Rose synthetic | 65 |
| Jasmine synthetic | 60 |
| Carnation synthetic | 60 |
| Isobutyl salicylate | 40 |
| Musk ketone | <u>30</u> |
| | 1,000 |

Woody Bouquet No. 7

| | |
|-----------------------------|-----|
| Methyl ionone | 100 |
| Lily of the valley compound | 80 |
| Cedrenyl acetate | 60 |
| Sandalwood E.I. | 50 |
| Cedrenol | 40 |
| Jasmine synthetic | 40 |

| | |
|----------------------------------|-----------|
| Isopropyl hydrotropic | |
| aldehyde 10% | 30 |
| Musk ketone | 30 |
| Rose synthetic | 20 |
| Patchouli | 20 |
| Dimethyl benzyl carbinyl acetate | 20 |
| Ylang ylang | 16 |
| Vetiver bourbon | 16 |
| Fleurs d'orange synthetic | 10 |
| Aldehyde C-11 (enic) 10% | 10 |
| Aldehyde C-12 (MNA) 10% | 6 |
| Cedarleaf 10% | 6 |
| Sage clary | 6 |
| Macrocyclic type musk | 60 |
| Amber synthetic | 50 |
| Oakmoss decolorized | <u>30</u> |
| | 700 |

Before World War II, perfumes without alcohol were innovated in Germany, among them sandalwood perfume types. The solvents used were diethyl phthalate, castor oil, etc. An example of such sandalwood type containing cedarwood is:

Sandalwood Perfume Compound⁴

| | |
|----------------------|---------------------|
| Sandalwood | 850 cm ³ |
| Cedarwood | 50 cm ³ |
| Phenyl ethyl alcohol | 50 cm ³ |
| Rose red synthetic | 35 cm ³ |
| Musk ketone | 10 g |
| Aldehyde C-16 | 5 g |

Men's fragrances traditionally contain woody components, among them cedarwood or its derivatives. Few examples of conventional woody types are:

Bois d'Inde 8⁵

| | |
|-----------------|-----------|
| Sandalwood E.I. | 115 |
| Cedrol crystals | 75 |
| Methyl ionone | 75 |
| Cypress oil | 38 |
| Ylang ylang | 25 |
| Geranium | 25 |
| Patchouli | 15 |
| Vetiver | 75 |
| Rose synthetic | 300 |
| Geranyl acetate | 25 |
| Amber synthetic | 30 |
| Ethyl vanillin | 12 |
| Coumarin | 25 |
| Musk ambrette | 30 |
| Musk xylol | <u>25</u> |
| | 890 |

Pagodes⁶

| | |
|----------------|-----|
| Sandalwood | 150 |
| Methyl ionone | 100 |
| Cedrol | 35 |
| Cedryl acetate | 35 |
| Bergamot | 170 |

| | |
|-------------------|-----------|
| Civet absolute | 30 |
| Caraway | 20 |
| Bois de rose | 75 |
| Rose oil | 5 |
| Lavender | 50 |
| Coumarin | 95 |
| Vanillin | 5 |
| Opoponax resinoid | <u>75</u> |
| | 865 |

Here is a base, which could be used in a men's fragrance:

Woody Base No. 8

| | |
|----------------------|-----------|
| Cedrenol | 300 |
| Cedrenyl acetate | 250 |
| Cedarwood | 150 |
| Methyl ionone | 100 |
| Phenyl ethyl alcohol | 50 |
| Linalool | <u>50</u> |
| | 900 |

An example of a men's woody fragrance type:

Vetiver Bouquet No. 9

| | |
|--------------------|-----------|
| Vetiver bourbon | 400 |
| Cedryl acetate | 150 |
| Amber synthetic | 120 |
| Methyl ionone | 120 |
| Patchouli | 80 |
| Cedarwood | 30 |
| Geraniol | 20 |
| Musk ketone | 20 |
| Mouse de chêne 50% | <u>20</u> |
| | 960 |

Spicy odor types were also part of men's fragrances. Here is an example:

Spice Bouquet No. 10

| | |
|----------------------|-----------|
| Amyl salicylate | 100 |
| Benzyl salicylate | 65 |
| Eugenol | 75 |
| Geraniol | 65 |
| Methyl eugenol | 50 |
| Coumarin | 50 |
| Heliotropin | 50 |
| Ethyl vanillin | 50 |
| Labdanum absolute | 50 |
| Bergamot | 40 |
| Cedarwood | 35 |
| Terpinyl acetate | 35 |
| Phenyl ethyl alcohol | 25 |
| Guaiacwood | 25 |
| Tolu resinoid | 25 |
| Lilial | 20 |
| Cedrenol | 15 |
| Methyl ionone | 15 |
| Musk ketone | <u>20</u> |
| | 810 |

