CONTENTS

- Definition
- Classification
- Uses
- Health hazards
- Analysis
- Rules and regulations
INTRODUCTION
Food

- Food is the energy source
- on which depends both the health and ill health
FOOD COLOURS

- 1 factor of attraction of food is its colour
- Influence Appetite and choice of food
What the natural colour of a food indicates?

- May indicate degree of sweetness, ripeness, or decay
- May indicate type of flavour
- May provide visual information about the phytochemical properties that are +ve to health
What is a Colour Additive?

- A color additive is any dye, pigment or substance that can impart colour, alone or through reaction with other substances, when added or applied to a food, drug, cosmetic or to the human body.
SYNONYMS

- Food Coloring Agents
- Food Colorants
- Colorants
- Color additives
- Food dyes
Why are color additives added?

The primary reasons include:

- Offsetting color loss due to light, air, extremes of temperature, moisture, and storage conditions.
- Masking natural variations in color.
- Enhancing naturally occurring colors.
- Providing identity to foods.
- Protecting flavors and vitamins from damage by light.
- Decorative or artistic purposes
- Increase appetite appeal
- To make less desirable food more desirable
- To mask defects
- May keep certain foods tasting fresher for long time
Classification of food colors
FDA classification

1. Non certified
2. Certified
Non certified colors
- Do not need certificate to sell or use
- Derived from plants, animals, minerals, other than coal & phenol
- These are mainly foods and/or food ingredients rather than food additives
Classification

Non certified (natural)

- Naturally occurring
- Commercially produced
Permitted Natural Colours-India

a) Beta-carotene
b) Beta-apo-8' carotenol
c) Methyl ester of Beta-apo-8, carotenoic acid
d) Ethyl ester of Betaapo-8' carotenoic acid
e) Canthaxanthin
f) Chlorophyll

g) Riboflavin (Lactoflavin)
h) Caramel
i) Annatto
j) Saffron
k) Curcumin or turmeric
Natural ingredients - code of federal regulation (CFR)

- FD&C Blue No.2 (dye & lake)
- FD&C Green No.3 (dye & lake)
- FD&C Red No.3 (dye)
- FD&C Blue No.1 (dye & lake)
  - FD&C Red No.3 (dye)
  - FD&C Red No.40 (dye & lake)
  - FD&C Yellow No.5 (dye & lake)
  - FD&C Yellow No.6 (dye & lake)
- Orange B
- Citrus Red No.2
- Annato extract
- B-Apo- 8’ carotenol
- Beta carotene
- Beet powder
- Canthaxanthen
- Carrot oil
- Cohineal extract
...... natural ingredients - code of federal regulation (CFR)......

- Grape color extract
- Grape skin extract
- Paprika
- Paprika oleo-resin
- Riboflavine
- Saffron
- Titanium dioxide
- Turmeric
- Turmeric oleo-resin
- Vegetable juice
- Cotton seed flour-toasted partially, cooked
- Ferrous gluconate
- Fruit juice
- Grape colour extract
- Grape skin extract
- Paprika
Commercially produced

