

KHATRA ADIBASI MAHAVIDYALAYA



E-Content

Department: Chemistry

Semester: I (Major)

Session: 2023-2024

Subject: Basic Analytical Chemistry (CHEM/104/SEC-1)

Topic: Food Adulteration

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We are going to discuss.....

- **What is 'Food Adulteration'?**
- **Generally used Adulterants**
- **How serious is it?**
- **Tests for identification of adulterants**
- **How to prevent Food Adulteration?**

What are food additives?

- Food additives are the substance that become the part of a food.
- Food additives can be **colouring agent, emulsifiers and stabilizers, flavouring agents, antioxidants etc.**

PFA act, 1954

- The '**Prevention of Food Adulteration Act**' (PFA), 1954 aims at making provisions for the prevention of adulteration of food.
- According to PFA act, 1954 there are several clauses to define a food deemed to be 'adulterated'

What is 'Food Adulteration'?

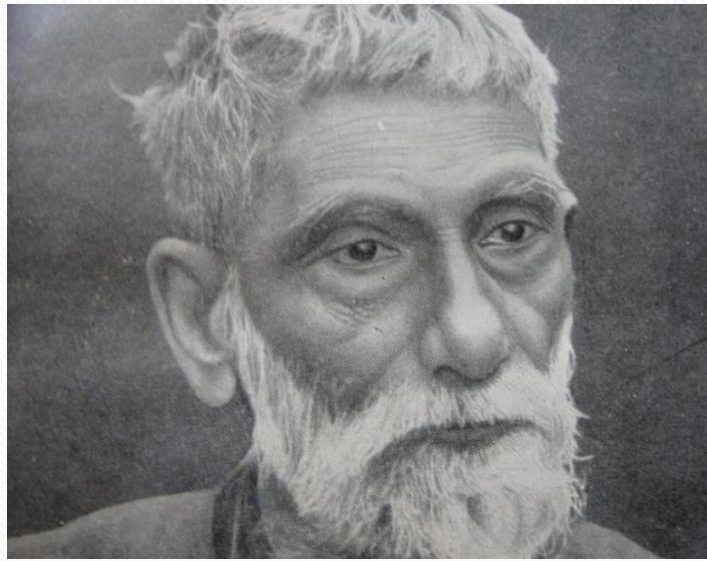
Act of intentionally debasing the quality of food offered for sale either by admixture or substitution of inferior substances or by the removal of some valuable ingredient

Reasons for food adulteration

- **Everyone wants to get maximum quantity of commodity for lower price**
- **Traders and manufacturers wants to maximize their profit**
- **They add adulterant in food to increase the weight and volume and to make the food more attractive to consumers**

Real scenario

- All over the globe, food adulteration is a problem
- Poor quality of foods are sold and consumed
- Leads to progressive deterioration of the health of the people
- Leads to slow poisoning and various diseases, can even result in death
- 'Food for health'—————> 'Food for death'



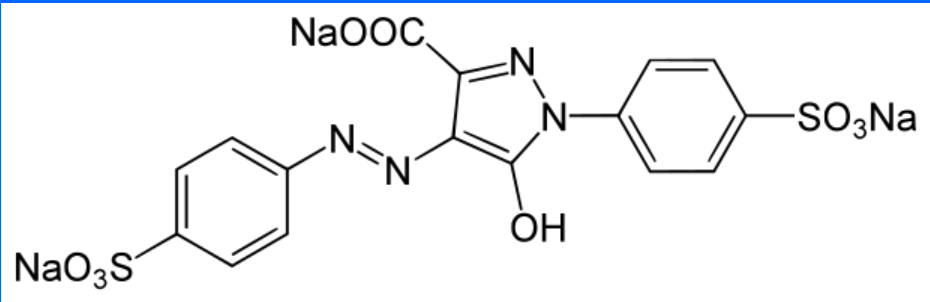
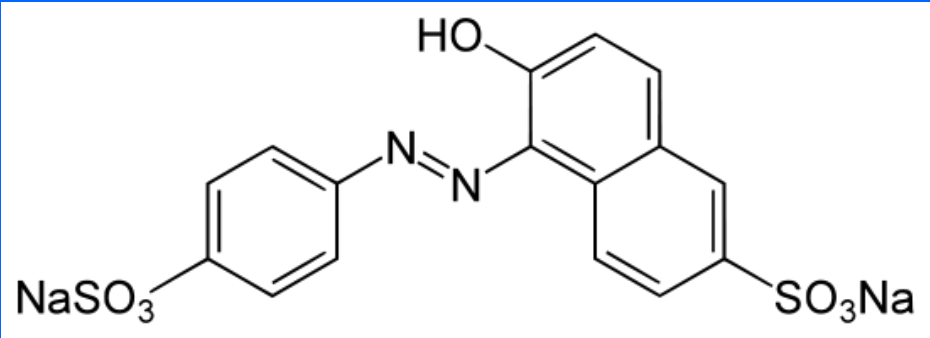
Acharya Prafulla Chandra Ray discovered how to detect adulteration in *Ghee* and *Mustard oil* in 1885.

