FOOD CHEMISTRY

Mini project submitted in partial fulfilment of the requirement for the Degree of Bachelor of Science in Chemistry

BY

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DECLARATION

We hereby declare that this work entitled ***FOOD CHEMISTRY*** is a bonafide record of the mini project work carried out by us under the supervision and guidance of ***Dr. Sunita Kurur Head Of The Department, Assistant Professor ,Departmet of Chemistry, All Saints' College, Thiruvananthapuram*** and that no part of this project has been submitted by me for any other degree, diploma or similar titles of any other universities.

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CERTIFICATE

This is to certify that this mini project report entitled ***FOOD CHEMISTRY*** submitted by Abira Krishna BR,Megha Ramakrishnan,Gowri JR,Rudra Suresh,Sanviya Paulson is a bonafide record of the mini project work carried out by us under the supervision and guidance and that no part of this report has been presented for any other degree, diploma or similar titles of any other university.

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Food Chemistry

Food chemistry is the study of chemical processes and interactions of all biological and non-biological components of food. A wide variety of methods are available to maintain and enhance appearance and taste of food. Food processing and preservation methods also create products that are convenient for consumers. Many chemicals with a little or no nutritive value are added to food for a variety of reasons. They are usually added during the preparation and processing of food items. Such chemicals are collectively known as Food Additives.

Food Additives

Substances that are added to food to maintain or improve the safety, freshness, taste, texture or appearance of food are known as Food additives.

They are added to food mainly for :

(i) Preservation.

(ii) Enhancing the appeal.

(iii) Adding nutritive value.

The major categories of Food Additives

1. Food colours
2. Flavours and sweeteners
3. Fat emulsifiers and stabilising agents
4. Flour treatment agents
5. Antioxidants
6. Preservatives
7. Nutritional Supplements.

Except for the last category, all others have no nutritive value.

Food Colours

A Food colour is defined as any dye, pigment or a substance which on addition to the food gives it colour. Sometimes, the loss of the natural colour of food during processing is compensated by adding food colours. Addition of food colours elevates the appearance of food and makes it more attractive. It also influences our perception of its taste. colorants are commonly used in the production of soft drinks, candies, bakery products, canned and vegetable products, diary products, and meat and fish products. There are two main types of Food colours based on its origin. They are (i) Natural Food colours and (ii) Artificial Food colours.

Natural food colours

Natural food colours are mainly obtained from seeds, Vegetables, Flowers and Fruits, Other plant parts. Some Natural food colours are also obtained from insects. common examples of natural colours include the following.

Carotenoids

They have deep red, yellow or Orange colour. They are produced by plants and algae as well as several bacteria and Fungi. One typical example is β-carotene.

Chlorophyllin

They are semi-synthetic derivatives of chlorophyll. They are generally water soluble salts.

Anthocyanins

They are water soluble pigments present in plants and their colour depends on the pH. They are structurally poly phenols belong to Flavonoids.

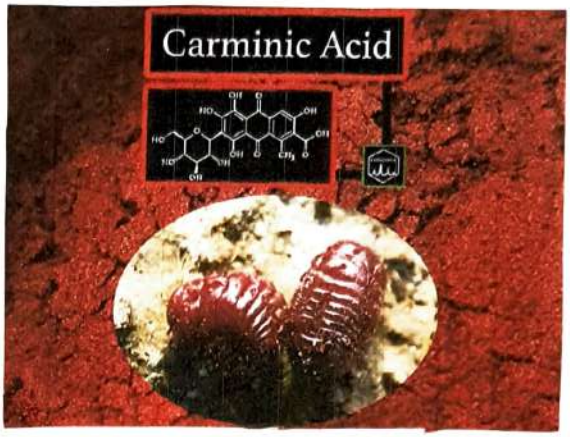
Betanin

It is otherwise called Beetroot Red. It is obtained from the extract of beet root juice. The colour depends on PH of the medium.

Carmine

Carmine gives deep red colours. It is derived from the insect cochineal.

Carmine



Turmeric / Curcumin

Turmeric (curcuma longa) is a flowering plant which is commonly used as a coloring and flavoring agent in many curries. It contains bright yellow pigment curcumin.