- **Annatto** - from seed of the *Achiote*
- A green dye - from *chlorella algae*.
- **Cochineal** - from the cochineal insect, *Dactylopius coccus*.
- **Betanin** - from *beets*.
- curcumene - *Turmeric*
- **Saffron**
- **Paprika** - red chilly
- anthocyanene – *Elderberry* juice
- **Caramel** - from sugar
USES
<table>
<thead>
<tr>
<th>Colourant</th>
<th>Colour</th>
<th>Use</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anthocyanin</td>
<td>Blue-reddish shades</td>
<td>Soft drinks, alcoholic drinks, pickles</td>
</tr>
<tr>
<td>Annatto</td>
<td>Orange shades</td>
<td>Dairy &amp; fat products, desserts</td>
</tr>
<tr>
<td>Beta-carotene</td>
<td>Yellow-orange</td>
<td>Butter, fats, oils, soft drinks, fruit juices, ice creams</td>
</tr>
<tr>
<td>Canthaxanthin</td>
<td>Orange red-red</td>
<td>Souses, soups, meat &amp; fish dishes</td>
</tr>
<tr>
<td>Paprika</td>
<td>Orange-red</td>
<td>Meat products, snack, soups, salad</td>
</tr>
<tr>
<td>Saffron</td>
<td>Yellow</td>
<td>Baked goods, rice dishes, meat dishes, soups</td>
</tr>
<tr>
<td>Crocin</td>
<td>Yellow</td>
<td>Dairy products, jams, pasta, rice</td>
</tr>
<tr>
<td>Lucin</td>
<td>Yellow</td>
<td>Ice creams, dairy products, sugar, flour</td>
</tr>
<tr>
<td>Beet powder</td>
<td>Bluish red</td>
<td>Frozen, ice creams, flavored milk</td>
</tr>
<tr>
<td>Ingredient</td>
<td>Color</td>
<td>Applications</td>
</tr>
<tr>
<td>-------------</td>
<td>----------------</td>
<td>------------------------------------------------------------------</td>
</tr>
<tr>
<td>Cochineal</td>
<td>orange</td>
<td>soft, alcoholic drinks</td>
</tr>
<tr>
<td>carmine</td>
<td>Bluish red</td>
<td>Soft drinks, sugar, flavor confectionary, pickles, souces</td>
</tr>
<tr>
<td>Sandal wood</td>
<td>Orange-orange red</td>
<td>Fish processing, alcoholic drinks, seafood, dressings, meat products</td>
</tr>
<tr>
<td>chlorophyll</td>
<td>Olive green</td>
<td>Soups, souces, fruit products, jams</td>
</tr>
<tr>
<td>caramel</td>
<td>Yellowish tan-red brown</td>
<td>Alcoholic drinks, soft drinks, desserts, ice creams, souces</td>
</tr>
<tr>
<td>turmeric</td>
<td>Bright yellow</td>
<td>Yogurt, frozen products, pickles</td>
</tr>
<tr>
<td>riboflavin</td>
<td>yellow</td>
<td>Cereal products, sherbet, ice cream</td>
</tr>
<tr>
<td>Ingredient</td>
<td>Colour</td>
<td>Uses</td>
</tr>
<tr>
<td>-------------------------</td>
<td>--------</td>
<td>-------------------------------------------</td>
</tr>
<tr>
<td>safflower</td>
<td>yellow</td>
<td>Soft drinks, alcoholic drinks</td>
</tr>
<tr>
<td>Titanium dioxide</td>
<td>white</td>
<td>Sugar coated confectionary</td>
</tr>
<tr>
<td>Iron oxide</td>
<td>red</td>
<td>Sugar coated confectionary, meat &amp; fish pastes</td>
</tr>
<tr>
<td>Silver, gold, aluminium</td>
<td></td>
<td>Surface coating of sugar confectionary, cake decoration</td>
</tr>
</tbody>
</table>
Physiological properties
natural colours

- Besides colouring food, several natural dyes possess bioactive properties and have been used as therapeutic agents and as diagnostic tools.

- Some of the dyes have been reported for following curative effects; analgesics, antibacterial, antifungal, antileprotic, antiviral and anti-inflammatory

- Choleretic and hydrochologic action - eg CURCUMINE

- Deodorant, reduce halitosis, healing - eg CHLOROPHYILL

- Pro vitamin A, prevention of UV sunburns, antioxidant and radical scavenger, prevention of lung and breast tumor - eg CAROTENE

- Prevention of macular degeneration - eg LUTEIN

- Prevention of cardiovascular disease and tumors - eg ANTHOCYANINS
certifiable colour additives
Every batch has to be certified

- manufactured from chemical compounds like petroleum & coal sources
Certified (synthetic)