- This work was published in *Journals of the Asiatic Society of Bengal* in 1894.

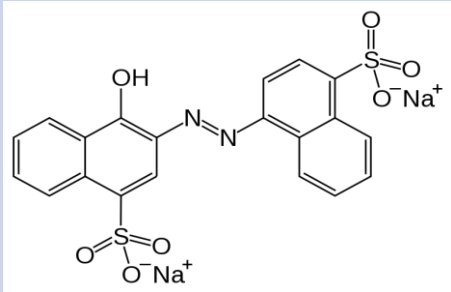
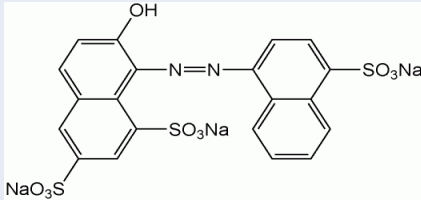
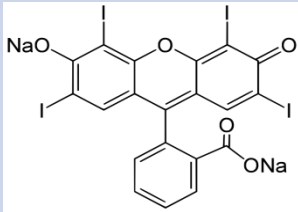


- **Swami Vivekananda had advised to enact laws prohibiting adulteration of foods.**
- **The famous compilation of Swamiji's maxims entitled '*Pearls of Wisdom*' bears evidence to the fact**

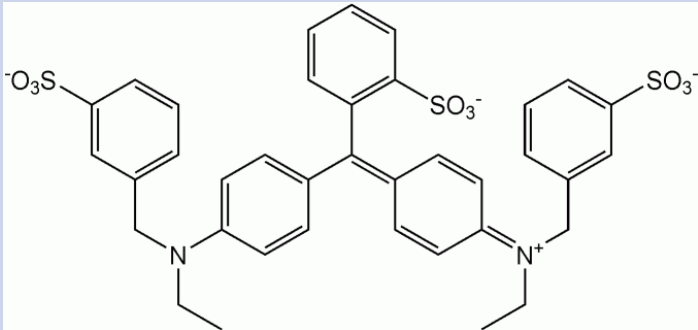
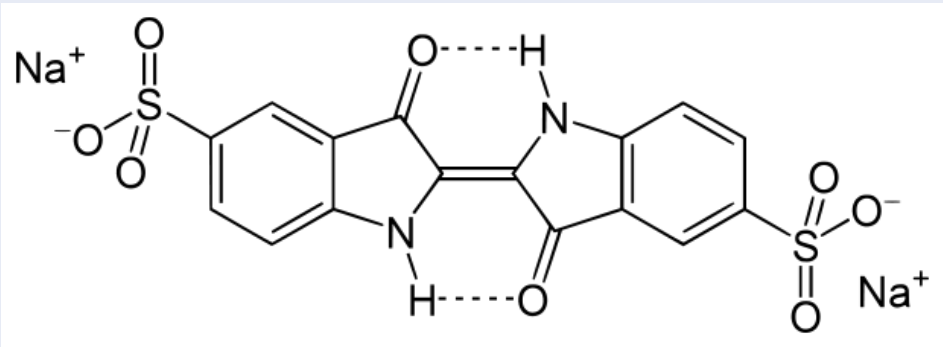
Permitted artificial food colours

