



SNS COLLEGE OF TECHNOLOGY (AN AUTONOMOUS INSTITUTION)

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DEPARTMENT OF FOOD TECHNOLOGY

**COURSE CODE & NAME: 19FTE304 & FOOD ADDITIVES AND
NUTRACEUTICALS
III YEAR / V SEMESTER**

UNIT : I – FOOD COLORS, EMULSIFIERS AND STABILIZERS

TOPIC 1: Natural and synthetic colors; fake colors; inorganic pigments.





INTRODUCTION

DEFINITION

- These food colours are any substance that is added to food or drink to change its colour for acceptability.
- Colour is one of those important ingredients upon which the quality of food and flavour can be judged.
- These are derived from both artificial and natural sources in varied intensities.



PURPOSE OF FOOD COLOURANTS

- To maintain or improve safety and freshness
- To maintain or improve nutritional value
- To improve taste, texture and appearance of the product
- To influence the consumer to buy a product through visual perception



CATEGORIES OF FOOD COLOURS

Natural colours:

Pigments made by living organisms.

Examples: Beetroot extract, luetin, annatto.

Nature-identical colours:

Man-made pigments which are also found in nature.

Example: Betacarotene and canthaxanthin.

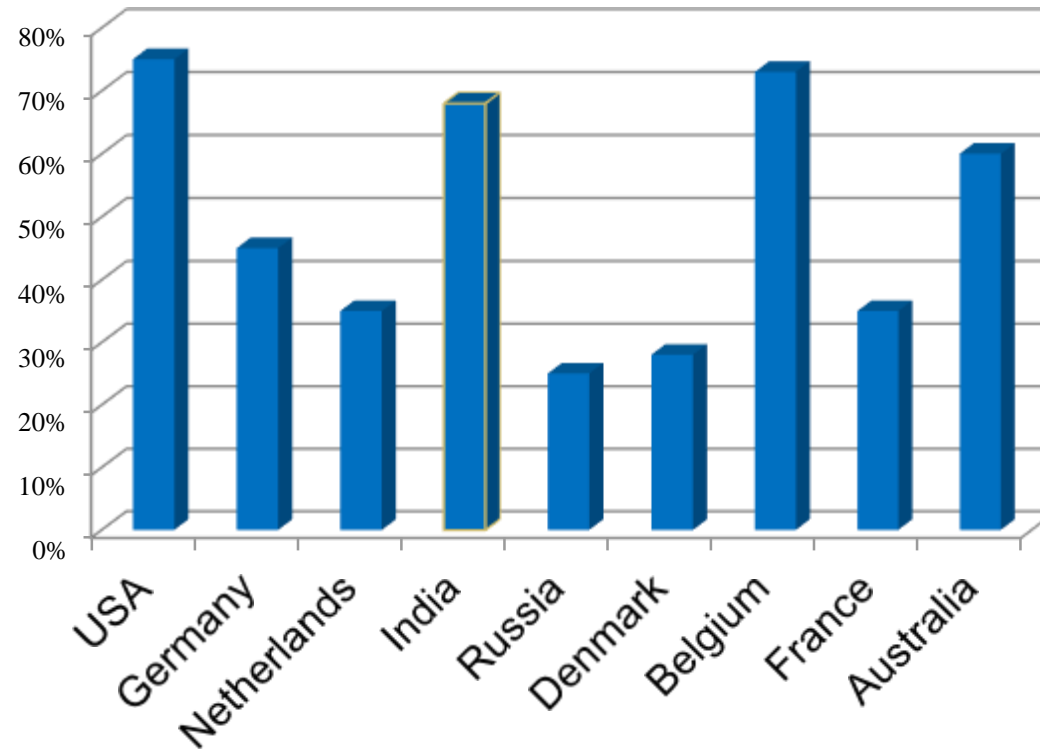
Artificial colours:

Artificial colours are purely man-made colours.

