LECTURE 11: FOOD COLOURS

11.1 Introduction

Colour is the first sensory quality by which foods are judged; food quality and flavour are closely associated with colour. Colour far outweighs flavour in the impression it makes on the consumer even when the flavour are pleasant. Colour powerfully influences the consumer's ability to identify the flavour and quality. Colour is the general name of the all sensations arising from the activity of the retina of eye. Colour is important to many foods, both that are unprocessed and manufactured. Together with flavour and texture, colour plays an important role in food acceptability. The colours of foods are result of natural pigments or of added colours. Colour compounds are a unique class considering their structural diversity and extremely complex chemical and physical properties.

11.2 Importance of Food Colours

As food should also be attractive to the eye, colour plays a key role in defining its quality. Colour is the first characteristic of the food that is noticed and it determines our expectation of both flavour and quality. Colorants affect the identification of flavor as well as it affects sensing the actual level of sweetness in the food.

1. To overcome the damage to the appearance caused by processing and to preserve product identity
2. To ensure colour uniformity of food products that naturally vary in colour
3. To intensify the colours of certain manufactured foods
4. To help protect flavour and light sensitive vitamins during storage by a sunscreen effect
5. To serve as a visual indication of quality
6. To give colour to certain foods such as sugar confectionery, soft drinks, sauces, ice lollies and soft drinks, this would otherwise be virtually colourless.

11.3 Why Food Products need to be Coloured?

Absence of any adverse reaction, on regular and prolonged consumption is the main requirement in choice of a dye as food additive. It is also necessary that it should impart attractive and natural colour to food.

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11.4 Classification of Food Colours

Colours added to food are regulated as food additives. In foods, colouring matter means those substances that when added restores or adds the colour in foods. Synthetic colourants used commercially are also known as certified colour additives. The added colourants can be classified as:

A) Natural Colours: Natural colourants are those that are extracted from animals, vegetables, fruits, minerals and spices used to colour foods. e.g. carotenoids from annatto, paprika, saffron, anthocyanins, caramel, chlorophyll and turmeric. Carotenoids are used the most followed by the red pigment and brown coloured caramels.

I. Anthocyanins

Anthocyanins are the water soluble compounds responsible for the red to blue colour of variety of fruits and vegetables. It can be derived from various sources including grapes, redcurrants and blackcurrants, raspberries, strawberries, apples, cherries, red cabbages, bringle. They provide orange, red, blue, violet and magenta colours.

The use of anthocyanins dates back to antiquity as Romans used highly coloured berried to augment the colours of wine.

II. Carotenoids

Carotenoids are widely spread natural pigments in plants and animals. It is estimated that nature produces some 3.5 tonnes of carotenoids every second. Over 600 different carotenoids have been identified and many of these are present in our diet.

They provide natural yellow, orange or red colours of many food as well as being used extensively non-toxic natural or nature-identical colorants. Chemically the carotenoids are aliphatic or alicyclic members of terpene group. Eight isoprene units joined in a tail-to-tail manner at the center of the molecule. The carotenoids can be divided into hydrocarbon carotenes and their oxygenated derivatives, called xanthophylls (violaxanthin, neoxanthin etc).

a) β-carotene

Beta carotene occurs in nature usually associated with a number of chemically closely related pigments and extracts have been used as food colorants for many years. It was first isolated from carrots and hence the name carotene was given to this yellow pigment. The carrot represents the most commonly known source of carotene. It also occurs in a wide variety of other fruits and vegetables including banana, jack fruit, maize, mango, papaya, pumpkin, watermelon, red pepper, spinach, peaches, apricots, oranges, broccoli, etc. It imparts yellow-to- orange colour in foods. It is used at a concentration of 0.13% to 2%. The most important application of oil soluble form of β-carotene is for colouring butter and margarine. In water-based products like ice-cream, yoghurts, etc., water soluble nor-bixin products are used.

b) β -apo-8'-carotenal

Beta-apo-8'-carotenal is found in abundance in the vegetable kingdom, e.g. in the pulp and skin of citrus fruits and in various fodder plants including oranges, spinach, grass and marigold. It was first synthesized in the year 1962.

Certain specifically developed β-apo-8'-carotenal formulations products may be used in food products like cheese, imitation dairy products, pastry, whipped margarine, non-standardized salad dressings and fresh dressing.

c) Canthaxanthin

Canthaxanthin is a diketo carotenoid pigment with an orange-red colour. It occurs in the edible mushroom, chanterelle (Cantharellus cinnabarinus), in the plumage and organs of flamingoes, the scarlet ibis (Guara rubra), and the roseate spoonbill (Ajaja ajaja), and in various crustacea and fish (trout, salmon). Canthaxanthin is the principal pigment of the pink edible mushroom, Cantharellus cinnabarina. It is also isolated from algae, hydra and the brine shrimp. It widely occurs in water birds that feed on crustacean. Thus it is a major pigment of several flamingo species, occurring in their feathers, leg, skin, egg yolk, blood plasma a d liver. It was first synthesized chemically in the year 1964.