Tobacco-type perfumes are among the other types of men's fragrances. The following cedarwood-containing formula serves as an example:

Havana Perfume No. 16

| | |
|----------------------|-----------|
| Sandalwood E.I. | 170 |
| Chypre type compound | 115 |
| Vetiver | 100 |
| Cedarwood | 50 |
| Phenyl ethyl alcohol | 35 |
| Isoeugenol | 30 |
| Lemongrass oil | <u>30</u> |
| | 530 |

Cedarwood is also a component of perfumes for hair oil, as illustrated by this formula:

Violet⁷

| | |
|-------------------|--------------------|
| α -Ionone | 60 cm ³ |
| Linalyl acetate | 35 cm ³ |
| Ylang ylang | 15 cm ³ |
| Benzyl acetate | 5 cm ³ |
| Cedarwood | 10 cm ³ |
| Bitter almond oil | 15 drops |

Generally, 0.5 to 1.5 percent of the perfume oil is used.

Cedarwood is the main component of perfume compounds used for the aromatization of tobacco products. Two examples of such compounds are:

Manille II⁸

| | |
|------------|------------|
| Cedarwood | 500 |
| Geranium | 250 |
| Patchouli | 50 |
| Sandalwood | <u>200</u> |
| | 1,000 |

Fleur de Sumatra⁹

| | |
|-------------------|------------|
| Cedarwood | 500 |
| Lavender | 50 |
| Cloves | 50 |
| Calamus | 30 |
| Methyl isoeugenol | 25 |
| Coumarin | 200 |
| Eugenol | 50 |
| Labdanum resinoid | 90 |
| Aldehyde C-16 | 10 |
| Amber fixative | <u>235</u> |
| | 1,245 |

Another type of a perfume compound containing cedarwood and citronella is used in mosquito repellent preparations.

Dermatological Considerations

Some components of the given illustrative formulas, which were developed before the advent of dermatological safety considerations of perfume materials, are restricted, and have to adhere to specifications or are prohibited, according to IFRA's recommendations. Among these materials are:

Bergamot: Limited to 2 percent in a fragrance compound at 20 percent concentration in a consumer product used on the skin exposed to sun. For terpeneless bergamot or one with partially removed terpene fraction, this limit is reduced proportionally.

Cassia: Limited to 1 percent in a fragrance compound.

Cinnamic alcohol: Limited to 4 percent in a fragrance compound used at 20 percent in a consumer product.

Hydroxycitronellal: Limited to 5 percent in a fragrance compound.

Isoeugenol: Limited to 1 percent in a fragrance compound used at 20 percent in a consumer product.

Musk ambrette: Should not be used as a fragrance component.

Oakmoss: Limited to 3 percent in a fragrance compound used at 20 percent concentration in the consumer product.

Opoponax: Only opoponax preparations obtained by steam distillation or solvent extraction may be used in fragrance products. Usage is limited to 3 percent in a fragrance compound used at 20 percent concentration in a consumer product.

Application

Besides contributing lastingness and persistence, cedarwood is known to have a rounding effect on chypre, fougère, origan, musk, rose, violet and other fragrance types. We have illustrated in previous pages the use of cedarwood and/or its derivatives in various earlier fragrance types. Most modern women's fragrances, especially those of semi-oriental type of odor, contain smaller or larger amounts of woody notes. Among them are cedarwood and its derivatives. Cedryl methyl ether, used in Opium (YSL), is but one example.

Newer women's fragrances comprising cedarwood are Lalique de Lalique, Hanae Mori, Inspiration (Jourdan), Paradox (Jacomio) and Wild Wind (Gabriela Sabatini), to cite just a few. Of the later women's fragrances, Grain de Folie (Gres), April Field and Baby Doll (YSL) may be mentioned. In conventional men's fragrances, cedarwood has been used in Cuir de Russie, various redwood and woody-earthly bouquets, spicy, and tobacco compositions.

As men's fragrances became more sophisticated, cedarwood remained part of them. In addition, various cedarwood derivatives—including α -cedrene epoxide (of woody, patchouli, ambergris, tobacco and sandalwood odor tonalities) and cedrenyl formate (of woody, vetiver, and amber odor tonalities)—became available. Several more recent men's fragrances containing cedarwood include Halston Z (Halston), L'Homme (Bond), Rocabar (Hermès), Paco

Energy (Paco Rabanne), ST Dupont pour Homme, Santos (Cartier), He (Armani), Rochas Man (Rochas), Viking (Royal Copenhagen) and Aqua Nautilus (Mavive).