Example:Alura red, Brilliant blue etc



GLOBAL MARKET TREND IN USE OF FOOD COLOURS



Used in sweet, bakery, confectionery, Ice-cream, fruits and vegetables, beverages and so on



Natural colours are best over artificial colours



REASONS:

Artificial food colourings causes:

Attention Deficit Hyperactivity Disorder (ADHD)

Behavioural problems

Depression

Food allergies

Headaches and migraines



AVAILIBILITY



Food colours are available as

- Liquids
- Liquid gel dye
- Powders
- Gels
- Pastes



NATURAL COLOURANTS

- Natural coloring matters are synthesized by plant and animal organisms or microorganisms and they naturally exist in them.
- Pigments produced by modification of living organism materials such as caramel, vegetable carbon and Cu-chlorophylline (vide infra) are accepted as natural although they are not found in nature (except carbon)
- . The most notable colorants obtained from animal sources are Natural Sepia (cuttle fish), Crimson (Kermes Louse) and Tyrian purple (Murex shellfish)



TYPES AND USES OF NATURAL COLOURS





Permitted Natural Colours



In India, Rule 26 of The Prevention of Food Adulteration Act, 1954 (PFA) and The Prevention of Food Adulteration Rules, 1955 & 1999 permitted following colours which are isolated from natural sources

- ❑ Beet root concentrates
- ❑ Annatto
- ❑ Beta-carotene
- ❑ Cochineal Extract
- ❑ Grape extract
- ❑ Paprika oleoresin
- ❑ Turmeric Oleoresin
- ❑ Luetin
- ❑ Phycocyanin
- ❑ Saffron





BEET ROOT CONCENTRATES



Beet contains inorganic nitrates which are precursor to a very important signalling molecule that our body needs to function- Nitric Oxide. NO acts as a vasodilator to allow more oxygen flow in Cardiovascular diseases

Source: Red beet roots (*Beta vulgaris*)

Colour: Red, yellow & bluish red

Colour pigment: Betalains

Applications:

- Ice Cream
- Ice bar
- Hard candy
- Jam and jellies
- Sherbets
- Noodle/pasta



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PRESERVATIVES

Under Rule 52 of PFA rule (1955), definition of preservative is given as

A preservative means a substance which when added to food, is capable of inhibiting, retarding or arresting the process of fermentation, acidification or other decomposition of food.

CLASSIFICATION:

- Class I preservatives.
- Class II preservatives.



Nutritional benefits of betalain



- Detoxifies body
- Fat free and energy giving
- Lowers cholesterol and BP
- Prevents skin ageing
- Excellent food during pregnancy, contains natural folic acid
- Studies have shown that betalains have antioxidant, antimicrobial and antiviral activity (Pedreno and Escribano, 2001).



ANNATTO

Strong pigmentation of annatto seeds makes it a natural food colour and it has plenty of applications in cosmetics but more importantly, it has numerous medicinal and herbal effects.



Annatto extract:

- Extracted from annatto seeds, *Bixa orellna* L.

History:

- Originated in Brazil
- Formerly used for body painting to ward off evil and also as an insect repellent.

Two forms:

Bixin & Norbixin

NUTRITIONAL BENEFIT:

- Improves memory
- Excellent wound healer
- Improves immunity
- Prevents constipation



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BETA CAROTENE

Beta carotene is an organic, strongly coloured red-orange pigment abundant in plants and fruits.

Source: Carrot (*Daucus carota*)

Colour: Orange and yellow

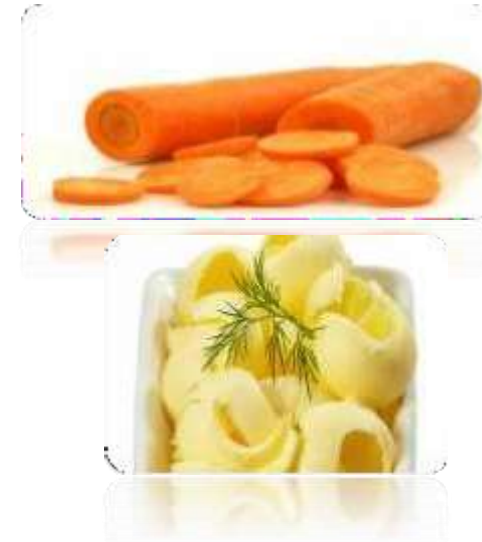
Colour pigment: Carotinoids

Applications:

- Margarine

Nutritional benefits of Beta carotene

- Act as Provitamin A
- Prevents from UV rays and sunburns
- Act as antioxidant and radical scavenger
- Prevents skin ageing
- It prevents from lung and breast tumour



Studies have shown that Feeding carotene extracts prevents carcinoma formation in a two-stage model of skin carcinogenesis in male Sencar mice. (Punnamperuma. 2000).



