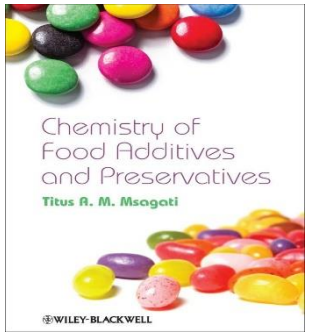
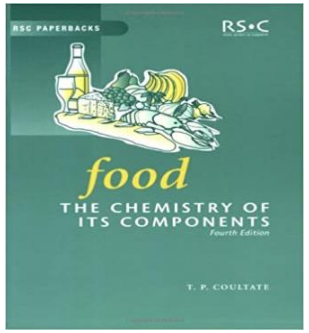
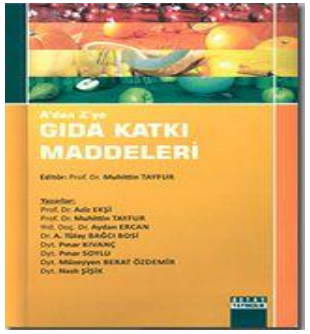
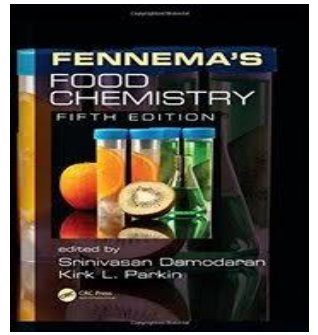
7. Week:
COLOURANT FOOD ADDITIVES

1. 

2. 

3. 

4. 

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COLOURANT FOOD ADDITIVES

Colour is very important in our appreciation of food. Each food has a colour tone that identifies with itself. Some colors, such as coffee, salmon, wheat, and cherry red, get their name from some foods. Therefore, one of the features that the consumer is looking for in food is its recognised colour.

Colourant food additives are introduced in foods to give them a more attractive look and, in some instances, to replace lost or fading natural colours during preparation, transportation or storage.

Many food pigments are, unfortunately, unstable during processing and storage. Complete prevention of undesirable changes is often difficult or impossible.

Pigment stability is impacted by factors:

* the presence or absence of light,
* oxygen
* metals and oxidizing/reducing agents
* temperature
* water activity
* pH

Because of the relative instability of naturally occurring pigments, colourants are sometimes added to foods.

Some of these additives are natural (e.g. carotenoids, anthocyanins and betalains) and others are prepared chemically or artificially (e.g. azocompounds, amaranth, brilliant blue, indigo carmine, new red, ponceau 4R, sunset yellow, tartrazine and allura).

It is forbidden to contain coloring additives such as bread, eggs, pasta, tomato paste, juice, coffee, tea, salt, honey and raki.

CLASSIFICATION OF FOOD COLOURANTS

Basically, food colourants are divided into two classes depending on whether they are natural or artificial, or the chemistry of the functional groups responsible for the coloring effect.

Natural or artificial food colorants are classified into three main groups: natural food colorants, naturally identical colorants and artificial / synthetic colorants.

Based on their chemistry, food colorants can be grouped as follows: flavonoids (main sources are fruits and vegetables); indigoid (main source beet); and carotenoids (main sources are carrots, tomatoes and oranges).

Natural food colourants

This class includes compounds originating from plant sources, mainly anthocyanins which are obtained from red fruits. Natural food colouring agents are composed of a number of major and minor pigment classes.

One of the known properties of the natural colourants is their instability towards pH, heat or light. This property is in sharp contrast to synthetic colourants, which are stabilised by the presence of other molecules.

Some of the natural sources of food colourants include the anthocyanins with characteristic colour ranging from red to blue found in mature fruit (e.g. strawberry, blueberries, cherries, grapes), vegetables (e.g. onions, cabbages), seeds (e.g. purple sunflower) and flowers. Another source is betanin which has a characteristic red colour as found in red beets (beetroot). Caramel pigment is obtained through catalytic heating of carbohydrates. Some pigments such as carminic acid or carmine are obtained from insects (female cochineal insects).

Other sources include the carotenoids, β- carotene (e.g. bixin, norbixin or annatto extract); lycopene; lutein (xanthophyll and canthaxanthin). Other sources include the widely known natural green pigments of chlorophyll and chlorophyllin (a water-soluble pigment). Curcumin is another source, extracted from a root tuber of a plant known as curcuma. Curcumin is also the major pigment of turmeric.