COLOUR	NAME OF THE COLOUR	PERMITTED DOASE (per kg bodyweight)
Yellow	 Tartrazine	7.5 mg
	 Sunset Yellow	2.5 mg

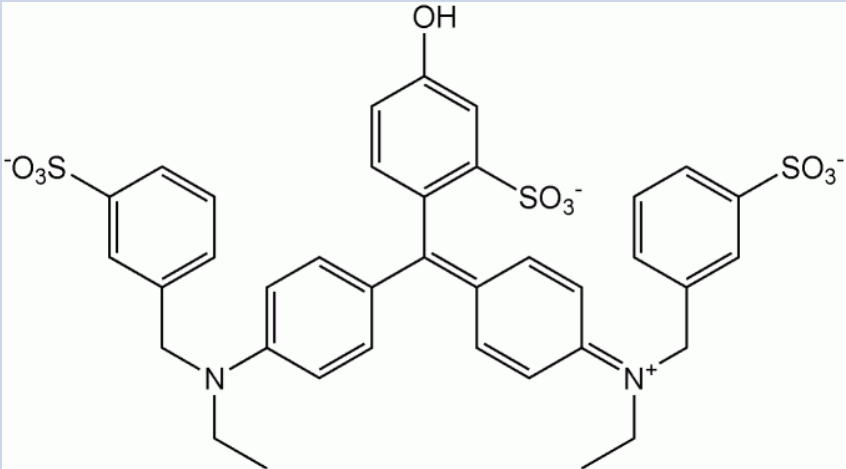
Permitted artificial food colours

COLOUR	NAME OF THE COLOUR	PERMITTED DOASE (per kg bodyweight)
Red	 <p>Carmoisine</p>	4 mg
	 <p>Ponceau-4R</p>	4 mg
	 <p>Erythrosine</p>	0.1 mg

Permitted artificial food colours

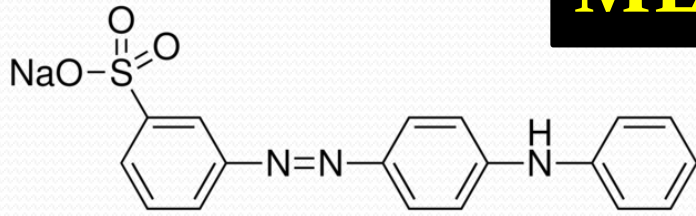
COLOUR	NAME OF THE COLOUR	PERMITTED DOASE (per kg bodyweight)
Blue	 <p>Brilliant blue</p>	12.5 mg
	 <p>Indigo Carmine</p>	5 mg

Permitted artificial food colours

COLOUR	NAME OF THE COLOUR	PERMITTED DOASE (per kg bodyweight)
Green	 <p data-bbox="852 1133 1070 1179">Fast green</p>	4 mg

**These colours are very costly, so traders
mix cheap industrial colours in foods to
make it attractive**

METANIL YELLOW



- For **industrial use only**, not for human consumption
- Popularly known as 'Kishori colour'
- Frequently used in Turmeric powder, various yellow sweets like Laddu, Dorbesh, Mihidana, Bonde, Amriti, Jalebi, Jaggery
- Also used in Biryani, Polao, Beguni

➤ HARMFUL EFFECTS

- Cancer
- Stomach pain
- Ulcer
- Infection in testicles

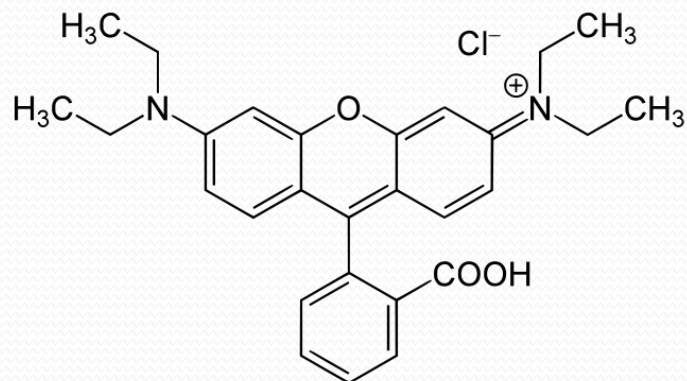


How to detect adulteration of foods with Metanil Yellow?