Cedarwood and/or its derivatives are suitable in lipstick, hair oil and powder perfumes, as previously shown by example. The use of cedarwood and its derivatives in soap perfumes will be the subject of our next article. Woody notes are of importance in perfumery. Therefore, cedarwood and its derivatives are likely to remain valuable components of future fragrances.

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Woody Notes in Perfumery Part III: Cedarwood and Derivatives in Soap Fragrances

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In part I of this cedarwood series (Perfumer & Flavorist, May/June 2001), we discussed various cedarwood oil types and derivatives. In part II of this cedarwood series (Perfumer & Flavorist, July/August 2002), we discussed the application of cedarwood and its derivatives in various types of fragrances. We have also given examples of the use of cedarwood in imitations of several essential oils, and of the use of cedarwood derivatives in some specialties.

This article will address soap fragrances, of which cedarwood and its derivative are a part. Cedarwood is a good fixative; it has a rounding effect on the odor of other perfume components and does not discolor in soap.

Introduction

Soap perfumes of the past could be classified in the following categories:

Single flower types: This category includes carnation, chrysanthemum, lilac, muguet, gardenia, magnolia, rose, sweet pea, violet, and so forth.

Established soap fragrance types: This category includes almond, cucumber, lavender, lily-milk, palmolive, pine, reuter, sandalwood and Windsor, among others.

Fantasy bouquets: This category includes fougere, cashmere, chypre, cuir de Russie, foin coupe, peau d'Espagne, musk and tabac.

A number of these classifications still apply today. Among these are cashmere bouquet, cucumber, lavender, palmolive, musk, rose, sandalwood and violet. Several have been updated. An example is palmolive, which contains a sandalwood-like new aroma chemical: 3,3-dimethyl-5-(2,2,3-trimethyl-3-cyclopenten-1-yl)-4-penten-2-ol (Polysantol, Firmenich).

T-1 lists some perfume materials considered as modifiers of cedarwood.

Classic Applications

Now, let us take a look at some traditional illustrative soap formulas containing cedarwood:

Cashmere Bouquet Type No. 1

| | |
|------------------|-----|
| cedarwood | 250 |
| bergamot | 125 |
| patchouli | 100 |
| geraniol | 90 |
| cassia | 35 |
| methyl cinnamate | 25 |
| benzoin resinoid | 20 |
| vetiver | 5 |
| | 650 |

Chrysanthemum No. 592¹

| | |
|--------------------|-------|
| terpineol | 135 |
| cananga | 200 |
| hydroxal S H&C | 200 |
| clove oil | 70 |
| geranium | 90 |
| spike lavender | 60 |
| bergamot synthetic | 75 |
| cedarwood Florida | 40 |
| sassafras | 30 |
| cinnamon Ceylon | 10 |
| musk ketone | 10 |
| Peru synthetic | 80 |
| | 1,000 |

Chypre No. 7

| | |
|------------------|-----|
| cedarwood | 180 |
| amyl salicylate | 110 |
| ionone | 45 |
| terpinyl acetate | 45 |
| terpineol | 40 |
| benzyl acetate | 30 |
| spike lavender | 25 |
| citronella Java | 25 |
| coumarin | 20 |
| oakmoss resinoid | 15 |
| patchouli | 10 |
| vetiver bourbon | 5 |
| | 550 |

Some materials considered as modifiers of cedarwood

T-1

| For Lift and Freshness | For a Floral Note | For a Spicy Effect | For Sweetness | Fixatives |
|------------------------|--------------------------|----------------------|---------------|---|
| bergamot | aurantiol | cassia | coumarin | amber synthetic |
| lavender | jasmine synthetic | clove oil | heliotropin | musk synthetic (various types) |
| linalool | lily of the valley | cinnamic alcohol | vanillin | benzophenone |
| rosemary | geranium | eugenol methyl ether | tolu balsam | dimethylhydroquinone |
| sage clary | neroli synthetic | | | amyl salicylate |
| cedarleaf | rose synthetic | | | isobutyl salicylate |
| thyme | styrallyl acetate | | | patchouli |
| aldehyde C-11 (enic) | ylang ylang, or cananaga | | | |
| aldehyde C-12 (MNA) | | | | resinoids: elemi galbanum labdanum myrrh oakmoss olibanum |

