

# Safety and use of food colorants

A focus review on caramel

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# Outline

## **1. Food Additives**

- a) What they are
- b) Reasons for use
- c) Functions

## **2. Regulation on Food Additives**

- a) Carry over principle
- b) Stringent re-evaluations

## **3. Food colours**

- a) Why they are used
- b) Caramel colours

# Food Additives

# Food Additives

Substances intentionally added to the product directly or indirectly during production, processing, storing or packaging to improve or protect the quality of the product

- ✓ May/may not have nutritive value
- ✓ not normally consumed as a food and not normally used as a characteristic ingredient of food
- ✓ may be expected to result, in it or its by-products becoming directly or indirectly a component of such food

# Justification for food additives

- The use of food additives justified only when such use has an advantage
- does not present an appreciable health risk to consumers
- does not mislead the consumer
- serves one or more technological functions and only where these objectives cannot be achieved by other means that are economically and technologically practicable

# Functions of food additives

- Sweeteners- added as a taste enhancer
- Colours- added to improve appearance
- Preservatives prolonging shelf-life of foods
- Antioxidants prolonging shelf-life of foods
- Stabilisers to maintain the physico-chemical
- Emulsifiers to maintain the mixture of oil and water in a foodstuff.

# Regulations on Food Additives

# Regulation of food additives

- Codex
- FDA
- EU- EFSA
- Canada-Food and Drug Regulations
- Kenya –KEBS
- Ministry of Public Health (Cap 254)



# Listing system of food additives

- Colours

E100- E 180

E100- Curcumin

E123-Amaranth

E150a caramel I

E150b Caramel II

E150c Caramel III

E150d Caramel IV

- 16 sweeteners

E 420, E421, ..E950-E968

E420- Sorbitals

E421- Mannitol

E 950- Acesulfame K

E 951- Aspartame

E 952- Cyclamates

E 954 - Saccharins

E 955 -Sucralose

# **Foods in which additives not permitted by virtue of the carry over principle set 1333/2008**

- Unprocessed foods
- Honey
- Non-emulsified oils and fats of animal or vegetable origin
- Butter
- Unflavoured pasteurized and sterilized milk and unflavoured plain pasteurized cream (excluding reduced fat cream)
- Unflavoured fermented milk products, not heat-treated after fermentation

## **Foods additives not permitted.....**

- Unflavoured leaf tea
- Sugars
- Dry pasta, excluding gluten-free and/or pasta intended for hypoproteic diets
- Natural mineral water and spring water and all other bottled or packed waters
- Unflavoured buttermilk (excluding sterilised buttermilk)
- Coffee (excluding flavoured instant coffee) and coffee extracts

## **Foods in which colour not permitted by virtue of the carry over principle(32)**

- ▶ Unprocessed foods
- ▶ All bottled or packed waters
- ▶ Cream and cream powder (unflavoured)
- ▶ Chocolate milk
- ▶ Buttermilk (unflavoured)
- ▶ Oils and fats of animal or vegetable origin
- ▶ Ripened and unripened cheese (unflavoured)
- ▶ Butter from sheep and goats' milk
- ▶ Salt, salt substitutes, spices and mixtures of spices

## Foods no colour permitted(32)....

- Wine and other products covered by Council Regulation (EC) No 1234/2007
- Cocoa products and chocolate components in chocolate products
- Tomato paste and canned and bottled tomatoes
- Wine vinegar
- Honey
- Malt and malt products
- Sugar including all mono- and disaccharides
- Flour and other milled products and starches

# Re evaluation programme of food additives

- Food additives approved before 20 January 2009 to be re evaluated
- 17 already re-evaluation by EFSA
- 5 food colours shall be evaluated by 15.4.2010- E123, E 151 E 155 E 180
- Emulsifiers, stabilizers, gelling agents to be re evaluated by 31.12.2016
- E 322 E 400-E 419 E 422-E 495 E 1401-E 1451
- Re evaluation by 31.12.2016
- E 551 Silicon dioxide, E 620-625 Glutamates, E 1105 Lysozyme and E 1103 Invertase
- The remaining food additives other than colours and sweeteners shall be evaluated by 31.12.2018

# Food Colours

Added to food:

- to make up for colour losses following exposure to light, air, moisture and variations in temperature, processing
- to enhance naturally occurring colours;
- to add colour to foods that would otherwise be colourless or coloured differently.

