Diethyl Succinate

Use in fruit, fermented, savory and brown flavors, as well as in dairy and citrus flavors

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Sometimes even the most interesting raw materials can seem, at first sight, to be rather mundane and uninspiring. For example, at first sight diethyl succinate (FEMA# 2377, CAS# 123-25-1) can seem to be little more than a weak and ineffective alternative to ethyl butyrate and many other low molecular weight aliphatic esters. The character is very mild, predominantly fruity, with hints of leaf green and cooked apples.

Because diethyl succinate is a diester, it has a relatively high molecular weight for a chemical with such a light, fruity aroma character. Interestingly, it is also relatively polar for a flavor chemical with such a high molecular weight. Both these attributes point toward an enhanced taste effect compared with simple aliphatic esters with similar odor character, and this is in fact the case. Diethyl succinate is useful primarily because it subtly deepens and rounds out taste effects. It also is useful in applications involving heat because it is much more heat stable than most ingredients with a similar odor profile.

Several other diesters on the FEMA GRAS list have somewhat similar properties, most importantly diethyl malonate (FEMA# 2375, CAS# 105-53-3) and dimethyl succinate (FEMA# 2396, CAS# 106-65-0). Both are useful but marginally less so than diethyl succinate. More recent diester additions have distinctly higher molecular weights and serve a somewhat different function.

Fruit Flavors

Watermelon: Most of the components of typical watermelon flavors taste very light and thin, and unfortunately many of the most obvious ways of deepening and rounding out watermelon flavors also serve to flatten them and blunt their impact. Diethyl succinate adds subtly to the odor impact and simultaneously rounds out the taste dramatically at levels up to 5,000 ppm in the flavor. This and all subsequent dose rates refer to the level of use in a flavor that is intended for use at 0.05% in a taster, a ready-to-drink beverage or a bouillon.

Grape: Similarly high levels, up to 2,000 ppm, are exceptionally useful and attractive in grape flavors. The effect when used in conjunction with ethyl acetate (FEMA# 2414, CAS# 141-78-6), which is normally the dominant ester, is particularly helpful.

Apple: One thousand ppm of diethyl succinate adds attractive depth and richness to apple flavors without adding an overtly cooked aspect to the profile.

Blueberry: Similar levels, around 1,000 ppm, deepen and add realism to blueberry flavors, which, like watermelon flavors, often tend to be light and thin.

Raspberry: The range of levels of use in raspberry flavors varies dramatically. High levels, in the region of 1,000 ppm, work well in flavors with a more fruity profile. Much lower levels, down to 20 ppm, are more appropriate in more subtle or floral flavors.

Strawberry: Levels used in strawberry flavors also vary, but not as widely. In modern style flavors 500 ppm is a good starting point, adding succulence and depth.

Pineapple: Five hundred ppm of diethyl succinate is also optimal in pineapple flavors, especially those with a fresh, juicy character.

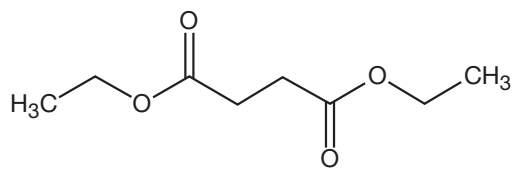
Blackberry: Levels also vary in blackberry flavors, and 500 ppm is typical.

Blackcurrant: The levels used in blackcurrant flavors range up to 400 ppm, and this chemical significantly deepens the fruity component of the flavor.

Peach: The effect in peach flavors is necessarily more subtle, but 200 ppm can be useful to add realism.

Mango: Similarly subtle levels, in the region of 100 ppm, of this ingredient deepen and add taste and realism to mango flavors.

Diethyl succinate **F-1**



Passion fruit: Levels from 20–100 ppm of diethyl succinate are effective in passion fruit flavors.

Apricot: The range of 20–100 ppm levels also works well in apricot flavors, adding depth and realism.

Cherry: Fifty ppm is an ideal level in authentic cherry flavors, although higher levels can be used in more traditional—and obviously fruity—style flavors.

Pear: Twenty ppm is a good starting level in pear flavors, adding succulence and depth.

Fermented Flavors

Whiskey: Diethyl succinate is found widely in nature and is especially prevalent in fermented flavors. It has the effect of softening the flavor profile, adding depth and a subtle, lasting taste effect to spirits and wines sometimes described by wine tasters as "length." Levels of use in whiskey flavors can be quite high, and 5,000 ppm is a good starting point.

Brandy: The effect of diethyl succinate in brandy flavors is very similar but perhaps the ideal level of use is a little lower, around 3,000 ppm in flavors.

Red wine: This ingredient is especially useful in wine flavors to give an impression of age and depth of taste. Levels vary, but 2,000 ppm is typical. Levels used in white wine flavors also vary but are generally lower, depending on the style desired.

Rum: Rum flavors might be expected to be typically higher in aliphatic esters than brandy or whiskey flavors, but in practice the ideal level of this chemical in rum flavors is around 2,000 ppm.

Tequila: The level of use of this ingredient in tequila flavors is much lower, generating a subtle effect starting at around 200 ppm.

Beer: The effect of diethyl succinate in beer flavors is even more subtle, and 50 ppm is a good place to start.

Brown Flavors

Brown sugar: Diethyl succinate is useful in all types of brown sugar flavors, ranging from golden syrup to molasses. The level of use varies but is generally quite high, typically around 4,000 ppm.

Vanilla: In the same way as brown sugar, the level of use in vanilla flavors varies dramatically, but at the high end, 4,000 ppm is a good level to give a noticeable character of matured vanilla bean extract.

Coffee: Levels also vary in coffee flavors, but here it is wiser to start off at a much lower level, around 100 ppm.

Walnut: Diethyl succinate can be added to most nut flavors but the effect is probably best appreciated in walnut flavors, and 100 ppm is a good starting point.

Chocolate: Similar levels, around 100 ppm, are effective in most chocolate flavors, but higher levels can be used in flavors specifically intended for use in alcoholic drinks.

Savory Flavors

Beef: At first sight this essentially fruity note does not seem to have an obvious application to savory flavors. However in practice at moderate levels, the fruity note does not intrude unduly, and the ingredient adds a subtle aspect of succulence to the taste. A good starting level is 500 ppm.

Fried onion: Five hundred ppm is also an effective level in fried onion flavors, adding depth and attractive taste effects.

Tomato: The effects, and the level of 500 ppm, are very similar in tomato flavors, although here the fruity note is actually desirable.

Dairy Flavors

Blue cheese: Five hundred ppm is an interesting level in blue cheese flavors. At this level the ingredient adds subtly to the fruity note and also enhances the taste effect.

Cream: The subtle fruity note of diethyl succinate is very helpful in cream and milk flavors. Levels vary but 100 ppm is typical.

Citrus Flavors

Orange: Diethyl succinate is not such an obviously useful ingredient in citrus flavors. Nevertheless, the effect at 50 ppm is helpful to push the profile in the direction of fresh juice.

Grapefruit: Similar levels, around 50 ppm, are also useful to shift grapefruit flavors more in the direction of juice and to minimize the peel note.