Synthetic food colour

Synthetic Food colours are derived from chemicals and are used in food industry and pharmaceuticals. Their potential sources are Petroleum, Petrochemicals and mineral compounds. Some common examples are:

Quinoline yellow WS

Quinoline Yellow is used as a greenish Yellow food colourant. It is a mixture of organic compounds and is water soluble.

Carmoisine

It is a synthetic food dye in the red to maroon colour range. It is in the azo dye group. It's another name is Azorubine.

Ponceau 4R

It is a strawberry red azo dye and is usually synthesized from aromatic hydrocarbons.

Brilliant Blue FCF

It is a synthetic dye used primarily as a blue colourant for processed foods, medications, dietary supplements, and cosmetics. It belongs to triarylmethane dye.

Erythrosine

It is also known as Red No. 3 and is an organoiodine compound, which is specifically a derivative of fluorine. It is a pink dye.

Tartrazine

It is a synthetic lemon yellow azo dye primarily used as a food colourant. It is a commonly used color all over the world, mainly for yellow, and can also be used along with Brilliant Blue FCF.

Sl. No	Quality Parameters	Natural Food Colours	Synthetic Food Colours
1.	Source / origin	Obtained from natural sources	Obtained by chemical reaction.
2.	Stability	May be less stable	High stability to light, O_2 and PH.
3.	Brightness	Less bright	Highly coloured.
4.	Uniformity in colour	Not uniform	colour uniformity
5.	Cost	Expensive	Less costly.
6.	Possibility of contamination.	High micro-biological contamination	Low microbiological contamination.
7.	Acceptability.	Good consumer acceptability	Consumer acceptability is questionable.

THE E-NUMBER OF FOOD ADDITIVES

For the Consumers Information, each food additive is assigned a unique number called an E-number. These are found on food labels in European Union. There are different categories of food additives such as E100-E199 are food colours, E200-E299 are preservative, E300-E399 are antioxidants, E600-E699 are flavouring agent and so on.

E-Codes number	Groups of Food Ingredients
E-100	Coloring agents
E-200	Preservatives
E-300	Anti-oxidants
E-400	Thickeners, Stabilizers, Gelling agents, Emulsifiers
E-500	Agents for physical characteristics
E-600	Flavor enhancers

FOOD COLOUR

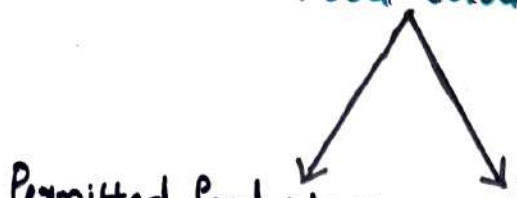
Curcumin - E100
Tartrazine - E102
Quinoline yellow WS - E104
} food colour

Sodium benzoate - E211
Acetic acid - E260
} Preservative

Vitamin C (Ascorbic acid) - E300
Butylted hydroxyanisole (BHA) - E320
Butylted hydroxytoluene (BHT) - E321
} Antioxidant

Monosodium glutamate (MSG) - E621
Zinc acetate - E650
} flavouring agent

Food Colour



Permitted food colours | **Non permitted food colours**

Permitted food colours

Permitted colours	Non-permitted colours
Tartrazine	Rhodamine
Sunset yellow FCF	Orange G
Ponceau 4R	Amaranth
Carmoisine	Fast red
Erythrosine	Metanil yellow
Brilliant blue FCF	

Food colour is one of those important ingredients upon which the quality of food and flavour can be judged.

Importance of food colours

* 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.

