Flavor Bites: Methyl Thiobutyrate

Formulating more cost-efficient fruit and dairy flavors

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Sulfur notes are often used in fruit flavors. They add complexity and realism, and can shift the secondary characteristics of the flavor significantly when used at higher levels. Equally important in the current financial climate is their cost-effectiveness, as even the most exotic and expensive sulfur chemicals can provide more "bang for the buck" than any of the cheap bulk components of a flavor. So, no apologies for selecting—methyl thiobutyrate (FEMA# 3310; CAS# 2432-51-1)—yet another sulfur chemical this month! Widely found in nature, particularly in strawberries, it can be used to good effect in an even wider variety of flavors.

One of the first sulfur chemicals to be widely used in fruit flavors was dimethyl sulfide (FEMA# 2746). At low use levels this chemical enhanced the fruit notes and added authenticity; at higher levels it completely altered the flavor character, giving it a cooked fruit profile, and at highest levels of use dimethyl sulfide added a cooked vegetable note. However, the chemical was exceptionally difficult to purify, and trace impurities of dimethyl disulfide and trisulfide increased on storage, imparting an unpleasant character of old abandoned drains. Pure dimethyl sulfide worked especially well in raspberry, lychee and blackcurrant flavors, but in strawberry and most other fruit flavors, it could play only a small role without appearing intrusive. Clearly, something much better was needed.

Methyl Thiobutyrate and Fruit Flavors

Most of the fresh strawberries sold in the markets are not necessarily ripe—they are, in fact, picked with a complicated supply chain in mind. However, if one is lucky enough to grow them (and pick them before the birds can get to them) one can notice a delightfully unsubtle sulfurous aroma of ripeness. That aroma is mainly caused by methyl thiobutyrate.

Strawberry: Methyl thiobutyrate works perfectly in strawberry flavors, adding powerful notes of ripeness and juiciness. 100 ppm adds fairly subtle shading to a strawberry flavor that has noticeable green, unripe notes. 500 ppm is ideal for a ripe strawberry flavor that has low green notes. Higher levels, around 1,000 ppm can be used in cooked strawberry flavors. However, using methyl thiobutyrate at very high levels is not recommended, as it adds a rotten note to the strawberry character.

In the context of sulfur containing flavor chemicals, methyl thiobutyrate is relatively stable. It hydrolyzes a little on storage but this effect is not accompanied by an offnote—the overall intensity simply diminishes a little.

Pineapple: Most pineapple flavors incorporate methyl 3-(methylthio) propionate (FEMA# 2720) and ethyl 3-(methylthio) propionate (FEMA# 3343). These chemicals possess a specifically juicy pineapple character, but at higher levels they rob pineapple flavors of any hint of freshness. Methyl thiobutyrate can be used to complement these two chemicals in all pineapple flavors. It adds a strong juicy note and also enables the other two sulfur chemicals to be used at rather higher levels, before the flavor character becomes canned or processed. Good starting levels are 50 ppm, in fresh pineapple flavors, and 1,000 ppm in canned pineapple flavors.

Mango: Mango flavors represent another obvious fruit category for methyl thiobutyrate. Mango flavors vary considerably, both with respect to the popularity of different varieties of mango and the familiarity of the market with the natural fruit. Broadly speaking, they can be divided into flavors with very high terpene hydrocarbon/mango skin content (popular in Asia) and flavors with much more subtle skin notes (more popular in the West). Methyl thiobutyrate can be used at around 50 ppm in flavors with high skin notes and around 150 ppm in flavors with subtle skin notes.

Other tropical fruits: Other tropical fruit flavors that can successfully incorporate methyl thiobutyrate include guava (at around 70 ppm), purple passion fruit (at around 40 ppm), papaya (at around 40 ppm) and lychee (at around 10 ppm).

Peach and apricot flavors will typically incorporate a number of sulfur chemicals such as 2-iso-propyl-4-methyl thiazole (FEMA# 3555) to give a skin note and 4-mentha-8-thiol-3-one (FEMA# 3177) to give a catty note. Both the characteristics are highly desirable, but if the levels are raised too much, the effect becomes artificial tasting. The addition of only a trace (around 10 ppm) of methyl thiobutyrate adds juiciness and also helps to blend in high levels of the other two sulfur notes.

There are many other interesting fruit applications of methyl thiobutyrate: melon flavors (around 40 ppm), blackcurrant flavors (around 30 ppm), grape flavors (around 40 ppm), raspberry flavors (around 20 ppm), blueberry flavors (around 20 ppm), plum flavors (around 10 ppm), cherry flavors (around 10 ppm), pear flavors (around 10 ppm), apple flavors (around 10 ppm), cranberry flavors (around 10 ppm) and banana flavors (around 20 ppm).

Other Flavors

Application areas of methyl thiobutyrate are by no means restricted to fruit flavors. It is also an important component of dairy flavors in nature—the chemical makes a dominant contribution to the character of all rind washed cheeses. The most extreme example of this category is Ami du Chambertin, a soft, very smelly, rind washed cheese from Burgundy; less extreme examples include milder cheeses such as Reblochon. A good level of use in flavors replicating this type of cheese character is 200 ppm, whereas much more subtle levels can be used in other dairy flavors.

Yogurt flavors can accommodate moderate levels of methyl thiobutyrate, around 100 ppm, especially if they contain high levels of volatile components such as acetaldehyde. Cream flavors are much more delicate; levels around 50 ppm work well. Milk flavors use even lower levels, around 30 ppm. Methyl thiobutyrate is also a useful modifier of the cooked note in condensed milk flavors—levels of use vary according to the levels of other sulfur compounds present, but 40 ppm is a good starting point. Finally, along similar lines, caramel and toffee flavors can benefit from the addition of 40 ppm of this versatile chemical.

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