COCHINEAL EXTRACT

The cochineal is a scale insect from which the natural colour carmine is derived. It does not contain much nutritional aspects rather it is sometimes responsible for some allergic reactions.

Source: Cochineal insect

Colour: Magenta-red

Colour pigment: carmine or carminic acid

Applications:

- Cakes
- Alcoholic drinks
- Beverages
- Ice cream
- Candy
- Sweets.





LUETIN

Lutein in marigold along with zeaxanthin are potential antioxidants deposited in the retina of eyes and prevent macular degeneration

Source: Marigold flower (*Tagetes erecta*)

Colour: Light yellow to intensely yellow color

Colour pigment: Lutein

Applications:

Baked goods

Beverages

Breakfast cereals

Chewing gums

Dairy product

Egg products

Fats and oils

Sauces



Nutritional benefits of Lutein

- Antioxidants in marigolds help fight and prevent cancer
- Boosts immunity
- Improves ocular health
- Excellent wound healer by rubbing on burns or scratches



GRAPE EXTRACT



Anthocyanins and flavonols are the most important grape polyphenols as they possess many biological activities, such as antioxidant cardioprotective, anticancer, anti-inflammation, antiaging and antimicrobial properties (Xia *et al* 2010)

Source: Cherry, raspberry, strawberry

Colour: Blue purple

Colour pigment: Anthocyanins

Applications:

- Fruit filling pie
- Gelatin desserts
- Jam, jelly and squashes
- Ice cream
- Candy
- Sweets.

BENEFITS:

- Anti-inflammatory and Anti-allergic
- Antibacterial
- Antiviral
- Anti-carcinogenic
- Vasodilator actions
- Visual acuity





PAPRIKA OLEORESIN



Its active pigments accounts for 30–60% of total carotenoids in fully ripe fruits which comprises of 11 conjugated double bonds, keto group, and a cyclopentane ring. These structural characteristics give rise to free radical scavenging ability and prevent colon carcinogenesis. They also have stronger antioxidative effects than carotene. (Derera. 2005)

Source: Red pepper (*Capsicum annuum*)

Colour: Bright orange to red-orange in food products

Colour pigment: Capsanthin and Capsorubin

Applications:

- Seasonings
- Snacks
- Salad dressings
- Popcorn
- Beverages

Nutritional benefits of Capsanthin

- Anti-inflammatory and Antioxidant properties
- Natural sources of omega3 fatty acid
- Fight against gastritis and acidity
- Decreases motion sickness and nausea
- Rich source of Vit C
- Relaxes respiratory muscles



TURMERIC OLEORESIN (CURCUMIN)

Turmeric (*Curcuma longa*) has been used for 4,000 years to treat a variety of conditions. Studies show that turmeric may help fight infections and some cancers, reduce inflammation, and treat digestive problems (Krishnaswamy 2008)

BENEFITS:

Source: Turmeric (*Curcuma longa L.*)

Colour: Yellow orange

Colour pigment: Curcumin and curcuminoids

Applications:

Preserved foods like pickle

Baked foods

Confectionary





Chlorophyll:



- Chlorophyll is common substance in nature which is a green pigment occurring as a result of vegetable and fruit plants photosynthesis.
- Chlorophyll is used in bakery products, dairy products, candies, cereals, jams and jellies to give green color.
- Chlorophyll is also used as a complementary color when it is needed to dim off the yellowish cheese milk color



LIMITATIONS OF USING NATURAL FOOD COLOUR

- Some sources of natural colours have their own flavour which may affect the taste of the finished product. (Turmeric)
- Actual colour may not retain as such when subjected to high temperatures.
(Grape juice extract)
- Can cause allergic reactions (Cochineal extract, Annatto)
- Natural food colour are costlier than artificial colourings
(Saffron)
- At times raw ingredients remains scarce. (Marigold extract)
- Require in large quantities when compared to Artificial dyes.
➤ (Cochineal extract)