Permitted food colours :-

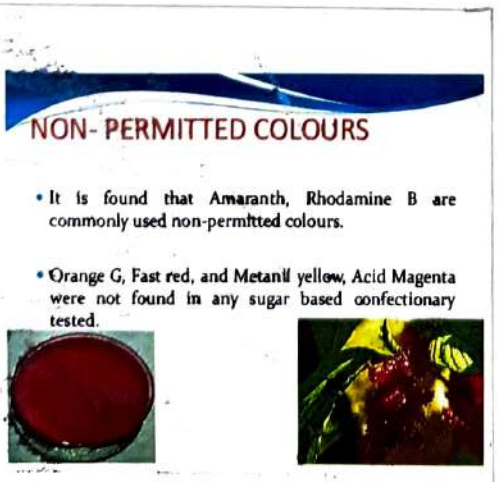
are those which are non toxic and acceptes. Done through a certification process conducted by FSSAI. Generally known as food safety and standards Authority of India. This includes Indigo Carmine (Blue), Brilliant Blue FCF (Blue), Fast Green FCF (Green), Tartrazine (Yellow), Sunset Yellow FCF (Yellow), Ponceu 4R (Red), Carmoisine (Red), Erythrosine (Red).

PERMITTED FOOD COLOURS – SAFETY ASSESSMENT

Colour	Name	Acceptable Daily Intake (mg/kg bw)
Red colour	Ponceau 4R	4.0
Red colour	Carmoisine	4.0
Red colour	Erythrosine	0.1
Yellow colour	Tartrazine	7.5
Yellow colour	Sunset yellow FCF	2.5
Blue colour	Indigo carmine	5.0
Blue colour	Brilliant blue FCF	12.5
Green	Fast green FCF	25.0

Non permitted food colours are

those which are hazardous for the health of human beings. This includes Rhodamine B (Pink), Orange II (Orange red), Metanil yellow (Yellow), Butter yellow (Pale yellow), Malachite Green (Dark green), Amaranth (Deep red), Acid Magenta (Magenta), Orang G1 (Orange).



FSSAI

Food Safety and Standards Authority of India

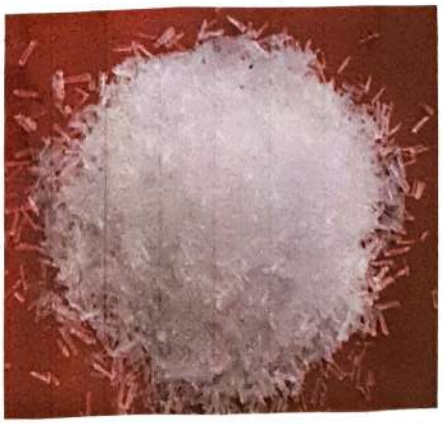
FSSAI has been created for laying down Science based standards for article of food and to regulate their manufacture, storage, distribution, sale and import to ensure availability of safe and wholesome food for human consumption. Food safety and standards Authority of India is a statutory body established under the Ministry of Health & family welfare, Goverment of India. The FSSAI has been established under the food safety and Standards Act, 2006, which is a consolidating statue related to food safety and regulations in India. It is mandatory to obtain a license from the FSSAI to run a food business in India.

Flavours and Flavour Enhancers

Flavour is the distinctive taste of food or drink. Flavour is the term used to describe the sensory impression of food which is a combined effect of taste, colour and trigeminal impression. Flavour enhancers bring out the flavour in foods without imparting a flavour of their own. Common food flavour enhancers are:

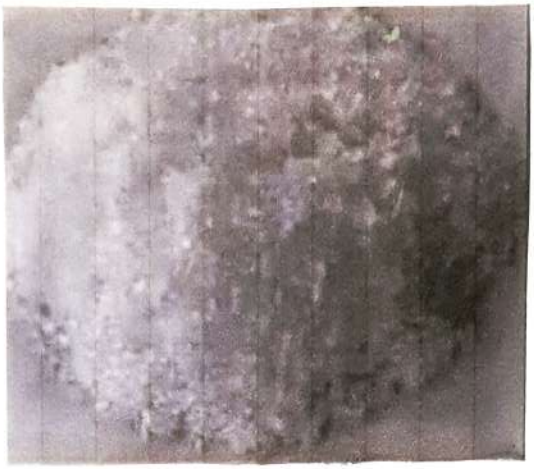
Monosodium Glutamate [MSG]

Monosodium glutamate (MSG) is the sodium salt of the naturally occuring amino acid, glutamic acid.



