Natural Perfumes

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"Natural" has been a desirable marketing position for several years, and in all likelihood will remain so in the foreseeable future. Perfume is not immune from this trend. Almost all fragrances now contain significant amounts of synthetic products, so making a natural perfume involves some special formulation considerations to be commercially, technically and aesthetically viable.

There is no universally accepted definition of a natural product, but most materials and processes used two or three thousand years ago should meet the most critical criteria. In regard to perfume, the origin of our modern word gives a clue to its ancient application. Its source is the Latin *"per fumum"* — by smoke. Many ancient aromatics were resins and roots which were burned, usually as part of a religious rite. Aromatics were also important to the Egyptians for use in mummification. No pure ethyl alcohol or distillation processes were available, and the formula known as "The Egyptian" is as close as they came to our concept of hydroalcoholic fragrances (Figure 1).

Figure 1

"THE EGYPTIAN"

- Cinnamon
- Cassia
- Myrrh
- Resin
- Wine as Solvent

Figure 2

EAU DE COLOGNE 1709

Rose Oil	2 drams
Melissa Oil	2 drams
Neroli Oil	5 drams
Lavender Oil	6 drams
Geranium Oil	8 drams
Rosemary Oil	9 drams
Lime Oil	1 oz.
Cedra Oil	2 oz.
Petitgrain Oil	2 oz.
Orange Oil	2 oz.
Lemon Oil	3 oz.
Bergamot Oil	4 oz.

Figure 3

CHRONOLOGY

1837	Benzaldehyde
1855	Benzyl Acetate
1868	Coumarin
1974	Vanillin
1876	Phenyl Ethyl Alcohol
1885	Heliotropin
1888	Musk Ketone
1893	Ionone

The ancient world never technically progressed past "The Egyptian." The modern era had its roots when the West contacted the Arab world beginning in 1202, when Venice conquered Constantinople. Fragrant materials, reduced to extracts by distillation, became easier to ship. Ethyl alcohol was distilled from wine and became a universal solvent. Fragrance industries were founded in Italy and the south of France. By the 18th century, with the inclusion of a variety of flowers and citrus products, a fragrance creation such as the famous Eau de Cologne was possible (Figure 2).

As opposed to "The Egyptian," the Eau de Cologne would today be recognizable as a perfume. It appears to be a "Natural Perfume," since all the materials originate in nature. The oils were obtained by distillation with water, steam or alcohol, solvent extraction, cold pressing or enfleurage. The last method deserves some explanation, being remote from modern chemical extraction techniques. Panes of glass were spread with fat, and flowers were placed on top. The aromatic oil migrated out of the petals and into the fat. Solvents then removed the aromatic substance. This method is slow and labor intensive, and rarely if ever used in the modern world. The technology represented by the Eau de Cologne formulation is a giant advance over antiquity and brings us to the brink of modern perfumery.

Essential Oils are defined as materials obtained by pressing or distillation. Concretes are extracted by solvents, and when the waxes are removed from the concrete (by isolating the alcohol-soluble components) the result is the absolute. All the methods of producing natural aromatics result in products of variable quality and composition, depending on growing conditions and the exact processing condition.

The 19th century saw explosive growth in organic chemistry in Germany. As a byproduct of extensive work on coal tar, aromatic substances were isolated and synthesized at an increasing rate (Figure 3).

The major break with "natural" came when aromatic materials not existing in nature were synthesized and introduced into perfume compounds. The legendary landmark of this development was Chanel No. 5 (introduced in 1921), containing a potent dose of decidedly unnatural aldehydes. An ever-increasing array of synthetics were added to the perfumer's palette, making possible almost all current fragrances. Economics, consistency, abundant supply, variety of odor profiles, stability — the advantages of synthetics are so overwhelming that they rapidly became pervasive.

