Flavor Bites: 3,5-Dimethyl Cyclopentane-1,2-Dione

Use levels for aroma and taste effects in brown, nut, savory, fruit and fermented flavors

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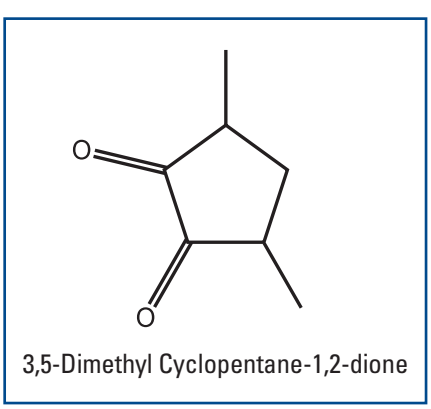
Theory suggests that aroma and taste are two distinct characteristics. Although this is scientifically true, flavorists can, however, compile a substantial list of raw materials that are used primarily for aromatic characteristics but also have (or appear to have) a significant effect on taste perception. 3,5-Dimethyl cycolpentane-1,2-dione (FEMA# 3269) is a good example of this interesting category of raw materials. It has an aroma best described as a complex blend of maple, caramel, candy floss and phenolic notes, with a strong affinity to malt. At the same time it also confers a lingering sweet character, especially in "brown" flavor applications. This sweet character may be quite simply considered a sweet taste effect or, more probably, an enhancement of pre-existing sweetness, as the brain associates these odor types very strongly with sweet tastes.

3,5-Dimethyl cyclopentane-1,2-dione is a member of a small family of similar chemicals that can often be used interchangeably or, better still, in combination. The other chemicals belonging to this family are 3-methyl cyclopentane-1,2-dione (FEMA# 2700), often called maple lactone; 3-ethyl cyclopentane-1,2-dione (FEMA# 3152); 3,4-dimethyl cyclopentane-1,2-dione (FEMA# 3268); and 3-methyl cyclohexane-1,2-dione (FEMA# 3305).



3,5-Dimethyl Cyclopentane-1,2-dione

As all these chemicals exist in a balanced mixture of keto-enol tautomers, different chemical names are sometimes used to describe them. For example, 3,5-dimethyl cyclopentane-1,2-dione is the tautomer of 3,5-dimethyl cyclopent-2-en-2-ol-1-one. Similarly, these chemicals possess the same mixture of odor characteristics, though in quite different ratios. For instance, sequential ranking of chemicals possessing the maple note, from strongest to weakest by FEMA number, is: 2700, 3269, 3268, 3305 and 3152. Similarly for caramel, it is: 3268, 3269, 2700, 3305 and 3152; for candy floss, it is: 3152, 3169, 3168, 2700 and 3305; and finally for phenolic it is: 3305, 2700, 3269, 3268 and 3152. However, in terms of overall strength, FEMA number ranking goes like this: 3305, 3268, 3269, 2700 and 3152.

3-Methyl cyclopentane-1,2-dione is particularly effective in maple and smoke flavors, even as 3,4-dimethyl cyclopentane-1,2-dione may be the first choice for caramel, licorice and coffee flavors. Meanwhile, 3-ethyl cyclopentane-1,2-dione is especially good in fruit flavors, and 3-methyl cyclohexane-1,2-dione is outstanding in smoke and bacon flavors. Yet, overall, 3,5-dimethyl cyclopentane-1,2-dione is the most useful and adaptable member of the family.

The dose rates of 3,5-dimethyl cyclopentane-1,2-dione given in this article are the levels to be used in flavors that are intended to be dosed at 0.05% in a ready-to-drink taster, beverage or bouillon, with an assumption that the chemical is used alone, without other members of the same family. Blends are often highly advantageous, and make matching a great challenge. That said, the levels of 3,5-dimethyl cyclopentane-1,2-dione used in blends would be proportionately lower than when the chemical is used alone. Although the possible blendings of these chemicals are endless, an interesting guideline would be to use one part of 3,5-dimethyl cyclopentane-1,2-dione in conjunction with 100–200 parts of 3-methyl cyclopentane-1,2-dione for a good effect in flavors.

