B. Sc. III Year

Synthetic drug & dyes

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Synthetic drug & dyes

- **Synthetic drugs :**

  Drug may be defined as a substance used in prevention, treatment, diagnosis or cure of disease in human being or other animals.

- A drug may be single compound or combination of two or more compounds.

  Ex. Paracetamol, Aspirin

- **Qualities of good drug :**

  An ideal drug should satisfy the following conditions.

- i) It should be localized at the site where it is desired to act.
- ii) It should act on a system with efficiency and safety.
- iii) It should be nontoxic.
- iv) It should have minimum side effects.
- v) Drug should be easily available.
- vi) It should be less expensive.
- vii) It should not disturb physiological process.

❖ Classification of Drug :

Drugs are classified as follows :

❑ a) Functional drugs :

The drugs which are used to stimulate or depressed various functions of body so as to provide some relief to body without curing of disease.

Functional drugs are classified as follows.

➢ i) Analgesics :

The drugs which are used to reduce body pain without loss of consciousness are called as analgesic drugs.

Ex. Aspirin, Ibuprofen, analgin

➢ ii) Antipyretics :

The drugs which are used to reduce the elevated body temperature are called as antipyretic drugs.

Ex. Paracetamol

iii) Anaesthetics :

The drugs which are used to produce temporary insensibility to human being are called as anaesthetic drugs. There are two types of anaesthetic drugs.

a) General anaesthetic :

The drugs which are used to produce unconsciousness and depression in central nervous system are call as general anaesthetics.

Ex. Chloroform, divinyl ether, ethylene, cyclopropane, avertin

b) Local anaesthetic :

The drugs which are used to produce an anaesthetic effect to a limited area of the body when applied externally or injected are called as local anaesthetics.

Ex. Lignocaine, xylocaine, cocaine, benzocaine etc

- **iv) Antidiabetics :**

  The drugs which are used to control the level of glucose in the blood are called antidiabetics. This disease is caused due to deficiency of effective insulin.

  Ex. Tolbutamide, glycogen

- **v) Anti inflammatory :**

  The drugs which are used to reduce inflammation in joint pains are called anti inflammatory drugs.

  Ex. Aspirin

- **vi) Sedatives :**

  The drugs which are used to depress central nervous system without producing sleep are called sedatives.

  Ex. Veronal, bromatol, ethyl alcohol.

- **vii) Hypnotics :**

  The drugs which are used to depress central nervous system with producing sleep are called hypnotics.

  Ex. Acetophenone, phenyl ethyl ketone, diethyl ketone, ethyl alcohol.

- **viii) Tranquillizers :**

  The drugs which are used in the treatment of mental disorders are called tranquillizers.

  Ex. Chlorpromazine, reserpine, phenothiazine

b) Chemotherapeutic drugs :

The drugs which are used in the treatment and cure of specific diseases are called chemotherapeutic drugs. They are classified as follows :

i) Antimalerials :

The drugs which are used to cure the malaria disease are called antimalerials.

Ex. Chloroquine, pamaquine, quinine .

ii) Antibacterials :

The drugs which are used in the treatment of infectious diseases caused by bacteria are called as antibacterials.

Antibacterial drug may be bacteriostatic and bactericidal. Bacteriostatic drugs which are used to inhibit the growth of bacteria and bactericidal drugs which are used to kill the bacteria.

Ex. Sulphanilamide, sulpha drugs.

iii) Antifungals :

The drugs which are used in the treatment of infectious diseases caused by fungi are called as antifungals.

Ex. Salicylic acid, benzoic acid.

iv) Antituberculars :

The drugs which are used in the treatment of tuberculosis known as antitubercular drugs.

Ex. p-amino salicylic acid (PAS), isoniazide

v) Antibiotics :

It is a chemical substance produced from one micro-organism which inhibit the growth of other infectious micro-organisms.

Ex. Penicillin, Cefixime, Streptomycin.

vi) Antiseptics :

The chemical substances which are used to prevent the sepsis of wounds to kill the germs and harmful bacteria are called antiseptics.

Ex. Dettol (chloro xylenol), phenyl salicylate.

vii) Disinfectants :

The chemical substances which are used on non living objects to kill the germs are called disinfectants.