# Browning reactions

- Caramalization
  - heating of sugar
- Enzymatic browning
  - Enzymes in plants-protection
- Maillard reaction
  - amino acids +sugars





# Caramel colours production

- Class I: Prepared by heating carbohydrates with or without acids or alkalis; no ammonium or sulfite compounds are used.
- Class II: Prepared by heating carbohydrates with or without acids or alkalis in the presence of sulfite compounds; no ammonium compounds used.
- Class III: Prepared by heating carbohydrates with or without acids or alkalis in the presence of ammonium compounds; no sulfite compounds.
- Class IV: Prepared by heating carbohydrates with or without acids or alkalis in the presence of both sulfite and ammonium compounds .

# Caramel colours production...

- carbohydrate raw materials - food grade nutritive sweeteners consisting of glucose, fructose, invert sugar and/or polymers thereof (e.g. glucose syrups, sucrose or invert sugars, and dextrose).
- The acids and alkalis are food-grade sulfuric or citric acids and sodium, potassium or calcium hydroxides or mixtures thereof.
- ammonium compounds: Ammonium hydroxide, ammonium carbonate and ammonium hydrogen carbonate, ammonium phosphate, ammonium sulfate, ammonium sulfite and ammonium hydrogen sulfite.
- sulfite compounds: sulfurous acid, potassium, sodium and ammonium sulfites and hydrogen sulfites.

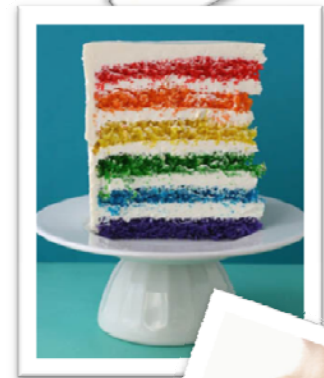
# Uses of caramel colours

**FDA Title 21: Food and Drugs (data is current as of September 6, 2012 )**

**1. Subpart A- Foods-** *Uses and restrictions.* Caramel may be safely used for coloring foods generally, in amounts consistent with GMP...

**2. Subpart B—Drugs-** *Uses and restrictions.* Caramel may be used for coloring ingested and topically applied drugs generally in amounts consistent with GMP.

**3. Subpart C – Cosmetics-** *Uses and restrictions.* Caramel is safe for use in coloring cosmetics generally, including cosmetics applied to the area of the eye, in amounts consistent with GMP.



Beverages	Maximum permitted level mg/l	Maximum reported use level(mg/l)			
		a	b	c	d
Non-alcoholic flavoured drinks	<i>Quantum satis</i>	10,000	30	1360	5,000
Cider and Perry	<i>Quantum satis</i>	6,000	3,000	2,040	500
Americano	<i>Quantum satis</i>	5,000	5,000	100	1,000
Aromatised wines, aromatised wine based drinks and aromatised wine product cocktail/s as mentioned in Reg(EEC)160/91	<i>Quantum satis</i>	10,000	5,000	680	200
Aromatised wine based drinks(except bitter soda) and aromatised wines as mentioned in Reg (EEC)160/91	<i>Quantum satis</i>	5,000	5,000	680	5,000
Spirit drinks(including products less than 15% alcohol by volume except those mentioned in	<i>Quantum satis</i>	5,000	5,000	680	5,000

Food stuffs	Max permitted level(mg/kg)	Max reported use level mg/kg			
		a	b	c	d
Bugre meat with minimum vegetable and or cereal content of 4%		100	100	100	100
Candied fruits and vegetables		200	200	2,050	200
Complete formulae and nutritional supplement for one under medical supervision		50	50	9,500	1000
Confectionary		10,000		8,000	300,000
Breakfast sausages with a minimum cereal content of 6%		100	100	100	100
Complete formulae and nutritional supplement for use under medical supervision		50	50	9,500	1,000
Edible ices		500	500	500	500
Edible casings		500	500	500	500
Extruded,puffed and /or fruit flavoured breakfast cereals		10,010	500	2,040	500
Fine bakery wares		15,000	3,000	11,500	5,000
Malt bread		30,000	3,000	2,040	5,000
Vinegar		6,000	5,000	100,000	100,000