- Add few drops of Conc. hydrochloric acid to sample.

Instant appearance of **violet** colour confirms the presence of Metanil yellow.





RHODAMINE-B

- Organic dye
- Commonly used in the textile and plastic industries
- Frequently used in sweets like Gulab jamun, Halwas, Hawai mithai, Coloured papads etc.

➤ HARMFUL EFFECTS

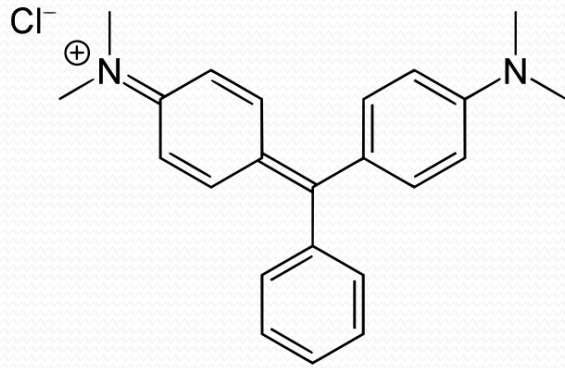
- Damage Spleen, Liver, Kidney
- Causes **Cancer**



➤ **How to detect adulteration of foods with Rhodamine-B?**

- Make the water solution of the sample. If **light is glittered** from the solution in sunlight, then the presence of Rhodamine-B is confirmed.

MALACHITE GREEN



- Organic dye
- Industrially used to colour silk, wool, jute, leather, cotton and paper
- Used to colour Parwals, Peas, Green chilli, other green vegetables

➤ HEALTH EFFECTS

- Potentially carcinogenic
- Toxic to human cells



➤ Detection of Malachite green

- Take a cotton piece soaked in liquid paraffin and rub the outer green surface of a small part of green vegetable. If the cotton turns **green**, we can say the vegetable is adulterated with malachite green.

LEAD CHROMATE (PbCrO_4)

- Inorganic salt
- Used to colour Turmeric whole, Turmeric powder, Pulses, Mixed spices

➤ HEALTH EFFECTS

- Anemia
- Abortion
- Paralysis
- Brain damage



ALUMINIUM as thin foils

- Used in **Sweets** and **Betel leaves** instead of food grade Silver

➤ HEALTH EFFECTS

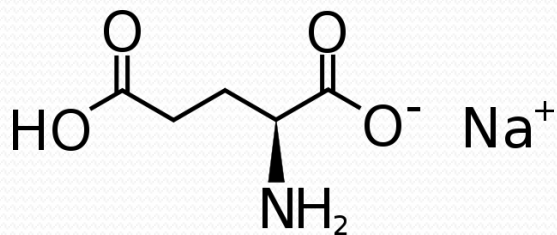
- Mental retardation
- Spongy bone
- Alzheimer's disease



Aluminium or Silver foil?

- Burn the foils in flame.
- Aluminium foils are reduced to grey ash
- Pure Silver leaves burn away compleately leaving glistening balls





MONOSODIUM GLUTAMATE(MSG)

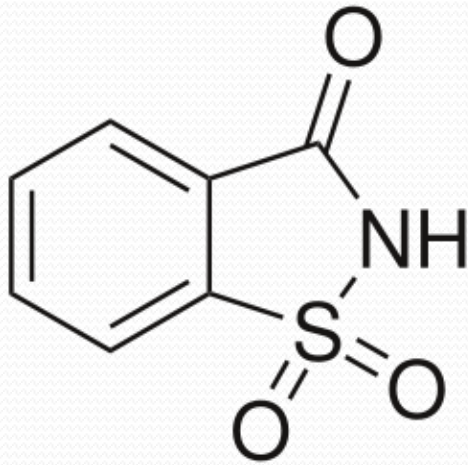
- Popularly known as 'Ajinamoto'
- Enhance flavour in some prepared foods, specially in Chinese foods