Nature-identical food colourants

Members of this class are actually compounds synthesised to the chemical identity of the natural colourants such as β-carotene, canthaxanthin and riboflavin.

Generally, the majority (if not all) of the natural and nature-identical colours are hydrophobic, that is, mostly insoluble in water. Ways of introducing them into foods:

* to convert them into their sodium or potassium salt forms, making them hydrophilic

* to dissolve them in a hydrophobic medium such as oil, and then introduce them into water-soluble platforms

Synthetic/artificial food colourants

As their name suggests, artificial food colourants are a product of chemical processes in which molecules which are capable of imparting colours to foods are produced or synthesised. Examples of synthetic food colourants include tartrazine and carmoisine. The majority of synthetic colourants are hydrophilic and thus water soluble, a property which means they can be introduced in foods without the need for pre-processing. The main classes of synthetic food colours are azo dyes (e.g. amaranth); quinoline (e.g. quinoline yellow); xanthene (e.g. erythrosine); triarylmethanes and indigoid (e.g. indigo carmine).

SOME IMPORTANT FOOD COLOURANTS

β-carotene

Some of the natural colourants such as β-carotene, which is obtained naturally from a number of fruits and vegetables, can also by synthesised or produced artificially. This pigment is an isomer of carotene which has a characteristic colour of orange–yellow. The compound is also used in the food industry as a food supplement, as it also shows characteristic antioxidant activity.

Cochineal extract and carmine

Carmine pigment is obtained naturally as a concentrated solution after removing alcohol from an aqueous alcoholic extraction of the dried insect coccus cacti. This insect is known to be rich in carminic acid which is the principle colouring pigment (orange–red colour) .

Turmeric

This pigment is a product from a root tuber of a plant known as Curcuma longa. Solvent extraction of this rhizome yields turmeric oleoresin, containing the colouring molecule known as curcumin which is responsible for the characteristic colour orange–yellow.

Canthaxanthin

This colouring agent can be prepared synthetically or extracted from natural sources (mainly from algae of Daphnia species, brine shrimp and Cantharellus cinnabasinus). This pigment is responsible orange–red characteristic colours in foodstuffs.

Anthocyanins

These compounds occur in abundance in the plants (e.g. in sunflower, ginger and cranberries). They are found mainly as glycosides, existing in various combinations and providing various characteristic colours ranging from red, blue or purple . Examples of pigments that belong to the anthocyanins include cyaniding, delphinidin, pentunidin and malvidin. Anthocyanins are known to be readily absorbed and metabolised.

Caramel

Caramel is normally obtained from a controlled heat treatment of some of the carbohydrates, and is responsible for characteristic reddish-brown to brown-black colouration.

Titanium dioxide (TiO_2)

TiO_2 occurs naturally in three different crystalline forms and to avoid such a mixture, when used as food additive TiO_2 is normally prepared artificially through synthesis.

The synthetic compound, which is a white opaque powder, is used as a colouring agent in cheese and confectionary products.

Paprika and paprika oleoresin

This compound is obtained naturally from the dried pods of mild capsicum (Capsicum annuum). The compound is responsible for a characteristic deep red colouration, due to its main ingredients of capsanthin and capsorubin.

These compounds are used as colouring agents in meat products, vegetable oils and a number of canned products. The compounds also find use as spices.

Working Mechanisms of Food Colourants

The mechanism by which colouring and colour retention agents work involves the binding to oxygen atoms. This causes oxidation in foods, resulting in loss or fading of the natural colour thus preventing the destructive process before it commences.

Measurement of colour and physico-chemical parameters

Purified pigments are characterised by parameters:

* colour strength
* sugar
* viscosity
* Brix measurements
* pH
* bulk density
* storage stability

Quality measurements and Analytical Methods

Due to the many colouring agents and colour retention molecules that enter the market, both natural and synthetic, it is necessary to monitor the quality of such products. The most common quality assurance that is normally performed on food colourants is the peroxide value (PV) measurement. This is generally performed using high-performance liquid chromatography (HPLC) . The determination of the peroxide value may also be accomplished photometrically using the ferric thiocyanate method. Because they have strong UV absorbing chromophores and contain electro-active functions, it is common to use chromatographic and electrochemical methods for the analysis of colorants in foodstuffs.