



# $\gamma$ -Valerolactone

This material works well for all nut flavors, but is particularly welcome in walnut, adding depth without disrupting its profile.

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$\gamma$ -Valerolactone (FEMA# 3103, CAS 108-29-2) has a complex odor profile; one that defies easy description. It is quite possible to see some element of the hay-like character of  $\gamma$ -hexalactone within this odor mixture but the caramel character of  $\gamma$ -butyrolactone is definitely dominant. Behind these two warm notes there is also a distinct fruity aspect to the odor profile.

$\gamma$ -Valerolactone is described in many different and contradictory ways in the literature and this is not surprising, given the odor complexity of the chemical. Several sources describe it as “herbaceous,” although the present author finds it difficult to make this connection.

Aside from  $\gamma$ -valerolactone’s use in its own right, it is also the least problematic alternative to  $\gamma$ -butyrolactone, which is a controlled substance in many countries.

The present article describes applications of  $\gamma$ -valerolactone. The levels suggested are for use in flavors intended to be dosed at 0.05% in ready-to-drink beverages or simple bouillon.

## Brown Flavors

**Brown sugar and molasses:**  $\gamma$ -Valerolactone fits perfectly into the many different styles of brown sugar flavors. It works best at a relatively high level of around 2,000 ppm.

**Coffee:** Similar levels, around 1,500 ppm, are also ideal in coffee flavors, adding realism and depth to a category of flavors that can often seem overly bright and shallow.

**Malt:** Levels of addition to malt flavors vary depending on the desired profile and are generally lower in malted milk flavors; 500 ppm is a good place to start.

**Cocoa and chocolate:** In a similar way, the ideal level of addition of  $\gamma$ -valerolactone in cocoa flavors is around 300 ppm, which is higher than the ideal level in a typical milk chocolate flavor, around 100 ppm.

**Caramel and toffee:** 300 ppm is also a good starting point in caramel and toffee flavors, although higher levels are acceptable in flavors having a strong burnt sugar profile.

**Licorice:** 200 ppm is a good initial level for this ingredient in licorice flavors, adding welcome complexity.

**Vanilla bean:** Much lower levels of  $\gamma$ -valerolactone, in the region of 50 ppm, work well for the complex task of recreating the elusive profile of authentic vanilla bean extract.

**Black tea:** 50 ppm also is useful in black tea flavors, adding complexity, depth and realism.

## Nut Flavors

**Walnut:**  $\gamma$ -Valerolactone works well for all nut flavors but is particularly welcome in walnut flavor, adding depth without disrupting its profile even at high levels, up to 2,000 ppm.

**Hazelnut:** In hazelnut flavors,  $\gamma$ -valerolactone adds depth and realism. High levels of around 1,200 ppm work best.

**Peanut:** This ingredient is also extremely effective in roasted peanut flavors, adding depth and rounding out a flavor profile that is often over-bright. The ideal level of addition is in the region of 800 ppm.

## Savory Flavors

**Grill:**  $\gamma$ -Valerolactone is especially helpful in all types of grill flavors, offsetting the more obvious fatty ingredients

and adding realism; 500 ppm is a good starting level.

**Fried potatoes:** The same problem of over-simplicity often can plague fried potato flavors, especially French fried flavors. Here, 500 ppm of  $\gamma$ -valerolactone adds depth and realism.

**Bread:** Freshly baked bread and pizza base flavors can similarly benefit from the addition of around 500 ppm of this raw material.

**Cooked cheese:** The best level of addition of  $\gamma$ -valerolactone in cooked cheese flavors, especially Cheddar and Gruyere, is around 300 ppm.

**Smoke:** Smoke flavors can easily seem far too phenolic; 300 ppm of  $\gamma$ -valerolactone softens their profile and adds depth.

**Beef:** The ideal level in most roast and boiled beef flavors is lower than in grilled beef, around 200 ppm.

**Chicken:** Similarly, roast and boiled chicken flavors benefit from the addition of around 200 ppm of  $\gamma$ -valerolactone.

**Melted butter:** 200 ppm of this ingredient is also effective in adding authenticity to cooked and melted butter, together with ghee flavors.

**Bacon:** The ideal level of use in bacon flavors depends very much on the desired profile but 200 ppm is a reasonable starting point.

**Soy sauce:** 200 ppm of  $\gamma$ -valerolactone adds welcome complexity and depth to soy sauce and related flavors.

**Mushroom:** Cooked mushroom flavors are given added depth and realism by the addition around 100 ppm of this ingredient.

**Fried onion:** Cooked onion flavors, especially fried onion flavors, gain realism from relatively modest levels of addition, around 50 ppm.

**Tomato:** Only quite modest levels of around 30 ppm are needed in fresh tomato flavors to noticeably increase realism. Higher levels of around 100 ppm can be used effectively in cooked tomato flavors.

### Fruit Flavors

**Peach and apricot:**  $\gamma$ -Valerolactone is especially effective in peach and apricot flavors, harmonizing effectively with the higher  $\gamma$ -lactones that dominate both of these flavor profiles; 600 ppm is a good starting level.

**Strawberry:** The ideal level in strawberry flavors is a little lower, around 500 ppm, but the same lactone combinations work in a similar way.

**Raspberry:** In raspberry flavors,  $\gamma$ -valerolactone adds depth and authenticity to the profile. Levels vary but generally are lower in more floral flavors

and higher in more authentic flavors; 300 ppm is a good starting point.

**Blackberry:** In general, somewhat lower levels or around 150 ppm are more effective in blackberry flavors, adding noticeable depth.

**Mango:** 150 ppm of  $\gamma$ -valerolactone also adds pleasant depth and realism to fresh mango flavors.

**Blackcurrant:** In the case of blackcurrant flavors, the effect is much more subtle and only really noticeable in authentic style flavors. The best level of addition is around 50 ppm.

**Plum:** A similarly subtle effect, at a 50 ppm level of addition, is welcome in plum flavors, adding authenticity.

**Cherry:**  $\gamma$ -Valerolactone is not very effective in simplistic, i.e., strongly fruity or benzaldehyde cherry flavors but it does add realism at around 50 ppm in authentic style flavors.

### Other Flavors

**Cereals:** This ingredient fills out the background character of all cereal flavors at around 100 ppm.

**Beer:**  $\gamma$ -Valerolactone is extremely useful in all beer flavors, adding welcome body to the taste. The ideal level of use varies considerable, starting at around 30 ppm in light lager-type beer flavors and ranging up to 150 ppm in dark beers.

**Wine:** Finally, levels of use in wine flavors vary in a similar fashion, from 30 ppm in lighter white wine flavors up to 100 ppm in heavier red wine flavors.

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