Canthaxanthin is used at 5 to 60 ppm levels to impart red colour to food products. It blends well with β-carotene to produce orange shades. Canthaxanthin is frequently used to enhance and standardize the colour of tomato products like juice, sauce, soup, and dehydrated powder. The other food applications include Russian and French dressings, fruit drinks, and ice cream.

d) Annatto

Annatto is a natural colorant derived from pericarp of annatto (Bixa orellana L.) seeds. Annatto is fast growing shrub which produces cluster of pods containing 10 to 50 seeds. The seeds are covered with thin pulpy, bright orange resinous coating which serves as a source of colour.

Annatto colour is generally used at a level of 0.5 to 30 ppm in food products resulting in hue ranging from light yellow to dark orange. The type of colour preparation employed and the product to be coloured also dictate the end effect.

Oil-soluble annatto was formerly used in fat-based products like butter and margarine. However now it is also used in creams, spreads, desserts, etc. Water soluble annatto was traditionally used in cheese and cheese products.

e) Betalain

Betalain is found in wide range of fruits, vegetables, leaves of some plants and in underground part of beet-root.
Among the different phenolic compounds that are relevant in plant foods, indigoids and indol derivatives represent the largest class. Betalain is the most noticeable group among indigoids. The betalain contain nitrogen in their ring structure and also contain glycoside residue. Betalain is defined as 'a water soluble, indigoid pigment distributed in the cytoplasm responsible for most red, violate, orange and yellow colours found in flowers, fruit, some leaves and underground part of beet root'.
Betalain colourants have been used in a wide variety of food products such as beverages, jams, jellies, ice cream, yoghurt, gelatin desserts, canned fruits, toppings, confections etc. It is a natural food colourant and relatively safe. It has various health benefits. Betalain has no impact on environment. It gives consumers an appeal of fresh foods. The betalain can be used as colourant in organic foods, a developing concept in recent years. Since very low level of colour is used in food product it imparts very less technical defects to product.

B) Nature identical synthetic colours: These are synthesized in the laboratories and a very limited range is available.

C) Artificial colours: These are two types FD and C dyes and FD and C lakes. Dyes are water-soluble compounds that produce colour in solution. Lakes are made by combining dyes with alumina to form insoluble colourants. Coal tar is available in wide range of colours. Indigocarmine is an example of synthetic colour.

D) Inorganic colours: PFA prohibits use of inorganic colour except titanium dioxide, which is permitted in chewing gum (Max limit 1.0 %).

Food Colours Permited by FSSA

Natural colouring matter which may be used – Except as otherwise provided in the rules the following natural colouring principles whether isolated from natural colours or produced synthetically may be used in or upon any article of food.
a) Carotenoids
b) Chlorophyll
c) Riboflavin (Lactoflavin)
d) Caramel
e) Annatto
f) Saffron
g) Curcumin or turmeric

Addition of inorganic matter and pigments prohibited- Inorganic colouring matters and pigments shall not be added to any article of food; Provided that chewing gum may contain

Titanium dioxide – (food grade) up to a maximum limit of 1 per cent.

Synthetic food colours which may be used- No synthetic food colours or a mixture thereof except the following shall be used in food

S. No.	Colour	Common Name (1956)	Colour index	Chemical Glass
(1)	(2)	(3)	(4)	(5)
1.	Red	Ponceu 4R Carmoisine Erythrosine	16255 14711 45430	Azo Azo Xanthene
2.	Yellow	Tartrazine Sunset yellow FCF	19140 15985	Pyrazolone Azo
3.	Blue	Indigo Carmine Brilliant Blue FCF	73015 41190	Indigoid Triarylmethane
4.	Green	Fast green FCF	41153	Triarylmethane

Use of Lake colours as colourant in foods—Aluminium Lake of Sunset yellow FCF may be used in powdered dry beverages mix (powdered softdrink concentrate) upto a maximum limit of 0.04 percent weigh by weight. The maximum limit of colour content in final beverage for consumption shall not exceed 8.3 ppm and that of aluminium content shall not exceed 4.4ppm of the final beverage for consumption. Provided that the powdered dry beverages mix (powdered softdrink concentrate) label shall give clear instruction for reconstitution of product for making final beverage.