Brown Flavors

Maple: 3,5-Dimethyl cyclopentane-1,2-dione is very effective and interesting in maple flavors when used alone at around 1,000 ppm. Meanwhile, much lower levels can be equally intriguing when used in conjunction with 3-methyl cyclopentane-1,2-dione and 3,4-dimethyl cyclopentane-1,2-dione.

Toffee: This chemical works particularly well in toffee flavors, giving different effects at different use levels. For instance, use level of around 50 ppm gives a mild brown sugar effect, but 4,000 ppm dominates the

flavor and gives a distinctly burnt toffee note.

Caramel: A good starting point for 3,5-dimethyl cyclopentane-1,2-dione in caramel flavors is 500 ppm to add an interesting brown character.

Malt: The best use level in malt flavors is around 500 ppm, rather less in malted milk type flavors. In fact, 3,5-dimethyl cyclopentane-1,2-dione is a clear favorite among this family of chemicals in malt flavor applications, although combinations with 3-methyl cyclopentane-1,2-dione are also interesting.

Coffee: The levels used in coffee flavors vary widely, but to get a typically roasted character a level of 1,500 ppm is a good starting point; less for milder flavors.

Chocolate: Ideal use levels of 3,5-dimethyl cyclopentane-1,2-dione in chocolate and cocoa flavors also vary, but are generally much lower; 100 ppm is a good starting point. A combination of two parts of this chemical with one part of 3,4 dimethyl-cyclopentane-1,2-dione is also very effective.

Licorice: 100 ppm of 3,5-dimethyl cyclopentane-1,2-dione is a good starting point in licorice flavors.

Nut Flavors

Praline: Around 200 ppm of 3,5-dimethyl cyclopentane-1,2-dione is ideal for hazelnut and praline flavors.

Walnut: Up to 500 ppm can be very effective to add depth and realism to walnut flavors.

Peanut: A good starting point for 3,5-dimethyl cyclopentane-1,2-dione in peanut flavors is 200 ppm, but up to 1,000 ppm can be used in highly roasted peanut flavors.

Almond: 100 ppm of this chemical can add a pleasant, but subtle, toasted note to almond flavors. Similarly, higher levels can be used to give a more roasted effect.

Savory Flavors

Beef: 3,5-Dimethyl cyclopentane-1,2-dione can be used at quite low levels, around 20 ppm, in beef flavors to add a hint of sweetness and depth. This ingredient is a valuable component of the brown character of roast beef flavors.

Fried onion: Similar use levels are also effective in fried onion flavors; if raised a little, the effect is slightly burnt.

Chicken: 3,5-Dimethyl cyclopentane-1,2-dione can be used at lower levels, starting around 10 ppm, in chicken flavors. Clearly, this ingredient is more useful in brown chicken meat flavors than in white meat flavors.

Bacon: Bacon flavors can accommodate widely varying levels of this chemical, up to around 1,000 ppm in highly fried and smoked flavor types.

Smoke: 3,5-Dimethyl cyclopentane-1,2-dione is very effective in smoke flavors, at around 500 ppm, when used in conjunction with 3-methyl cyclopentane-1,2-dione.

Cooked rice: Adding realism and depth, 20 ppm of this chemical works as an extremely effective modifier of the dominant pyrazine notes in cooked rice flavors.

Fruit Flavors

Strawberry: 3,5-Dimethyl cyclopentane-1,2-dione is not an obvious strawberry flavor ingredient, but it can give an interesting, slightly jammy effect at around 10 ppm.

Apricot: Once again, only a subtle effect is needed in apricot flavors, and 5 ppm of 3,5-dimethyl cyclopentane-1,2-dione makes a good starting point.

Guava: Similar to apricot flavors, a good level of this chemical in guava flavors is around 5 ppm.

Tamarind: This subtle flavor is quite difficult to duplicate and the addition of 3,5-dimethyl cyclopentane-1,2-dione at 10–30 ppm works well.

Fermented Flavors

Whiskey: 3,5-Dimethyl cyclopentane-1,2-dione provides a good rounding effect in whiskey flavors when used at around 100 ppm.

Rum: The effect is similar in rum flavors, but the level of use can be a little higher, at around 200 ppm.

Brandy: The ideal level of 3,5-dimethyl cyclopentane-1,2-dione in brandy and cognac flavors is around 80 ppm.