

# Insider Tips on Formulating with Fragrance

In 2008, Allured Publishing Corp. will release a new compilation—58 articles published in the past six years in *Cosmetics & Toiletries*, *Global Cosmetic Industry (GCI)* and *Perfumer & Flavorist* magazines—under the title *Fragrance for Personal Care*.

This 546-page book contains 13 chapters on essential oils and aroma chemicals, and 16 chapters on marketing and trends, with smaller groups addressing artistry and craft, naturals and organics, packaging and branding, and regulatory and business. Nineteen chapters are grouped under the heading “Technology and Formulation,” but tips on that topic are scattered throughout the book and collected in this column by the author for the convenience of formulators, and to give a sample of the range of contributors inside this book (Figure 1).

## Danute Pajaujis Anonis

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

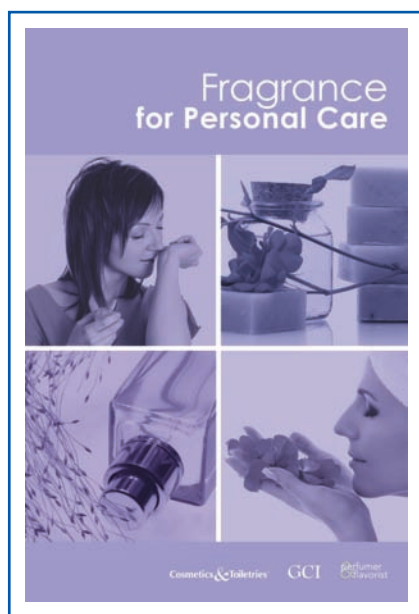


Figure 1. Contributions from more than 60 authors are collected in *Fragrance for Personal Care*.

For example, one might mention cyclododecyl methyl ether in the woody category, 3,7-dimethyl-6-octene nitrile (citronellyl nitrile) in the citrus, green, herbal category, or 6-butyl-3,6-dihydro-2,4-dimethyl-2H-pyran (three isomers), which imparts a geranium odor with rose and mint notes. Today’s soap fragrances contain fewer essential oils, but cedarwood remains part of contemporary soap perfumes. Cedarwood and its derivatives are likely to remain valuable soap perfume components for the foreseeable future.<sup>1</sup>

Exfoliating products and self-tanners have very extreme pH conditions that are unstable with fragrance.

## Andrew Kaplan

Most personal care products such as shampoos, conditioners, lotions and cosmetics incorporate fragrance to give them a pleasing scent. Fragrances are composed of essential oils and other aromatic materials, and their role in scenting personal products makes for the frequent use of essential oils in product formulations.

In some products that are labeled as *all natural*, formulators sometimes want to avoid using the word *fragrance* on the label because of the inference that such an ingredient may not be natural. Instead they simply list the various essential oils used to provide the odor quality.

One of the biggest challenges that natural fragrance formulators run into is that the range of materials used to create these products is much more limited than those used to create fragrances based on petrochemical synthesis. This challenge is being met through current

research that is finding more effective and efficient processing methods for extracting essential oils not yet commercially available.<sup>2</sup>

## Rob Brown

When fragranting lotions/creams or shampoos with a botanical fragrance, formulators use essential oils, a blend of essential oils, or a blend of essential oils and other natural raw materials that are aromatic in character.

Usually, a product described as *made with real botanicals* has had botanical extracts added for their perceived health benefits. For example, chamomile extract or stinging nettle extract listed on package labels often are incorporated into the product for health or medicinal benefits, not for aromatic purposes. Although chamomile extract will have a slight odor when it is incorporated into a hair care product, it does not add to the fragrance value of the product. However, using a chamomile fragrance, chamomile essential oil, or a blend of essential oils with chamomile in it in the product will fragrance the product.<sup>3</sup>

## Philip Carrubba et al.

Fragranting various hair care products presents a different set of technical issues for each product type.<sup>4</sup>

**Shampoo:** Surfactants comprise a major part of the shampoo formula and can absorb fragrance. They also frequently have fatty base notes that need masking. For these technical reasons, and for the esthetic aromatic statement desired, shampoos generally contain a relatively high level of fragrance, between 0.5% and 1%.

**Conditioner:** Quaternary ammonium compounds are oily and have fatty amine base notes that may seem fishy and must be masked. The quats can also negatively affect the fragrance’s ability to bloom out of the product. The selection of a fragrance that provides both masking and bloom is an important factor

in a conditioner. The different effects of the quats and the shampoo surfactants are important considerations when attempting to develop a fragrance that can be used in both product forms within a product line.

**Gels:** The main problem in fragrancing gels is to maintain solubility and product clarity. To achieve solubility, the fragrance must be added to the

product before the gelling reaction occurs.