Consequently, the vast majority of contemporary

Figure 4

ALL NATURAL BQT

Bergamot Oil	20
Geranium Oil	150
Palmarosa Oil	200
Sunflower Oil	210
Turkish Rose Oil	50
Rosewood Oil	150
Sandalwood Oil	100
Vanilla Absolute	10
Violet Leaves Abs.	10
Ylang Ylang Oil	100
	1000

Figure 5

THE COST OF NATURALS

(Summer 1995)

Turkish Rose	$5,410/kilo
Vanilla Abs.	$4,650/kilo
Violet Leaf Abs.	$1,895/kilo

Figure 6

NATURE IDENTICAL BQT

Bergamot Reconsitituted	20
Geranium Base	150
Palmarosa Oil	200
Sunflower Oil	210
Rose Abs. Type	50
Linalool Syn.	150
Sandalwood Base	100
Vanillin	10
Methyl Ionone Gamma	10
Ylang Reconstituted	100
	1000

replaced by nature-identical proprietary compounds. These compounds are based on the major components of the natural oils, but lack many trace elements. The Rosewood Oil has been replaced with Linalool Synthetic, which is present at approximately 55 percent in the natural oil. Similarly, Vanilla Absolute is replaced with Vanillin, and Violet Absolute with Methyl Ionone Gamma. The addition of Sunflower Oil or numerous other vegetable oils or capric/caprylic triglyceride reduces the cost.

Is our nature-identical fragrance a "Natural Perfume?" The answer is surely a matter of interpretation and point of view. The empirical response of most suppliers and users is yes. The most rigorous analytical procedures in the world would not detect materials not present in nature. It is certainly possible that an improper stereoisomer may creep in, but most fragrance suppliers and consumers are unlikely to pursue the technical analysis to such an extreme.

So what's wrong with our nature-identical fragrance? To begin with, it is very confining to creativity. The perfumer's palette has benefited greatly from the synthetics introduced over the last century, and eliminating them has reduced us to a tiny part of the odor spectrum, mostly florals. Another area of compromise is stability, which is easier to achieve with synthetics, especially with problem application environments. Despite its drawbacks, the nature-identical fragrance has more reproducibility, stability and economy than its all-natural counterpart.

Head space technology — used by some fragrance companies to reproduce the scent of flowers — seems natural enough. To understand the technique, a quick review of the history of fragrance duplication is needed. Until the 1960s, duplication was done by perfumers based on smell alone, a tedious, time consuming and inexact method. The introduction of gas chromatography was a tremendous advance. Complicated mixtures could be separated, and each ingredient identified by comparison to known peak locations combined with smelling the material as it vented the apparatus. In rigorous terms, the GC separates the mixture but cannot determine the components. The addition of a mass spectrometer to analyze each component was another major technical breakthrough, allowing precise chemical "fingerprinting" of the ingredients.

Gas chromatography work used a small liquid sample injected into the column. Head space devices allowed gas to be tested. Bowls were placed around flowers, in redwood forests — wherever a story could be generated — and the scent reproduced. Since it was known that the aroma constituents of living things change once they die, this seems the closest we can come to a natural perfume. But is it?

It is necessary to touch briefly on the structure of a typical perfume compound. Aroma chemicals vary greatly in volatility. The most long lasting, tenacious components make the base note of the fragrance. Materials of medium volatility comprise the middle note. Fleeting, highly volatile materials make the top note. Each is an essential part of the whole, providing long lasting qualities in addition to initial impact.

What does a head space analysis provide? Top notes. Top notes aren't bad, but they do not make a finished fragrance. So, other materials must be added to round the composition, and we have necessarily moved away from nature.

There is another limitation to reproducing nature. Components can be identified more easily than they can be synthesized, especially as stereospecific compounds. What is the realistic likelihood that every trace material in the head space around a flower will be synthesized and the final product be economically viable? Finally, the "living" material so painstakingly wrought from nature contains nature identical — but not necessarily naturally derived — aroma chemicals.