Monopottassium glutamate (MPG)

It is the pottassium salt of glutamate acid. It is not popular as MSG.



Calcium Diglutamate [CDG]

CDG is the Calcium salt of glutamate acid and also the Calcium analogue of MSG.

Disodium Guanylate

Disodium guanylate is Sodium salt of the flavour enhancing nucleotide guanosine monophosphate (GMP). It is an expensive flavour enhancer.

Artificial Sweetners

They impart Sweet taste form fewer calories than Sugar. The calorific values of these compounds are very less Compared to the natural Sweetness. Sucrose. The usage of the artificial Sweetness is recommended for the diabetic patients. Saccharic is the first popular artificial Sweetening agent.

Popular artificial sweeteners are.

Aspartame

100 times sweeter than Sugar.

Saccharin

550 times sweeter than Sugar.

Sucralose

600 times sweeter than Sugar.

Alitame

2000 times sweeter than Sugar.

Fat Emulsifiers

These are a class of food additives which are used to prevent oil and water mixtures seperating in to layers. Commonly used fat emulsifiers are.

Lecithin

Lecithin is a mixture of fats that are essential to cells in the human body

Sorbitan monostearate

Sorbitan monostearate is used in the manufacture of food and healthcare products as a non-ionic surfactant with emulsifying, and wetting properties.

Stabilising Agents

The main function of the stabilising agents is to act as a thickening agent to get the foods in to the required consistancy. most stabilising and thickening agents are polysaccharides. Common examples are Starch. gums or Proties like gelatin.

Flour Treatment Agents

Flour treatment agents improve flour performance in food items like bread.

Some commonly used antioxidants are.

Sl. no	Common name	Uses
1.	Ascorbic acid. [vitamin C]	Soft drinks, jams, Condensed milk, Sausage.
2.	Sodium ascorbate.	
3.	Calcium ascorbate.	
4.	Tocopherols	Vegetable oils.
5.	Propyl gallate	Fats and oils for proffesional manufacture, Frying oils and fats dehydrated soups, chewing-gum.
6.	octyl gallate.	
7.	Butyl hydroxy anisol (BHA)	Sweets, raisins, Processed cheese, Peanutbutter, Instant soups.
8.	Butyl hydroxy toluene (BHT)	

— PRESERVATIVES —

A preservative may be defined as any a substance that prevent or retard deterioration when added to food and therefore they are added to food to fight spoilage caused by bacteria, molds, fungus and yeast. Preservatives also help keep food fresh for longer periods of time. And Preservatives can be made of "Natural" chemicals such as salt or alcohol. they can also be made by man-made or synthetic chemicals. Preservatives are generally classified as CLASS I and CLASS II Preservatives. Class I preservatives belongs to natural sources which also exhibit preservatives effects in foods. Class I preservative in any food is Not restricted. Class II preservatives are obtained by chemical derivations of compounds. the use of class II preservatives is restricted. They shall be added to only selected Products which in specified limit. Use of more than one class II preservative is prohibited.

CLASS I PRESERVATIVES	CLASS II PRESERVATIVES
Common Salt	Benzoic acid and its salts
Sugar	Sorbic acid and salts
Dextrose	Nitrates and Nitrites of Sodium or Potassium
Glucose	Sulphites and bisulphites.
Vinegar OR acetic acid	Propionic acid including salts.
Edible Vegetable oil	Niacin.

Glimps of Some Common Class II Preservatives

1. BENZOIC ACID AND ITS SALTS

- One of the most common food preservative.
- Used in jams jellies, tomato puree, ketchup, sweets etc.

2 SULPHUR DIOXIDE, SULPHITES AND BISUPHITES

- used in fruits and beverages.
- dehydrated fruits and vegetables soups and other mixes to control browning.
- Its salts are used to prevent fermentation and spoilage by yeasts and molds.

3 NITRATES AND NITRITES

- used for curing and pickling of meats.
- help to prevent the growth of harmful bacteria.

4 SORBIC ACID AND SALTS

- Used widely in bakery industry.
- Sorbic acid and its salts are practically tasteless and odorless in foods.
- Most effective acidic-food items such as fruit juices.