**Mousse:** The hydrocarbon propellant gas in mousses can cause fragrance insolubility. Adding too high a level of surfactant to aid solubility can deposit excessive solids in the hair. If mousses contain alcohol to help solubilize the fragrance, the alcohol must be masked.

**Hair spray:** Alcohol, the number one ingredient in hair sprays, must be masked during spraying while the resin odor must be masked after the alcohol volatilizes and the resins are left on the hair; however, not so much fragrance should be added that it lingers on the hair and interferes with the consumer's perfume or cologne.

**Hair treatments:** Permanent wave solutions work by breaking the hair's sulfide bonds. This reaction emits sulfurous malodors during use, reminiscent of rotten eggs. Very few fragrances can survive in this highly reactive environment and still perform as odor masks. One of the most popular fragrance types for this application is rose. Phenylethyl alcohol, typically a major component of many rose fragrances, often works well in such systems, but fragrance is generally unable to completely mask a permanent wave product.

Hair dyes, which also work by breaking the hair's sulfur bonds, represent similar fragrancing and reactant problems as permanent wave solutions. Masking the product's odor is often the best one can hope to accomplish.

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One of the biggest challenges to natural formulators is that the range of materials to create these products is much more limited.

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**Chintaman T. Bondar et al.**

Deodorants contain topical germicides such as quaternary ammonium compounds, parabens and triclosan. These active ingredients or product formulations can alter the perfume oils or individual odorants in the aqueous alcoholic solutions. Approximately 1–2% fragrance is required to cover the base odor and

release desirable top notes during use. It is important to conduct stability tests before large-scale manufacture and distribution.<sup>5</sup>

## Lin Lu Healy

Thickened emollients are typically obtained through producing an emulsion or a microemulsion. Attempts to achieve a clear, thickened anhydrous gel are normally achieved by using fumed silica or metal stearates. The problem is that the emulsions must involve a water phase, and the anhydrous gels based on silica or metal stearates often exhibit haziness and syneresis. One solution is block copolymer blends dissolved in white mineral oil or similar nonpolar materials. These systems can produce heterophase, thermally reversible, crystal-clear gels that possess many desirable properties for the cosmetic and pharmaceutical industries.<sup>6</sup>

## Randy Schueller and Perry Romanowski

Formulating a fragrance into a product offers many challenges. There are a variety of negative interactions between formula and fragrance—such as compatibility and viscosity issues, appearance changes and destabilization. The solutions to each problem will depend on the specific formulation.<sup>7</sup>

## Z. George Zhang

Most fragrance materials are strongly hydrophobic in nature and therefore not soluble in water, thus the formulation requirements are challenging. One solution is to solubilize these compounds into aqueous surfactant association structures, such as micelles or microemulsions, or into emulsions and vesicles.<sup>8</sup>

Systematic study, as described by the application of a full phase diagram, is very important to formulators because it can help them to arrive at the final composition much quicker and easier and with a better under-

standing of physical characteristics such as vapor pressure. In addition, the by-product of their research is the accumulation of a huge database of various possible formulations for the future.<sup>9</sup>

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**Cedarwood and its derivatives are likely to remain valuable soap perfume components for the foreseeable future.**

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## Felix Buccellato and Christian Buccellato

As mentioned, fragrancing personal care products can present a variety of problems, such as fragrance/product compatibility, color changes, solubility and reactions between fragrance and product.<sup>10</sup>

The first step in achieving compatibility between the product and fragrance ingredients is to examine the product. Most fragrance components are lipophilic: they do not like water at all, and in the best cases are only marginally soluble. They are usually compatible with oil, depending on the fragrance type. Within that general guideline there are degrees of solubility. Terpenes, sesquiterpenes and other aromatic, cyclic or polycyclic materials are extremely insoluble in any type of water system.

Color change can come from fragrance and often does, but fragrance is not the only source. Overall product stability depends on testing and keen observation. Almost any aldehyde, when mixed with ethanol, will undergo rapid changes. This should be an indication that other reactions, known or unknown, will be taking place.

## Karen Newman

Adding functional skin care ingredients to an otherwise straightforward

bath product can create a whole new fragrance challenge.<sup>11</sup>

- Firming and toning products contain high levels of proteins or enzymes that are affected by alcohols.
- Exfoliating products and self-tanners have very extreme pH conditions that are unstable with fragrance and have to be reformulated.
- The challenge with fizzing products is keeping the fragrance isolated from moisture.

## Steve Herman

Challenges to perfumers and application chemists arise from the complexity of fragrance chemistry, the varied interactions of aroma chemicals with the environment of emulsion and surfactant systems, and the added influence of external factors such as heat and light. Practical experience helps as a guide, and the brute force approach of raw materials studies can produce effective fragranced products. True understanding comes with the realization that fragrances are chemicals, that bases create an environment of varied character, and that the core of fragrance chemistry is chemistry.<sup>12</sup>

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