Foin Coupe No. 593²

| | |
|--------------------|--------------|
| coumarin | 400 |
| terpineol | 200 |
| spike lavender | 80 |
| bergamot synthetic | 120 |
| cedarwood Florida | 150 |
| myrrh resinoid | 30 |
| musk ambrette | 20 |
| | <u>1,000</u> |

Fougere No. 5

| | |
|----------------------------------|------------|
| cedarwood | 100 |
| terpinyl acetate | 60 |
| benzyl acetate | 40 |
| α -amyl cinnamic aldehyde | 40 |
| lavender | 40 |
| oakmoss resinoid | 40 |
| elemi resinoid | 40 |
| coumarin | 40 |
| petitgrain | 20 |
| amyl salicylate | 20 |
| bornyl acetate | 20 |
| patchouli | 20 |
| musk xylol | 20 |
| | <u>500</u> |

Musk No. 9

| | |
|----------------------|-----|
| amyl salicylate | 250 |
| cedarwood | 200 |
| copaiba balsam | 90 |
| phenyl ethyl alcohol | 70 |
| terpineol | 70 |
| geranium bourbon | 50 |
| terpinyl acetate | 50 |
| heliotropin | 45 |

| | |
|-----------------|--------------|
| sandalwood | 45 |
| bergamot | 30 |
| musk xylol | 25 |
| Peru balsam | 25 |
| patchouli | 20 |
| coumarin | 20 |
| vetiver bourbon | 20 |
| musk ambrette | 15 |
| | <u>1,025</u> |

Opoponax for Soap³

| | |
|-------------------|--------------|
| opoponax resinoid | 180 |
| rose synthetic | 60 |
| palmarosa oil | 80 |
| patchouli | 20 |
| bergamot | 250 |
| neroli synthetic | 50 |
| cedarwood | 135 |
| Peru resinoid | 200 |
| musk xylol | 25 |
| | <u>1,000</u> |

Palmolive Type No. 2

| | |
|------------------|------------|
| cedarwood | 100 |
| geranium bourbon | 80 |
| linalool | 40 |
| geraniol | 40 |
| patchouli | 30 |
| rosemary | 25 |
| benzyl acetate | 15 |
| musk xylol | 15 |
| cassia | 10 |
| lavender | 10 |
| clove | 60 |
| | <u>425</u> |

Peau d'Espagne No. 4

| | |
|-------------------------------|-------------|
| amyl salicylate | 185 |
| cedarwood | 170 |
| copaiba balsam | 120 |
| terpineol | 100 |
| geraniol | 100 |
| bergamot synthetic | 70 |
| sandalwood | 60 |
| coumarin | 50 |
| musk xylol | 35 |
| linalool | 30 |
| geranium | 30 |
| methyl benzoate | 20 |
| vetiver | 20 |
| bouleau rectified (birch tar) | 10 |
| | <hr/> 1,000 |

Pine No. 10

| | |
|-----------------------|-----------|
| pine needle oil | 250 |
| bergamot synthetic | 75 |
| ionone | 40 |
| cedarwood | 40 |
| dimethyl hydroquinone | 25 |
| geranium synthetic | 25 |
| amber synthetic | 5 |
| | <hr/> 460 |

Rose Geranium No. 8

| | |
|------------------|-----------|
| geranium bourbon | 200 |
| geraniol | 60 |
| rose synthetic | 40 |
| eugenol | 40 |
| cedarwood | 20 |
| musk xylol | 20 |
| musk ambrette | 10 |
| Peru balsam | 10 |
| guaiaacwood | 10 |
| | <hr/> 410 |

Cedarwood is a good fixative; it has a rounding effect on the odor of other perfume components and does not discolor in soap.

Sandalwood No. 3

| | |
|------------------|-----------|
| cedarwood | 150 |
| copaiba balsam | 100 |
| sandalwood EI | 100 |
| geraniol | 100 |
| heliotropin | 25 |
| geranium bourbon | 15 |
| ionone | 10 |
| | <hr/> 500 |

Violet Bouquet No. 6

| | |
|----------------|-----------|
| ionone | 185 |
| cedarwood | 100 |
| guaiaacwood | 50 |
| geranium | 50 |
| benzyl acetate | 50 |
| clove | 25 |
| musk xylol | 25 |
| vetiver | 12 |
| vanillin | 3 |
| | <hr/> 500 |



Due to the dermatological considerations, certain materials in today's soap perfumes are restricted in percentage used, or may have to be specially processed; other materials are prohibited, according to IFRA's recommendations.