NUTRITIONAL SUPPLEMENTS

Nutritional Supplements are Products used to improve the diet and often contain vitamins, minerals, herbs and amino acids. They are added to restore the lost supplements during processing and storage of food.

The common vitamins include:

- B vitamins, including niacin.
- vitamin C
- vitamin E

HEALTHY EFFECTS OF FAST FOOD, INSTANT FOODS, DEHYDRATED FOODS AND JUNK FOOD

We are living in a world we are adapted to a system of consumption of foods which has several adverse effects on health. life style changes has compelled us so much that one has so little time to really think about the quality and quantity of the food to be taken. "Eat healthy and live healthy" is one of the essential requirements for long life. It is better to have an awareness on the different types of food of contemporary importance and their health effects.

FAST FOODS

The Term Fast food generally refers to food that people intend to consume quickly, either on site or off site. Fast food is typically very poor in terms of Nutrition. Fast food is a type of food that we get from restaurant designed to deliver the order in the quickest possible way. There is plenty of well-researched evidence demonstrating various negative health effects of fast food. Some negative health effects are:

* They are generally very low in fibre. A low fibre diet is associated with a high risk of digestive conditions such as constipation and diverticular disease.

* The food and drug administration (FDA) identifies some preventable effects of eating fast-food. Such risk include obesity, insulin resistance, type 2 diabetes, and various cardiovascular conditions.

* A diet high in salt often increases a person's blood pressure, which means that a person is more likely to have a heat attack, stroke, kidney disease or heart disease.

* Eating fast food can lead to issues with edema, bloating and swelling.

* There are adverse effects on the nervous and reproductive systems.

INSTANT FOODS

Instant food are convenience foods which required minimal preparation typically just adding water or milk. They are usually in dried or powdered form that can be prepared easily and quickly, esp by adding hot water or milk eg: instant coffe, instant Noodles, Instant oatmeal, Instant rice etc....

A vast majority of instant food creats health issues mainly because of the presence of diffrent food additives involved during the processing. The fat content may lead to cardiovascular disease and increase the body weight. long term usages of instant food harmfully affect blood pressure, brain function and even digestive systems as well as lungs.

DEHYDRATED FOODS

Dehydration is the method of Preservation of foods. This process of reducing moisture of food to low levels for improved shelf life by adding one or More forms of energy to the food. Dehydrated foods also maintain their nutrients for much longer than their fresh counterparts.

Dehydrated foods have high Calorie ~~count~~ content by weight and can be high in sodium and sugar. These nutrients can cause weight gain and increase the risk of obesity, heart problems, and diabetes. Salt is the ~~common~~ common preservative in dehydrated foods and a high sodium diet can lead to hypertension and coronary heart disease.

Junk Food

Junk food is a term used to describe food that is high in calories from sugar/fat and possibly sodium, but with little dietary fiber, protein, vitamins, minerals, or other important forms of nutritional value. It is also known as HFSS food. [high in fat, salt and sugar].

Health Impact of Junk Food

1. Junk food allows people to eat without planning.
2. High fat content particularly cholesterol, sugar & salt have their aderse effects on health.
3. High calorie content with sugar can lead to obesity.
4. Dense sugar content can cause dental cavities and type 2 diabetes mellitus.
5. Flovers & Food colours can be allergic causing asthma, rashes and hyperactivity.

Trans fat

Trans fats are made with liquid oils are turned into solid fats, like shortening or margarine. These are called partially-hydrogenated oils [PHOs]

The United States Food and Drug Administration [FDA] has banned food manufacturers from adding PHOs to food.

