CARAMEL COLOR – The Science and Art: Beverages and other Applications

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Although caramel is used in a wide variety of food products, in general Caramel Color I is used in high proof spirits, Caramel Color II in high proof spirits containing certain vegetable extracts, Caramel Color III in beer, gravies, mixes and sauces, and Caramel Color IV in soft drinks and other food products. Use levels, of course, depend upon the shade desired but the table below gives examples of current use levels in a variety of products for different types of caramel color of a given color intensity. If the color under test has a higher or lower color intensity, adjust accordingly.

	Class I	Class III	Class IV Single	Class IV Double	Class IV Powder
Color Intensity	0.035	0.108	0.108	0.240	0.255
Beer, Light		0.02%			
Beer, Dark		0.3%			
Brandy	0.15%		0.05%		
Bread,Light		1.0%*			
Bread,Rye		2.0%*			
Bread,Pumpernin.		3.0%*			
Cake Mix, Spice					2.0%*
Cake Mix, Dark					5.0%*
Chocolate Milk					0.2%
Cocoa Extender					40.0%
Cola			0.4%	0.2%	
Ginger Ale			0.01%	0.005%	
Gravy		0.6%			
Gravy Dry Mix					3.0%
Gravy Browning Liq.		25.0%			
Ice Cream Wafer.		4.5%			
Licorice		3.6%			
Maple Syrup			0.08%		
Pet Food			0.2%	0.1%	
Root Beer			0.3%	0.15%	
Rum	0.1%				
Vinegar,Malt	0.2%				

* Based on flour weight

As with any food ingredient of a complex nature, application questions and problems concerning caramel color often arise. Below is a discussion of some of these issues.

Soft drinks account for a large part of the caramel market, and the necessary specifications for a product of suitable quality are well known. Caramel Color is used in colas for a variety of reasons, but first and foremost is to provide "eye appeal"; caramel color provides the color that looks refreshing and entices consumers to purchase the product. Among other reasons, caramel color is an emulsifier in its own right. Anwar and Calderon of the Pepsi-Cola Company patented caramel color as an emulsifying agent in 1971.[1] They state in the patent that one of the objects of the patent is "to provide an aqueous emulsion of flavoring oils that do not contain natural gums. The water insoluble flavoring agent may be added to the caramel or the caramel may be added to the flavoring agent. The amount of solids required to emulsify the flavoring agent will depend upon the particular type of flavoring agent used. Thus an agent which contains a high percentage of terpenes, such as orange oil, is more difficult to emulsify and will require a greater proportion of caramel solids to emulsify it than an agent containing a small concentration of terpenes such as distilled lime oil. Generally, all of the water which is necessary to serve as the aqueous phase for the emulsification of the flavoring agent is present in the volume of caramel used. The aqueous admixture of caramel and flavoring agent is then emulsified. The emulsification may be accomplished by means of a homogenizer, a colloid mill or other such apparatus. It is preferred that the average diameter of the emulsified particles be less than 3 microns."

Caramel color also helps protect flavors in clear bottles from deterioration from sunlight, and while sugar and gums provide most of this function, caramel color, with its specific gravity of 1.250 to 1.360 contributes "body" to the mouthfeel of the finished product.

Cola beverages have a negative colloidal charge and contain acidulants so the color used must be compatible in this environment (i.e. a negative caramel); if not, a floc type sediment will occur. On the other hand, a "plug" in the neck of the concentrate bottle or a ring in the neck of the beverage bottle is usually a flavor oil emulsion breakdown, caused by either the average flavor particle size being too large (over 1 micron if caramel color is the emulsifier), or a problem with the flavor oil-gum emulsion. Caramel may sometimes cause this problem, but usually what appears to be caramel are the flavor oils which have come out of dispersion and are colored brown by the inclusion of caramel.

Ginger ale concentrates generally have a high alcohol content, and the caramel color used, in addition to being a negative type, must be able to withstand the alcohol concentration, or precipitation will occur. Precipitations of caramel due to alcohol concentration alone are often reversible with the addition of a small amount of water, however too much water will cloud a ginger ale extract.