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Dermatological Considerations

Due to the dermatological considerations, certain materials in today's soap perfumes are restricted in percentage used, or may have to be specially processed; other materials are prohibited, according to IFRA's recommendations. A few examples of such perfume materials are:

Bergamot: This material is restricted because of its phototoxicity to 0.4 percent in consumer products.

Cassia: This ingredient is limited to 1 percent in a fragrance compound.

Cinnamic alcohol: This material is restricted to 0.8 percent in consumer products.

Hydroxycitronellal: This ingredient is limited to 5 percent in a fragrance compound.

Musk ambrette: This material is unequivocally prohibited.

Oakmoss: This ingredient is restricted to 0.6 percent in consumer products.

Opoponax: This material may only be obtained from the gum by solvent extraction or steam distillation.

Peru balsam: This ingredient may only be used as an extract or distillate, limited to 4 percent in consumer products.

Aroma Chemicals in Contemporary Soap Perfumes

In earlier soap and perfume formulas, more natural perfume materials were used. Later, newer aromatic chemicals were introduced, such as acetals, which included nonylacetaldehyde diethyl acetal and lauric aldehyde dimethyl acetal. Carbinols with interesting background odor tonalities began to find use, including benzyl ethyl carbinol and benzyl isopropyl

carbinols. Among the other later aroma chemicals were isocyclocitral (replacing citral) and dihydromyrcenol, which imparts a sweet lime-like and floral odor. Other veteran materials include Sandela (Givaudan) and Vertenex (IFF), and various jasmine and rose specialties, including Hedione (Firmenich) and Damascenone (Firmenich).

Today's soap fragrances contain a variety of aroma chemicals, many of which have multifaceted profiles and complicated

Today's soap fragrances contain a variety of aroma chemicals, many of which have multifaceted profiles and complicated structural formulas.

structural formulas. For illustration, let us take a look at a few selected aroma chemicals.

Woody: This category includes:

- α -cedrene epoxide, which possesses a woody, amber, sandalwood and tobacco odor tonality;
- acetyl octahydro tetramethyl naphthalene (Iso E Super, IFF), a complex mixture of isomeric ketones with a woody, amber and floral odor tonality;
- cyclododecyl methyl ether (Palisandin, Haarmann & Reimer), a cedarwood-like material with earthy patchouli and tobacco notes;
- p-tertiary butyl cyclohexyl acetate, which possesses a woody and floral odor tonality;
- and trim ethylcyclohexenyl pentenone (methyl ionone α iso, two main isomers, Quest), a material with a woody, tobacco and violet odor.

Citrus, green, herbal: This classification covers:

- mixed 3,5-dimethyl- and 2,4-dimethyl-3-cyclo hexene nitriles — a combination of certain fractions impart a strong green, cuminic note with an herbal, cinnamic, woody background, while in woody perfume compositions they act as bas modifiers;⁴
- 3,7-dimethyl-6-octene nitrile (citronellyl nitrile), which has a citrus odor with a green nuance;
- and 2-methyl-6-methylene-7-octen-2-yl acetate (three main isomers), of which Quest's Neobergamate Forte possesses a fresh citrus lime odor.

Floral: This category includes:

- ethyl-2-acetyloctanoate (Jessate, Quest), which imparts a floral, jasmine, fruity, herbaceous and green odor;

- tetrahydroalloocimenol (Tetralol, Millennium), which consists mainly of tetrahydrolinalool and tetrahydromyrcenol, imparting a floral, citrus odor tonality;
- and 6-butyl-3,6-dihydro-2,4-dimethyl-2H-pyran (three isomers), such as Quest's Gyrane, which imparts a geranium odor with rose and mint notes.

Applications

Although the vogue in soap perfumes is continually changing, there always remain a few relevant older traditional soaps, as illustrated previously. The rose scent also continues to be popular, as exemplified by a rose bouquet containing cedarwood in Dove soap. However, more sophisticated soap perfume types, adapted from fine fragrances, have been developed. Newer herbal, green, fruity fragrances include cedarwood, cedrol, cedryl acetate and cedryl methyl ether.

Today's soap fragrances contain fewer essential oils, but cedarwood remains part of contemporary soap perfumes. Additionally, its derivatives contribute a woody note in addition to amber, tobacco and musky odor tonalities. These materials find application in various citrus, floral, green, woody and semi-oriental fragrances. They are also compatible with modern papaya, avocado and raspberry fruity notes.

It must then be concluded that cedarwood and its derivatives are likely to remain valuable soap perfume components for the foreseeable future.

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