Flavor Bites: δ-Hexadecalactone

Formulating for both aroma and taste

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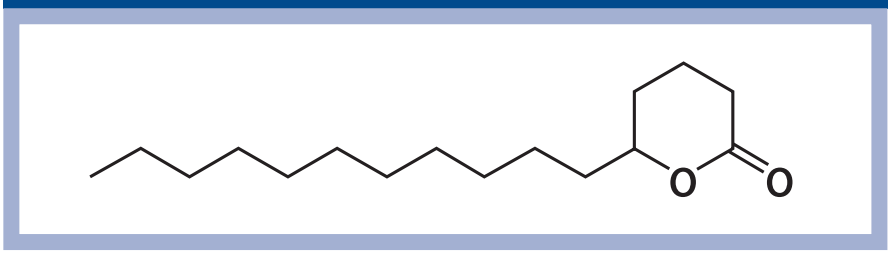
The focus of flavor creation has gradually shifted from an almost exclusive interest in aroma to a more naturally balanced interest in both aroma and taste. δ-Hexadecalactone (FEMA# 4673, CAS# 7370-44-7) is a perfect example of this trend. The aroma of this chemical is relatively restrained, soft and creamy, but the taste effects are much more interesting.

Most dairy products contain a wide range of lactones but normally only four occur in significant quantities: δ-decalactone (FEMA# 2361, CAS# 705-86-2), δ-dodecalactone (FEMA# 2401, CAS# 713-95-1), δ-tetradecalactone (FEMA# 3590, CAS# 2721-22-4) and δ-hexadecalactone. All these ingredients have somewhat similar creamy odor characters, but δ-decalactone offers by far the most aroma strength and impact. The other chemicals offer progressively weaker aromas with increasing molecular weight. Adding δ-dodecalactone in a common, naturally occurring ratio of around two parts of δ-dodecalactone to one of δ-decalactone increases the odor impact marginally but makes the creamy taste noticeably more realistic. This is probably actually not the ideal ratio of these two chemicals if they are viewed in isolation. A ratio of as high as 10:1 offers a far better taste effect, but unfortunately at a prohibitively high raw material cost, depending on the end use.

δ-Hexadecalactone has a weaker aroma than δ-dodecalactone, but it has a stronger creamy taste effect. The lack of aroma strength is not very important, but the better taste characteristics allow this chemical to be used at a practical ratio of two parts of δ-hexadecalactone to one part of δ-decalactone. This is a great improvement on the character of the widely used 2:1 mixture using δ-dodecalactone and δ-decalactone. It is probably also more economical and effective in use than the naturally occurring ratio of one part of δ-decalactone to two parts of all the other three δ-lactones.

The taste effects of δ-hexadecalactone are most obvious in dairy flavors, but it also plays a very interesting role in a very wide range of other flavor categories. In every case it adds only a subtle, but very heat-stable, aroma note. The main attraction is the interesting and effective creamy taste contribution, which adds naturalness and realism.

Structure of δ-hexadecalactone **F-1**



Dairy Flavors

***Butter*:** Widely different levels of δ-hexadecalactone can be used in butter flavors, depending on the level of creamy flavor desired. A good starting point in a flavor designed for use at around 0.05% in a ready to eat sauce is 4,000 ppm.

***Condensed milk*:** Condensed milk flavors can also accommodate high levels of this raw material, and 4,000 ppm deepens the taste of the flavor considerably.

***Cheese*:** In most types of cheese flavors, 2,000 ppm works well, especially in cheddar, gouda and gruyère types. Rather higher levels are effective in blue cheese flavors, and lower levels are best in cream cheese flavors.

***Cream*:** Cream flavors taste vastly better with the addition of 1,000 ppm of δ-hexadecalactone, and higher levels can be used in cream flavors with a hint of a sour note.

***Milk*:** Levels of use in milk flavors are lower than those in other dairy flavors; typically around 500 ppm is effective.

***Buttermilk*:** Similar levels, around 500 ppm, are helpful in buttermilk flavors and add to the realism of the flavor.

***Yogurt*:** Marginally lower levels, around 300 ppm, are preferred in yogurt flavors and can help overcome the thin taste of low-fat products.

Brown Flavors

Chocolate and cocoa: The best level of use in milk chocolate flavors is much higher, around 4,000 ppm, than in dark chocolate and cocoa flavors, where levels around 500 ppm are more appropriate.

Toffee and caramel: High levels can also be used successfully in both these flavor types, starting at around 2,000 ppm.

Vanilla: This note is more subtle in vanilla flavors, but it does add realism and creaminess at use levels around 500 ppm.

***Malt*:** Even lower levels can be effective in malt flavors, around 100 ppm, but higher levels are more appropriate for malted milk flavors, up to 500 ppm.

***Coffee*:** Only very subtle levels are needed in coffee flavors, but even additions as low as 10 ppm can be helpful. Higher levels can be used if a specifically creamy character is desirable.

Nut Flavors

Hazelnut and praline: These flavor types can easily taste thin, and the addition of up to 1,000 ppm of δ-hexadecalactone to nut flavors adds depth and authenticity.

Meat Flavors

***Lamb*:** This chemical is particularly effective in lamb flavors, and levels of use can be as high as 5,000 ppm.

***Beef*:** Roast beef flavors, especially those with a noticeable fatty aspect, can be improved by the addition of around 1,000 ppm of δ-hexadecalactone, adding a realistic taste background to a flavor category that can often taste too simplistic.

***Pork*:** Roast pork flavors can usefully incorporate levels of this ingredient, around 500 ppm, and higher in flavors that emphasize roasted or fried pork skin.

***Ham*:** Slightly lower levels, around 200 ppm, are optimal in ham flavors and can help reduce the harshness of the smoke components.

***Chicken*:** More modest levels are useful in chicken flavors, around 100 ppm, and possibly a little more in fatty chicken flavors.

Fruit Flavors

***Peach*:** The effect here is secondary to the γ-lactones but, nevertheless, quite high levels can be used, up to 1,000 ppm.

***Apricot*:** Most apricot flavors have a more subtle lactone character than peach flavors, and lower levels of δ-hexadecalactone, around 400 ppm, are effective.

***Strawberry*:** A good starting level for this raw material in strawberry flavors is 100 ppm, but higher levels can be used successfully.

***Guava*:** A good level in guava flavors is 100 ppm also, and more can be used in flavors that contain high levels of cinnamate esters.

***Raspberry*:** This chemical is especially effective at around 100 ppm, adding depth and realism to raspberry flavors.

***Blackberry*:** Slightly lower levels, around 50 ppm, are similarly useful in blackberry flavors.

***Pineapple*:** Quite low levels can be helpful in both fresh and canned pineapple flavors, starting at around 20 ppm.

Other Flavors

***Coconut*:** Coconut flavors can accommodate very high levels of δ-hexadecalactone, even up to 5,000 ppm in very creamy flavors.

***Coconut water*:** This chemical is similarly useful in coconut water flavors, but the level of use is much lower, around 200 ppm.

***Cream soda*:** The powerful, creamy taste of this traditional beverage can be improved by the unsubtle addition of around 2,000 ppm of δ-hexadecalactone to flavors.

***Potato*:** Flavors for potato products are always difficult to formulate and often need exceptional heat stability. Levels of around 200 ppm of δ-hexadecalactone and higher in fried potato flavors can be helpful.