Both positive and negative caramel colors are effective in soy sauce as long as the type chosen has the necessary salt stability (some soy sauces are preserved with

up to 20% salt). Usually the positive types have inherent salt stability: in the soft drink (negative) types special formulas are used to provide this stability. It has been found that the positive types of caramel give hues to the finished soy sauce that more closely resembles the hue of the naturally fermented sauces.

Chocolate milk and sometimes very dark cookies (biscuits), do not have true chocolate shades when using caramel alone. In cookies, very pleasing dark shades can be achieved by combining caramel color and alkali processed cocoa. In milk, caramel colors have almost a "muddy" appearance, but this can be overcome by the addition of approximately 0.01% by weight of FD&C Red #40 or Amaranth (formerly FD&C Red #2) giving "Dutch" chocolate shades. By the addition to the caramel and red mix of a small amount of blue and yellow, a more chocolate brown shade can be achieved.

An attractive eggnog shade in milk can be achieved with the use of a light, yellow, Class I color. This color also does a good job in giving baked or microwaved poultry an "oven roasted" appearance including light and dark highlights. Another use of this color is to make a variety of greens by mixing in FD&C Blue #1 (Brilliant Blue FCF). Greens as found in some of the sugars sprinkled on cookies (biscuits) at Christmas can be achieved with this combination.

Soups and gravies containing meat products and colored with caramel often give a consistent but slightly different shade before and after retorting. Both positive and negative caramels work well in this application depending upon the shade desired. Positive caramels generally contribute more red tones.

Vinegar is the product that has probably caused the most problems for caramel manufacturers. Malt vinegars are no problem, as they consistently work well with a positively charged caramel. Cider and distilled vinegars are another story. Negative caramels from the same drum that worked perfectly last week may have a problem with a new batch of vinegar this week. The exact cause of the problem is not known, but changes in alcohol and acetobacter nutrient sources may be involved. Vinegar bottlers are encouraged to make a 24-hour lab test with a new batch of vinegar whenever they change anything.

Caramel colors for beer must have a positive colloidal charge and alcohol stability. The addition of a negatively charged caramel to beer, which contains positively charged proteins, causes an immediate cloud which will agglomerate into particles large enough to precipitate out within a short time. For wines, whiskeys, and liqueurs, either negatively charged soft drink types or specifically formulated spirit types are recommended depending on the application.

If a wine is clarified using gelatin and tannic acid, sufficient tannic acid must be added to remove all of the gelatin. If not, the remaining gelatin (positively charged) and the caramel will precipitate and be removed in the filtration process causing a noticeable

lightening of the product.

For improved stability in liqueurs, especially the creme types it is important to premix the caramel with alcohol before adding the other ingredients. If using dairy ingredients, it is necessary to control the pasteurizer temperatures to prevent scorching the creme, as the scorched particles, brown in appearance, tend to rise, giving the impression of caramel failure.

Hi-proof rums (151^{o}) are best colored with a sucrose based Class I color. When you compare Class I caramel processed exactly the same way except for the syrup used (sucrose or corn syrup), the sucrose-based product will tend to have the higher alcohol tolerance.

A continuing problem with alcoholic beverages in clear glass bottles is that of fade. A product such as rum or a blend containing caramel will experience moderate fade under florescent light but the same product in direct sunlight will experience a ten-fold increase in fade rate. Current research indicates the least fade in direct sunlight is encountered with the light Class I caramels; while under florescent light the double strength soft drink type performs best. Alcoholic solutions of soft drink Class IV caramels subjected to direct sunlight tend to fade at a faster rate in the upper visible region (610u was used) than in the lower visible region (430u was used); while the Class I under study, in direct sunlight, tended to fade at an equal rate at both wavelengths, and gave the visual impression of less fade.

References

[1] U.S. Patent No. 3,622,343, Emulsions of Flavoring Oils and process for making same, Anwar and Calderon, Nov. 23, 1971