<b>Purity</b>	<b>150 a</b>	<b>150b</b>	<b>150c</b>	<b>150d</b>
Colour bound by DEAE cellulose	Not more than 50 %	More than 50 %	Not more than 50 %	More than 50 %
Colour bound by phosphoryl cellulose	Not more than 50 %		More than 50 %	
Sulphur bound by DEAE cellulose		More than 40 %		
Solid content				
Colour intensity	0,01-0,12	0,05-0,13	0,08-0,36	0,10-0,60
Ammoniacal nitrogen			Not more than 0,3 % ( 2 )	Not more than 0,6 % ( 2 )
Sulphur dioxide		Not more than 0,2 % ( 2 )		Not more than 0,2 % ( 2 )
2-acetyl-4-tetrahydroxy-butylimidazole			Not more than 10 mg/kg ( 2 )	
4-methylimidazole (4-MEI)			Not more than 200 mg/kg ( 2 )	Not more than 250 mg/kg ( 2 )
Total nitrogen	Not more than 0,1 %	Not more than 0,3 % ( 2 )	0,7-3,3 % ( 2 )	0,3-1,7 % ( 2 )
Total sulphur	Not more than 0,2 %	0,3-3,5 % ( 2 )	Not more than 0,2 % ( 2 )	0,8-2,5 % ( 2 )
Nitrogen/sulphur ratio of alcohol precipitate				0,7-2,7
Absorbance ratio of colour bound by DEAE cellulose		19-34	13-35	
Absorbance ratio of alcohol precipitate				8-14
Absorbance ratio (A 280/560)		Greater than 50		Not more than 50
Arsenic	Not more than 1 mg/kg	Not more than 1 mg/kg	Not more than 1 mg/kg	Not more than 1 mg/kg
Lead	Not more than 2 mg/kg	Not more than 2 mg/kg	Not more than 2 mg/kg	Not more than 2 mg/kg
Mercury	Not more than 1 mg/kg	Not more than 1 mg/kg	Not more than 1 mg/kg	Not more than 1 mg/kg
Cadmium	Not more than 1 mg/kg	Not more than 1 mg/kg	Not more than 1 mg/kg	Not more than 1 mg/kg
Heavy metals (as Pb)				

# Link between food color and **4MEI**

- 4-methylimidazole (4-MEI) is a by product formed in certain foods during the normal heating and browning process and possibly as a by product of fermentation.
- 4-MEI forms in foods, such as caramel, during the heating, roasting and cooking process and is practically everywhere. 4-MEI is not added to food.
- It is found in small amounts in foods and beverages that have been commonly consumed for decades, including confectionery, coffee, molasses, soy sauce, gravies, some beers and fizzy drinks





<u>Dark beer</u>	<u>4Mel, mg/kg</u>
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Samson	3.69
Staropramen	10.51
KruDovice	3.81
Bernard	12.70
Velkopopovicky' kozel	1.58
Starobrno	28.03

Source:

*B. Klejdus et.al. J. Sep. Sci. 2006. 29. (378-384)*

<u>Product</u>	<u>Amount: mg/kg</u>
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Steak Sauce	1.0-3.4
Whisky	0.12-0.14
Soy Sauce	0.35-0.55
Roasted coffee	0.37-1.24
Confectionary	Nd - 0.78

Note 1000ug=1mg

*Source:*

*S. Yoshikawa; Shokuhin Eiseigaku Zasshi (1981) 22 (3) 189-196*

*G. Fuchs; J. Ag. Food Chem. (1975) 23(1) 120-122*

## Products

## Amount: ug/kg

Beer	3.0 – 202 ug/kg (0.003-0.202)mg/kg 0.000003
Spirits	1.0 – 531 ug/kg
Sauces	2.0 – 154 ug/kg
Soups	54 – 663 ug/kg
Gravy	315-503 ug/kg
<b>Bread</b>	<b>5.27 mg/kg (5270ug/kg)</b>
Dessert pastries	30 – 818 ug/kg
Chocolate	11 – 35 ug/kg
Soft Drinks	37-613 ug/kg

### *Source:*

*S.C. Cunha et. al. J. Food Comp & Anal. 2011 24(11) 1009-1011*

*T. Shibamoto et.al. J. Ag & Food Chem. 2011 59(2) 615-618*

**THANK YOU**