➤ HEALTH EFFECTS

- **LIVER/ LUNG CANCER**
- Harmful for pregnant women
- Hinders growth of the foetus in mother's womb
- Harmful for babies below the age of 12 months





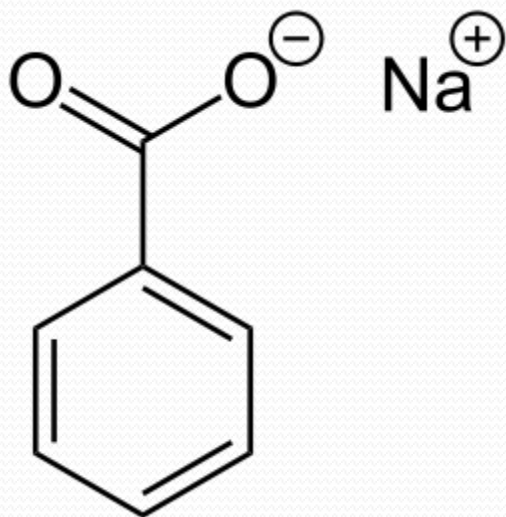
SACCHARIN



- 300-500 times sweeter than sugar
- Used as artificial sweetener

➤ HEALTH EFFECTS

- Proven to cause of **Urinary Bladder Cancer** in mammals



SODIUM BENZOATE

- Preservative
- Used to preserve Tomato Ketchups

➤ HEALTH EFFECTS

- Allergies
- Asthama



SODIUM NITRITE

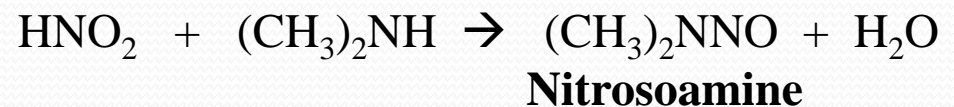
(NaNO₂)

- Preserves meat for a long time with spices and smoke
- Develops cured meat flavour and colour
- Mostly used in Restaurants



➤ HEALTH EFFECTS

- Causes **Stomach Cancer** from nitrosamine



CALCIUM CARBIDE (CaC_2)

- Used for artificially ripening banana, mangoes etc.

➤ HEALTH EFFECTS

- Diarrhoea
- Ulcers
- Miscarriages



▪Detection of other adulterants in some food by simple tests

Food article	Adulteration	Health effect
PANEER, RASAGOLLA, MILK KHOYA, JAM, JUICES	Starch (Wheat flower, Soyabin powder)	Gas in Stomach



➤Detection Test

Add iodine solution on the sample. Blue colouration shows the presence of starch.

Food article	Adulteration	Health effect
Wheat flour	Excessive sand and dirt, Chalk powder	Dangerous to stomach



➤ DETECTION TEST

- **Sand and dirt:** Sample + CCl_4 → Shake → Stand → sandy matter will collect at the bottom.
- **Chalk powder:** Shake the sample with dil. HCl . Effervescence indicates chalk.



Food article	Adulteration	Health effect
Edible oils	Argemone oil	Dropsy, Gastrointestinal problems, Cardiac arrest, Respiratory distress
	Mineral oil	Liver damage
	Karanja oil	Liver damage, Heart problems
	Castor oil	Stomach problems



➤ Detection tests

- **Argemone oil:** Sample + FeCl_3 + dil. HCl , observe through lens. Needle shaped brown crystals confirms presence of Argemone oil.
- **Mineral oil:** Sample + alcoholic KOH → Warm 10 min., add water. Turbidity shows the presence of Mineral oil.
- **Karanja oil:** 2 drops of sample + SbCl_3 + CHCl_3 . Appearance of yellow to orange colour → Karanjina oil present.
- **Castor oil:** Sample + Pet. Ether → Cool in ice → White turbidity → Castor oil present.

