Technical Tips

Caramel Color in Carbonated Soft Drinks

Caramel color is the most widely-used colorant in the food industry. The flavor and beverage sector represents the largest use of caramel color.

Selecting the appropriate Caramel Color

Caramel color first and foremost delivers color and provides "eye appeal". Caramel provides the color which looks refreshing and entices customers to purchase the beverage. The first choice for soft drink formulators is one of the Class IV caramels. They are negatively-charged with a wide range of color intensities and shades -- from red to nearly black. The shade is determined by the caramel manufacturing formulation and is measured as Hue Index. The higher the Hue Index value (Class IV caramels range from 4.2 to 5.9), the redder the product. Within any one class of caramel color, there exists an inverse relationship between color intensity (darkness) and hue (redness).

Caramel in aqueous solutions like soft drinks must be chemically-tailored to be compatible with other ingredients. Soft drinks normally carry negatively-charged particles because of tannins derived from plant material, root, bark, etc. Therefore, a negatively-charged caramel should be selected. An important parameter is the isoelectric point or the pH at which the colloidal charge is electrically neutral. Soft drinks need a caramel with an isoelectric point below the pH of the beverage to avoid flocculation/precipitation. A Class IV caramel has an Isoelectric Point between pH 0.5 and 2.0.

Malta, a soft drink common in Latin America, represents one of the exceptions as it requires a Class III caramel (such as DDW 301 or 304). The Isoelectric Point of a positively-charged Class III caramel is between pH 5.0 and 7.0. Malta, a positively-charged product, has a pH around 4.0. So, to avoid flocculation/precipitation one needs a higher isoelectric point to keep the charge positive.

Some beverage developers select a Class 1 caramel for higher hue -- more red to yellow tones. Standard Class 1 caramel colors are not stable in acidic conditions. In response, DDW recently developed acid-stable Caramel Color 520, a Class 1 innovation for the soft drink industry.

0.1% CARAMEL COLOR IN SOLUTION

DDW 520	DDW 108	DDW 050
Class I	Class IV	Class IV
Hue Index = 6.2	Hue Index = 5.8	Hue Index = 4.2

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Cola Flavor Concentrate

A one-part, cola flavor concentrate contains the following typical ingredients:

20 to 40% Water
50 to 70% Caramel Color
Class IV (normally contains 53% to 66% solids)
5 to 10% of the following:
Phosphoric acid
Kola nut extract
Caffeine
Gum arabic or other gum
One or more of:
Grapefruit oil
Lemon oil
Lime oil
Orange oil
One or more of:
Casia oil
Cinnamon oil
Clove oil
Coriander oil
Neroli oil
Nutmeg oil
Ginger oil

Caramel in Soft Drink Concentrates

In addition to the obvious function of delivering color, caramel helps to protect flavors from light deterioration. Caramel color also acts as an emulsifying agent in the preparation of soft drink concentrates to reduce the need for gums. A water-insoluble flavoring agent may be added to caramel or vice versa. Sufficient caramel solids must be present to emulsify flavor. A flavor which contains a high percentage of terpenes (e.g., orange oil) is more difficult to emulsify and will require a greater proportion of caramel solids than an agent containing a small amount of terpenes (e.g., distilled lime oil). Generally all the water -- necessary to serve as the aqueous phase for the emulsification of the flavor -- is present in the volume of caramel used. However, one can add more water to adjust the viscosity of the mixture. A homogenizer is most commonly used to accomplish the emulsification. During the emulsification the water-insoluble flavors break into very small particles with diameters ranging from as high as 10 microns to below 1 micron. For a carbonated soft drink application, the average diameter of these particles should be less than 1 micron to achieve a stable emulsion. Emulsion breakdowns are usually caused by the particle size exceeding 1 micron.

Most Class IV powders (such as DDW 605 or 610) are stable in phosphoric acid and citric acid. Formulators can select powdered caramel color in some beverage systems. The majority prefers liquid caramel for its economy.

Concentrates for soft drinks can be either one-part or two-part systems with caramel color in one or both parts.

Cola product developers usually select double-strength (such as DDW 050 or 055) caramel for its high color intensity and economy. Some believe single-strength's (such as DDW 105 or 108) higher specific gravity contributes "body" to the mouth feel of the cola beverage. Double-strength caramel meets the low caloric value requirements of "diet" or "light" cola formulations.

Caramel Dosage Rates in Finished Soft Drinks

	Single-strength (%)	*Double-strength (%)*
Cola	0.35 to 0.45%	0.15 to 0.20%
Root Beer or Sarsaparilla	0.25 to 0.35	0.10 to 0.15
Guaraná	0.025 to 0.035	0.01 to 0.015
Energy	0.025 to 0.035	0.01 to 0.015
Malta	0.02 to 0.08	not applicable
Cream Soda	0.02 to 0.03	0.01 to 0.015
Apple	0.02 to 0.03	0.01 to 0.015
Ginger Ale	0.005 to 0.015	0.002 to 0.007

Although the task of caramel color in a finished beverage is primarily color, its impact on taste can be significant. Because of the high cost of concentrate ingredients and possible negative interactions if the caramel is not of consistent quality, it does not make economic sense to sacrifice quality for cost. Problems can cost many times the cost of the caramel color.

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