- Artificial
- Natural identical
Based on consistency

- Certified
  - Dyes
  - Lakes
# Permitted Synthetic Colours-India

<table>
<thead>
<tr>
<th>s.no</th>
<th>Colour</th>
<th>Common name</th>
<th>Colour Index</th>
<th>Chemical Class</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Red</td>
<td>Ponceau4R Carmoisine Erythrosine</td>
<td>16255 17420 45430</td>
<td>Azo Azo Xanthene</td>
</tr>
<tr>
<td>2</td>
<td>Yellow</td>
<td>Tartrazine Sunset Yellow FCF</td>
<td>19140 15985</td>
<td>Pyrazolone Azo</td>
</tr>
<tr>
<td>3</td>
<td>Blue</td>
<td>Indigo Carmine Brilliant Blue FCF</td>
<td>73015 42090</td>
<td>Indigoid Triarylmethane</td>
</tr>
<tr>
<td>4</td>
<td>Green</td>
<td>Fast Green FCF</td>
<td>42053</td>
<td>Triarylmethane</td>
</tr>
</tbody>
</table>
In the USA, the following seven artificial colorings are permitted in food as of 2007:

- **FD&C Blue No. 1 - Brilliant Blue FCF, E133** (Blue shade)
- FD&C Blue No. 2 – **Indigotine, E132** (Dark Blue shade)
- FD&C Green No. 3 - **Fast Green FCF, E143** (Bluish green shade)
- **FD&C Red No. 40 - Alura Red AC, E129** (Red shade)
- FD&C Red No. 3 - **Erythrosine, E127** (Pink shade) [4]
- **FD&C Yellow No. 5 – Tartrazine, E102** (Yellow shade)
- FD&C Yellow No. 6 - **Sunset Yellow FCF, E110** (Orange shade)
<table>
<thead>
<tr>
<th>colourants</th>
<th>uses</th>
</tr>
</thead>
<tbody>
<tr>
<td>Blue No.1</td>
<td>Beverages, dairy products, icings, syrups</td>
</tr>
<tr>
<td>Blue No.2</td>
<td>Baked goods, snacks, cereals, ice creams, cherries</td>
</tr>
<tr>
<td>Green No.3</td>
<td>Beverages, puddings, ice creams, sherbets, dairy products</td>
</tr>
<tr>
<td>Red No.40</td>
<td>Gelatine, puddings, dairy products</td>
</tr>
<tr>
<td>Red No.3</td>
<td>Cherries in fruit cocktails, canned fruits for salads</td>
</tr>
<tr>
<td>Yellow No.5</td>
<td>Custards, beverages, ice creams</td>
</tr>
<tr>
<td>Yellow No.6</td>
<td>Cereals, backed goods, snacks, ice creams, dessert powder</td>
</tr>
</tbody>
</table>
Natural colours V/S Synthetic colours
Natural colorants

- Obtained from natural sources
- Processed by physical means
- May be less stable
- Less bright
- Not uniform
- No health harm
- Good consumer acceptability
- Expensive
- High microbiological contamination