Food article	Adulteration	Health effect
Ghee and Butter	Mashed Potato, Sweet Potato, Other Starches	Digestive problems, Liver disorder, Stomach pain,
	Vanaspati	Accumulation of Cholesterol in blood vessels



➤ DETECTION TEST

- **Starches:** Sample+ Iodine solution → Blue colouration → Starch present
- **Vanaspati:** Sample + HCl soln. + little sugar → Shake vigorously → Stand for 5 min. → Crimson red colour → Vanaspati present.



Food article	Adulteration	Health effect
Tea	Coloured leaves	Liver disorder, Cancer
	Used tea	Liver disorder
	Iron fillings	Stomach problems



➤ DETECTION TEST

Test 1: Sprinkle the tea powder on a wet filter paper, colour separation shows the presence of adulterants

Test 2: Mix the tea in hot water. If there is colouration, then confirmly there is coloured tea leaves.

Food article	Adulteration	Health effect
Coffee powder	Chicory powder	Stomach disorder, Joint pain
	Tamarind seed powder	Diarrhea



Original Coffee

➤ DETECTION TEST

- **Chicory powder:** Soak in water. Pure coffee powder floats while the chicory powder begins to sink with reddish colour.
- **Tamarind seed :** Sprinkle the coffee powder on a filter paper and add solution of sodium carbonate. Red colouration shows the presence of tamarind or date seed powder.



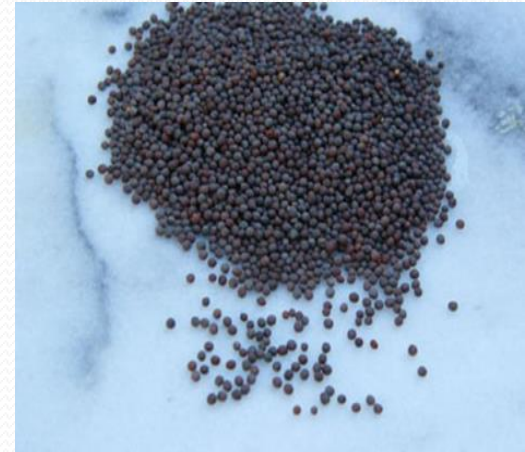
Chicory powder

Food article	Adulteration	Health effect
Mustard seeds	Argemone seeds	Dropsy

➤ DETECTION TEST

Examine with a magnifying lens.

Mustard seeds have a smooth surface while the Argemone seeds have a rough surface and are blacker.



Mustard seeds



Argemone seeds

Food article	Adulteration	Health effect
Black pepper	Papya seeds, rotten Peeper and light Berries	Stomach, Liver problems

➤ DETECTION TEST

Add a little solution of rectified spirit to the sample. Rotten pepper, papaya seeds and light berries floats.



Original Black Pepper



Papya seeds

Food article	Adulteration	Health effect
Pulses/besan	Kesari dal (Lathyrus sativus) [contains β -N-oxyl-amino- α -alanine(BOAA)]	Lathyrism (Lower limb paralyses)



Kesari dal

➤ DETECTION TEST

Add 50 ml. of dil. HCl to a small quantity of besan and keep on water for about 15 minutes. The pink colour indicates the presence of Kesari dal.



Lower limb paralysis

Food article	Adulteration	Health effect
Red chilli	Brick powder	Stomach problems



Chilli powder

➤ DETECTION TEST

- i) Add water to the powder and shake. Brick powder settles down.
- ii) To a little powder add solution Conc. HCl. Introduce as paste into flame through the backside of a matchstick. Brick red flame colour due to the presence of Calcium salts in brick powder.



Brick powder

Food article	Adulteration	Health effect
Sugar, common salt	Chalk powder	Liver disorder



Sugar

➤ DETECTION TEST

Dissolve the Sugar/Salt in a glass of water, Chalk powder will not dissolve, Sugar/Salt will be dissolved.



Chalk dust

Food article	Adulteration	Health effect
Parched rice (Muri)	Urea	Injurious to health



➤ Detection

In a container, take some Muri , add water to it, wait for 5 min. Then decant the water, add Soyabin powder to the water, shake and dip red litmus paper. Blue colour indicates the presence of Urea.

THANK YOU