Nerol Oxide

This heat-stable ingredient is suitable for a wide range of mango and berry applications, especially in confectionery.

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In counties where mangoes are indigenous, they are often principally valued for the powerful skin notes derived from a complex and varied series of terpene hydrocarbons. In the West these notes are often toned down significantly, but even at a more subtle level they still contribute significantly to the character recognition of the fruit. The most important varieties of mangoes in commercial terms have skin characters that are underpinned by the two very closely related hydrocarbons myrcene (FEMA# 2762, CAS# 123-35-3) and ocimene (FEMA# 3539, CAS# 13877-91-3). These terpenes can certainly be used to recreate the skin effect in mango flavors but they suffer from several serious disadvantages. The most serious technical problem is that they both polymerize on storage. This instability applies equally to storage of the raw material and to storage of the finished flavor and can cause the flavor to cloud and lose intensity quite rapidly. The second technical problem is their relatively high volatility—they will not survive in any applications involving the significant application of heat. Third, they are both extremely non-polar and do not perform very well in applications incorporating lipids. Myrcene now has the additional health controversy to contend with.[a]

[a]The California Environmental Protection Agency's Office of Environmental Health Hazard Assessment (OEHHA; *http://oehha.ca.gov/*) intends to list myrcene (using the synonum β-myrcene) as a known carcinogen under the state's Safe Drinking Water and Toxic Enforcement Act of 1986. OEHHA is relying on the National Toxicology Program's (NTP) data and conclusions for this action. In 2010, NTP published a report, "Toxicology and Carcinogenesis Studies of β-Myrcene (CAS# 123-35-3) in F344/N Rats and B6C3F1 Mice," which noted, "We conclude that β-myrcene caused kidney cancers in male rats and liver cancer in male mice…" OEHHA has requested comments as to whether β-myrcene meets the criteria set forth in the Proposition 65 regulations for authoritative bodies listings.

There are two feasible alternative raw materials with similar mango skin odor profiles. Diphenyl oxide (FEMA# 3667, CAS# 101-84-8) is an effective replacement in respect to oxidation and heat stability but it is also very non-polar and has a somewhat harsher aroma profile than myrcene. The best alternative mango flavor ingredient with a similarly natural tasting profile to the two hydrocarbons is nerol oxide (FEMA# 3661, CAS# 1786-08-9). This ingredient is much less susceptible to oxidation and polymerization than myrcene or ocimene. It is also a great deal more heat-stable, especially in confectionery applications. It is relatively polar, allowing its use in a wider range of applications.

Mango flavors are the most immediately obvious use for nerol oxide but this is certainly not the only flavor type where this type of herbal, mango skin note can be appreciated.

Tropical Flavors

Mango: The ideal level of nerol oxide in mango flavors varies considerably with the intended market and also the level of ripeness. Western markets prefer lower levels but notably higher levels are preferred in Asia. A level of 400 ppm is a reasonable starting point for flavors intended for Western markets.

Passion fruit: This ingredient can be quite helpful in passion fruit flavors in the region of 100 ppm, adding a degree of lift and brightness, even if it never takes on a dominant role.

Papaya: Papaya flavors can tend to be a little sweet and cloying and a modest addition of nerol oxide, around 50 ppm, counteracts this tendency.

Kiwi: In contrast, kiwi flavors struggle to attain depth but this raw material can still be useful at 50 ppm to add brightness.

Pineapple: Fifty ppm of nerol oxide adds complexity and lift to pineapple flavors. It is much more effective in fresh pineapple flavors than in canned pineapple flavors.

Banana: Fifty ppm also works very well in banana flavors, brightening the profile and adding welcome complexity.

Lychee: The effect in lychee flavors is quite similar to that in kiwi flavors but the ideal starting level is lower, around 20 ppm.

Citrus Fruit Flavors

Grapefruit: The mango skin note of myrcene is a significant contributor to most citrus flavors but especially to grapefruit flavors. Nerol oxide works very well to enhance this nuance at around 200 ppm.

Lemon: A level of 200 ppm also works well in lemon flavors, lifting the

profile and adding realism. The relative stability of this ingredient to oxidation is particularly helpful in lemon flavors.

Bergamot: The high price of genuine bergamot oil is a challenge for many brands of Earl Grey tea, and the addition of 200 ppm of this component adds affordable realism to synthetic bergamot flavors.

Mandarin, tangerine and orange: Levels of this ingredient in the range of 100–150 ppm work well in all three flavor types, brightening the profiles.

Berry Fruit Flavors

Raspberry: Nerol oxide helps to lift realistic raspberry flavors and add a subtle skin character. A level of 150 ppm is a good starting level.

Blackcurrant: A similar berry skin effect is also noticeable in blackcurrant flavors at around 100 ppm. This ingredient is only really useful in realistic flavors as opposed to traditional buchu oil-based flavors.

Cherry: Levels of use vary in cherry flavors; 100 ppm is better for flavors with a significant benzaldehyde component, and 50 ppm is better for more subtle flavors.

Blueberry: Fifty ppm of this ingredient also works well in blueberry flavors, adding a degree of brightness and realism, together with an impression of blueberry skins.

Strawberry: Levels ranging from 20–50 ppm work well in strawberry flavors, adding lift and helping to counterbalance the heavier notes.

Other Fruit Flavors

Pear: After mango, pear is the next best home for this raw material. The character helps add realism to the pear recognition skeleton and also adds a distinct note of pear skin. Levels can vary depending on the flavor type but will ideally be in the region of 200 ppm.

Peach: Although peach is not quite as obvious a use as pear, the effect is actually quite similar especially the focus on skin notes. Two hundred ppm is also a good starting point in this category of flavors.

Plum: Plum flavors are more popular in Asia than in the rest of the world and often lack authenticity. Nerol oxide is very helpful at 200 ppm.

Apple: The skin effect is also highly effective in apple flavors, especially green apple flavors. The ideal level of addition is a little lower, around 150 ppm.

Apricot: The best level in apricot flavors is also lower, in the region of 100 ppm, especially in flavors that have high linalool levels.

Other Flavors

Mint: Nerol oxide is very useful in both spearmint and peppermint flavors. Ideal levels vary but range from 100–300 ppm.

Parsley: Parsley flavors are not exactly common but it can be very challenging to capture a realistic fresh profile. Nerol oxide is useful at 200 ppm.

Rose: One hundred ppm is a useful addition to synthetic rose flavors, adding realism, lift and complexity and counterbalancing some of their natural heaviness.

Tea: Nerol oxide works well is all types of tea flavors, black, green and red. Forty ppm is a good starting point.