Synthetic colorants

- Obtained by chemical reaction
- High stability to light, O2, PH
- Highly colored
- Color uniformity
- Health problems
- Consumer acceptability questionable
- Less costly
- Low microbiological contamination
HAZARDS OF FOOD COLOURANTS
<table>
<thead>
<tr>
<th>Name</th>
<th>E #</th>
<th>Usage</th>
<th>Facts you need to know</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ponceau 4R, Conchineal Red A</td>
<td>E124</td>
<td>Food colouring</td>
<td>People with asthma, rhinitis or urtecaria - symptoms worsen</td>
</tr>
<tr>
<td>Sunset Yellow FCF, Orange Yellow S</td>
<td>E 110</td>
<td>Food Colouring</td>
<td>Animal studies indicate growth retardation and severe weight loss. People with asthma, rhinitis, or urtecaria should avoid this product.</td>
</tr>
<tr>
<td>Tartrazine</td>
<td>E 102</td>
<td>Yellow food coloring</td>
<td>Allergic reactions and asthmatic attacks. Implicated in bouts of hyperactivity disorder in children. Asthma, rhinitis and urtecaria - symptoms worsen</td>
</tr>
<tr>
<td>Name</td>
<td>E#</td>
<td>Usage</td>
<td>Facts</td>
</tr>
<tr>
<td>-----------------------------</td>
<td>-------</td>
<td>------------------------</td>
<td>-------------------------------------</td>
</tr>
<tr>
<td>Allura Red</td>
<td>129</td>
<td>Snacks, soups</td>
<td>Asthma, rhinitis urticaria</td>
</tr>
<tr>
<td>Amaranth, Brilliant black</td>
<td>123</td>
<td>Wine, fish role</td>
<td>Asthma, rhinitis urticaria, other</td>
</tr>
<tr>
<td></td>
<td>151</td>
<td>Snacks, cheese</td>
<td>allergies</td>
</tr>
<tr>
<td>Erythrocine</td>
<td>127</td>
<td>confectionaries</td>
<td>Promotes thyroid allergies</td>
</tr>
</tbody>
</table>
PERMITTED FOOD COLOURS – SAFETY ASSESSMENT
Usage of synthetic colours has been restricted to a maximum limit of 100 - 200 ppm
...safety assessment...

<table>
<thead>
<tr>
<th>Colour</th>
<th>Name</th>
<th>Acceptable Daily Intake (mg/kg b wt)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Red colour</td>
<td>Ponceau 4R</td>
<td>4.0</td>
</tr>
<tr>
<td>Red colour</td>
<td>Carmoisine</td>
<td>4.0</td>
</tr>
<tr>
<td>Red colour</td>
<td>Erythrosine</td>
<td>0.1</td>
</tr>
<tr>
<td>Yellow colour</td>
<td>Tartrazine</td>
<td>7.5</td>
</tr>
<tr>
<td>Yellow colour</td>
<td>Sunset yellow FCF</td>
<td>2.5</td>
</tr>
<tr>
<td>Blue colour</td>
<td>Indigo carmine</td>
<td>5.0</td>
</tr>
<tr>
<td>Blue colour</td>
<td>Brilliant blue FCF</td>
<td>12.5</td>
</tr>
<tr>
<td>Green</td>
<td>Fast green FCF</td>
<td>25.0</td>
</tr>
<tr>
<td>category</td>
<td>Range</td>
<td>Average</td>
</tr>
<tr>
<td>--------------------------</td>
<td>---------</td>
<td>---------</td>
</tr>
<tr>
<td>Candy &amp; confections</td>
<td>10-400</td>
<td>100</td>
</tr>
<tr>
<td>Beverages</td>
<td>5-200</td>
<td>75</td>
</tr>
<tr>
<td>Dessert powders</td>
<td>5-600</td>
<td>140</td>
</tr>
<tr>
<td>cereals</td>
<td>200-500</td>
<td>350</td>
</tr>
<tr>
<td>cherries</td>
<td>100-400</td>
<td>200</td>
</tr>
<tr>
<td>Pet foods</td>
<td>100-400</td>
<td>200</td>
</tr>
<tr>
<td>Bakery foods</td>
<td>10-500</td>
<td>50</td>
</tr>
<tr>
<td>Ice creams &amp; sherbets</td>
<td>10-200</td>
<td>30</td>
</tr>
<tr>
<td>sausage</td>
<td>40-250</td>
<td>125</td>
</tr>
<tr>
<td>snacks</td>
<td>25-500</td>
<td>200</td>
</tr>
<tr>
<td>Nuts, gravy, jam</td>
<td>5-400</td>
<td>-</td>
</tr>
</tbody>
</table>
REGULATION OF FOOD COLORS
In India control commettie for food standards (CCFS), National Codex Commettie, under Health Ministry, takes regulations according to PFA act

Laws of FDA & British food laws are taken as the basis
HOW FDA ACT

- Regulate
- Evaluate
- Certify
- Approve
How FDA act...