What is the bottom line on the head space technology? A marvelous marketing tool, which can certainly bedazzle many people, but emphatically less close to nature than the traditionally available essential oils.

Another popular marketing position is "fragrance-free," particularly for hypoallergenic products. Since emulsion bases often have fatty notes both out of the bottle and on the skin, masking fragrances are frequently employed. The "fragrance-free" claim thus crefragrances are certainly *not* natural. Of course it is still possible to make natural or nature-identified fragrances, but it is important to recognize the technical, creative and economic limitations they are subject to. Figure 4 has a formula for a modern all-natural fragrance.

There is certainly nothing wrong with the way this fragrance would smell. In fact, it could be very appealing. The practical problems could be formidable: price, skin irritation, decomposition and discoloration. Figure 5 shows some cost situations — prices naturally vary, but these indicate the magnitude of the situation.

Skin irritation and sensitization, phototoxicity and discoloration problems are exaggerated by the numerous trace materials present. Thus, natural products are emphatically not safer than synthetics; in fact, the opposite is far closer to the truth. The decomposition is often caused by the tendency of many natural products to oxidize. Color changes, most frequently a darkening over time, create quality control problems. Many of the less developed countries which are the source of naturals have variable technological competence. It is also difficult to get odor impact with naturals comparable to synthetics. This, although "natural," our all-natural fragrance is unlikely to have acceptable technical properties for most personal care applications.

Additional problems are characteristic of natural substances. There are significant crop differences caused by location and climate. Also, many valuable naturals have been eliminated from use because of their source, such as whales for ambergris. Political and natural disturbances also can create havoc in supply situations.

Figure 6 shows a modification of the fragrance we have been considering to create a nature-identical counterpart.

Fragrance companies do not customarily divulge their formulas, and consequently we must here deal in generalities rather than the nuts-and-bolts details. The Bergamot Oil, Geranium Oil, Turkish Rose Oil, Sandalwood Oil and Ylang Ylang Oil have all been ates a quandry. The presence of cosmetic labeling leads to some fancy footwork. Sometimes one or more fragrance materials are used and separately labeled, so instead of reading "fragrance," we find lavender oil or vanilla, for example. A closely related approach is to use botanicals for odor value. Alas, botanicals don't have much odor, at least in the quality and impact that traditional fragrances can provide. The reality of most "fragrance-free" products is that some attempt must be made to mask base odors while avoiding the word "fragrance" on the label.

Genetic engineering can muddy the definition of "natural" even more. It is possible to modify plant genes to produce species with new characteristics, thus creating new variations of essential oils. Hundreds of rose varieties have been created over the past few centuries. The biosynthesis of compounds in plants produces an abundance of trace materials significant to the complex odor character distinguishing natural oils from synthetics. Any change in genetic code can produce myriad unpredictable novel aroma chemicals. It is also possible to graft characteristics of one plant into another.

Another technical possibility is using microorganisms to produce the essential oils in cultures rather than whole plants. This would allow consistent quality and development of new odor types. The expense of the process has thus far precluded significant commercialization.

Genetic engineering is not as radical as might first appear. How many plants are natural in that they have never been intentionally altered for human purposes? Let's say we dilute our natural perfume with corn oil to reduce the cost. Corn seems natural, but from some perspectives, it is not. Corn did not exist in nature before the Native Americans developed it. In the process of domestication, plants with well formed husks and ears surrounded by a leaf sheath were preferred. Hybridization of maize with cereals such as teosinte and gama grass occurred. Several types of corn are now produced for different uses. The situation for corn is repeated over and over with plants yielding essential oils. "Natural" is a slippery concept to keep hold of.

In conclusion, everything of natural origin used in perfumery must be extracted by some sort of separation process which in many subtle ways alters the material from its natural state. Synthesized materials either reproduce a naturally occurring material or create a purely man-made compound. Using essential oils or nature identical blends brings us as close to a "Natural Perfume" as realities allow.•