INDIAN COMPANIES THAT PRODUCE NATURAL COLOURS

Anju Phytochemicals private limited ; Bangaluru

India

International flavours an Fragnances ; Chennai India

L Liladhar and company ; Navi mumbai India

SAF East company private company ; Mumbai India

Snowfield Plante naturelle ; Thane India

Vin Flavours ; Vadodara India



SYNTHETIC COLOURANTS

➤ DEFINITION

The substances which are not found in nature due to chemical structures and obtained by chemical synthesis are known as synthetic colorants.

- The first synthetic organic color obtained is the purplish lilac color discovered by William Henry Perkin in 1856. It was obtained from the organic coal tar.
- Synthetic colorants have many advantages over natural colorants.
- Synthetic food colorants surpass natural colorants due to their high coloring ability, various color tone, homogeneous color distribution, brightness, stability, and ease of application



- With high water and oil dissolution properties, shelf life of the synthetic colorants are quite long.

Synthetic colorants are divided into three groups according to their solubility.

- 1- Water soluble synthetic colors
- 2- Fat soluble synthetic colors
- 3- Lake colors



Water soluble synthetic colors



➤ Allura Red AC:

This synthetic colorant, generally known to be derived from insects, is actually produced from coal tar. Allura Red AC is used in the production of food like carbonated drinks, gums, snacks, sauces, soups, wine and especially apple wine. While European Union affirms its use; Denmark, Belgium, France, Switzerland, Austria, Norway and Sweden have banned it

➤ Amaranth:

This substance gives reddish brown color and it is water soluble .

➤ Sunset Yellow:

Sunset yellow, which is orange red color, is usually used for food such as bread, drinks, cereals, sweet powders, ice cream and snacks

➤ Brilliant Blue FCF and Brilliant Black BN:

Available in blue and black colors, it exists in powder and granular form. It is easily soluble in water while being less soluble in ethanol. Brilliant black is used in the production of various cheese, wine, sauce and beverages



- **Tartrazine:** Tartrazine is used to obtain lemon yellow color and is added to food products such as bread, beverages, cereals, peanuts, confectionery, cream, ice cream and canned food.
- **Erythosine:** Being a xanthen-class colorant in the structure of benzoate, erythosine exists the form of red powder or granules. It is added to flavored milk and puddings, ice products, chewing gum and candies, jelly and drink powders.
- **Quinoline yellow:** Quinoline yellow is a synthetic substance used to obtain a greenish yellow color. It is used in soft drinks, jams and canned foods, edible ice, sweets, candies, pickles, sauces and spices.
- **Brown FK and Brown HT:** Brown FK is used in smoked and cured fish, meat and chips, while Brown HT is used in various biscuits, chocolates and cakes.



Oil soluble synthetic colorants



- Artificial colorants soluble in oil or organic solvents are insoluble in water as they do not contain groups capable of forming salt form as in water-soluble colorants.
- This group of colorants are not allowed to be used for food coloring because of their toxic properties.

For example, the use of oil-soluble Penso SX for the coloring of butter and margarine was banned in 1976. Oil Red XO, Yellow AB used in the coloring of orange peels and Yellow OB are not allowed to use because of their toxic properties



Lake colorants

- Lake colorants are water-insoluble precipitation of aluminum hydrate substrate and are produced in the form of very fine powders.
- The dye content and particle size determine the color tone of the powder .
- As they are not soluble in water, oil and other solvents, they are dispersed in food and produce color.
- They are used in cakes, biscuit fillings, confectionery, powder drinks, sweets, soups and spice mixtures



Inorganic natural colorants



- Aluminium dust and silver for silver gray color, gold for real gold color, iron oxides for yellow, red, brown or black colors, titanium dioxide for white color and calcium carbonate for opaque appearance are important inorganic natural colorants.
- These colorants are used in the production of confectionery coating, liqueur decoration, chocolate, calcium carbonate, gum and bread



THANKYOU