Natural Trans Fat

Beef & Lamb
3 - 10%

Chicken & Pork
0 - 2%

Dairy Product
3 - 7%

Artificial Trans Fat

Some Baked Goods

Fast Fried Food

Chips

Trans fat in your food

-> Microwave popcorn

-> Frozen pizza

-> stick margarine

-> Fried food like french fries, doughnuts and fried chicken

-> shortening

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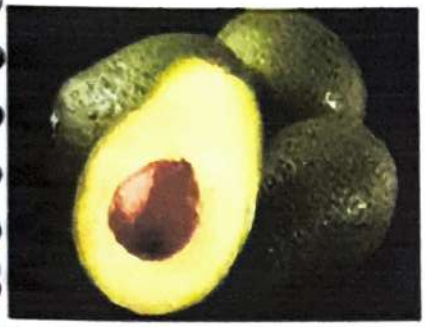
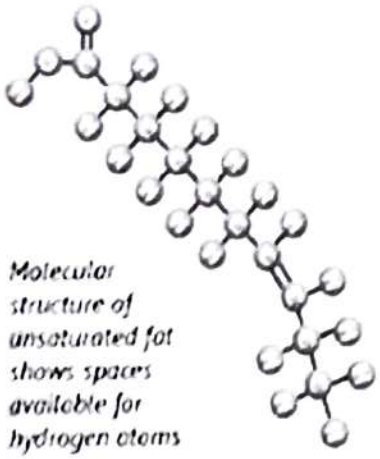
Different Kinds of Fat

Fatty acids, which are the building blocks of fat, are long chains of carbon and hydrogen atoms. Essential fatty acids are those needed by the human body that can only be obtained through food. Some fats are harmful, however.



UNSATURATED FATS

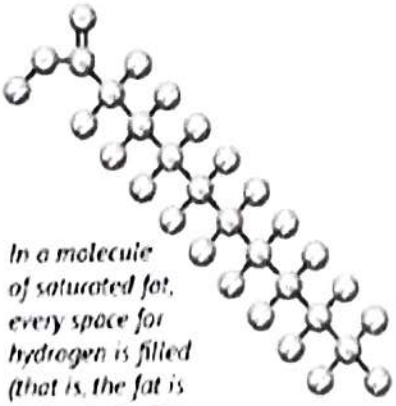
The so-called "good" fats can be found in nuts, avocados and other vegetables. The molecular structure of unsaturated fat causes it to be lower in calories than other fats.



Molecular structure of unsaturated fat shows spaces available for hydrogen atoms to bond

SATURATED FATS

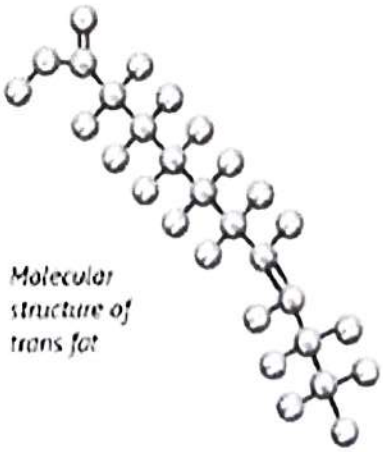
These fats are found mostly in animal products. It is recommended that people reduce their consumption of saturated fats in order to stay healty.



In a molecule of saturated fat, every space for hydrogen is filled (that is, the fat is "saturated" with hydrogen)

TRANS FATS

Trans fats are unsaturated (good) fats which have been partially saturated with hydrogen to extend their shelf life. Unfortunately, these trans fats are found to elevate "bad" cholesterol and should be avoided.



Molecular structure of trans fat

SOURCES: UC-CLERMONT COLLEGE; ALLIANCE FOR A HEALTHIER GENERATION; DREAMSTIME

Food colour

Food colouring is any dye, pigment or substance that imparts color when it is added to food or drink.

ex: Carotenoids, Carmine, Betamin, Erythrosine, Ponceau 4R

Fat Emulsifers

Emulsify fat means that you change the environment so the fat and water molecules can mix together more easily.

Preservatives

These are substances, when added to food, are capable of inhibiting, retarding or ~~as~~ arresting, the process of fermentation.

Nutritional Supplements

It comes in many forms including bars, drinks, powders & puddings. They have different amounts of nutrients.

Fast food

Is a type of mass-produced food designed for commercial resale, with a strong priority placed on speed of service.

Trans fat

This is also called trans-unsaturated fatty acids or trans fatty acids, is a type of unsaturated fat that occures in food.