Regulates

- Types of foods to which color additives to be added
- Which colorant to add
- How much to add
- Labeling, ie, how it should be identified on food label
How FDA approve and certify

- Monitor quality, consistancy, strength & safety of color prior to its use in food
- Animal studies & studies in humans are conducted
- Monitor the extent of consumption & any new researches on its safety
E number

- Are number codes for food additives, usually found on food labels, in European Union
- The numbering scheme follows that of the International Numbering System (INS) as determined by the Codex Alimentarius committee
- Accepted internationally, without the E,
### E value classification by numeric range

<table>
<thead>
<tr>
<th>Range</th>
<th>Colours</th>
</tr>
</thead>
<tbody>
<tr>
<td>100–109</td>
<td>yellows</td>
</tr>
<tr>
<td>110–119</td>
<td>oranges</td>
</tr>
<tr>
<td>120–129</td>
<td>reds</td>
</tr>
<tr>
<td>130–139</td>
<td>blues &amp; violets</td>
</tr>
<tr>
<td>140–149</td>
<td>greens</td>
</tr>
<tr>
<td>150–159</td>
<td>browns &amp; blacks</td>
</tr>
<tr>
<td>160–199</td>
<td>others</td>
</tr>
</tbody>
</table>

**Colours**

- yellows
- oranges
- reds
- blues & violets
- greens
- browns & blacks
- others
Analysis of food colorants
- To quantify
- To identify
Methods should be

- Simple
- Rapid
- Inexpensive
Analysis of natural colourants

- General methods
- Specific instrumental methods
General methods

Sensorial analysis-
Direct inspection

- Visual
- Smells
- Flavors
Specific instrumental methods

1. Physical instrumental methods
2. Physico-chemical instrumental methods
Physical instrumental methods

1. Monochromatic colorimeter
2. Tri stimulus colorimeter
3. Colorimetric spectrophotometer
Analysis

Physico chemical analysis

1. Sample preparation
2. Identification
3. Qualitative evaluation
Analysis of synthetic colourants

- Chromatography
- Spectrometry
- Electro chemical methods
DYES

- Dissolve in water,
- Not soluble in oil, soluble in water
- Manufactured as powders, granules, liquids or other special purpose forms.
- Used in beverages, dry mixes, baked goods, confections, dairy products, pet foods and a variety of other products.
- Have side effects
LAKES

- Are the combination of dyes and insoluble material.
- Lakes tint by dispersion.
- Lakes are oil dispersible.
- Lakes are more stable than dyes.
- Ideal for coloring products containing fats and oils or items lacking sufficient moisture to dissolve dyes.
- Typical uses include coated tablets, cake and donut mixes, hard candies and chewing gums, lipsticks, soaps, shampoos, talc, etc. in which leaching of colour is indesirable.
Applying the Food Coloring

- Apply a few drops of food colours to the food at a time
- stirr until it reaches the desired color.
- Food coloring is essentially made up of molecules that are formulated to absorb certain wavelengths of light, called photons.
- The molecules are so efficient that, when added to food of a different color, they can either trump or alter the original shade of the food.
...applying food colouring

- Food colouring processes depend on the solubility and stability of the colourant.

Eg: annatto

- **Stability**: light-fair
- **Heat**: good under 130 degree C
- **Solubility**: fats & oils
Colour retention agents

- Used to preserve a food's existing colour
- Absorb or bind O2, to prevent damage of food

Eg - Vit c
Conclusion

- Colour additives are added to foods for imparting colours, give a natural look, attract consumers.

- Though synthetic colourants have more advantages, they may have side effects as they may affect health.

- Their controlled use benefits.

- Sticking to natural colours is more healthful.
THANK YOU