Ex. Dettol (chloro xylenol), phenyl salicylate.

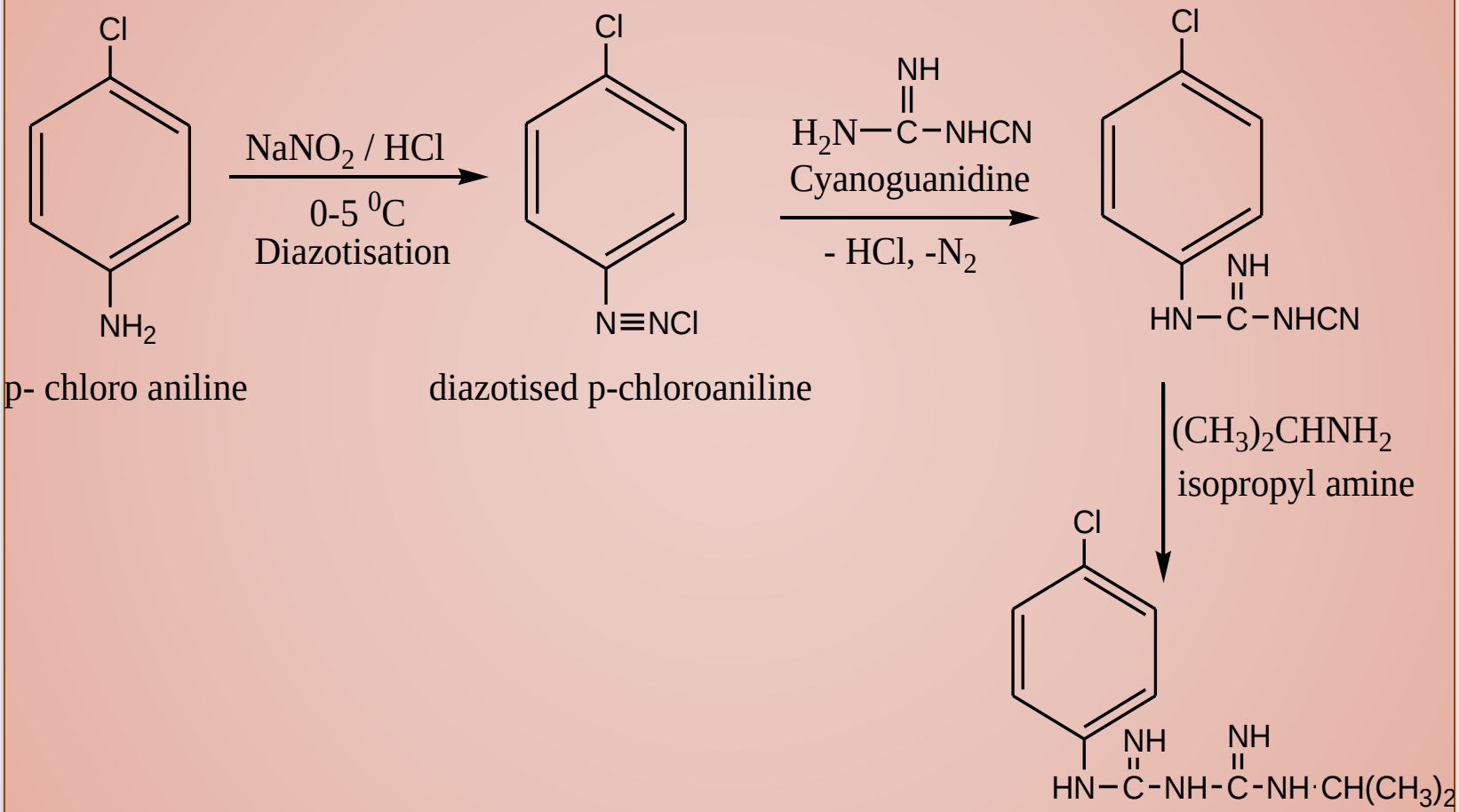
viii) Antivirals :

The drugs which are used in the treatment of infectious diseases caused by viruses are called as antivirals.

Ex. Methisazone

Synthetic and uses of following drugs :

a) Paludrine : It is prepared from p-chloro aniline as follows



p- chloro aniline

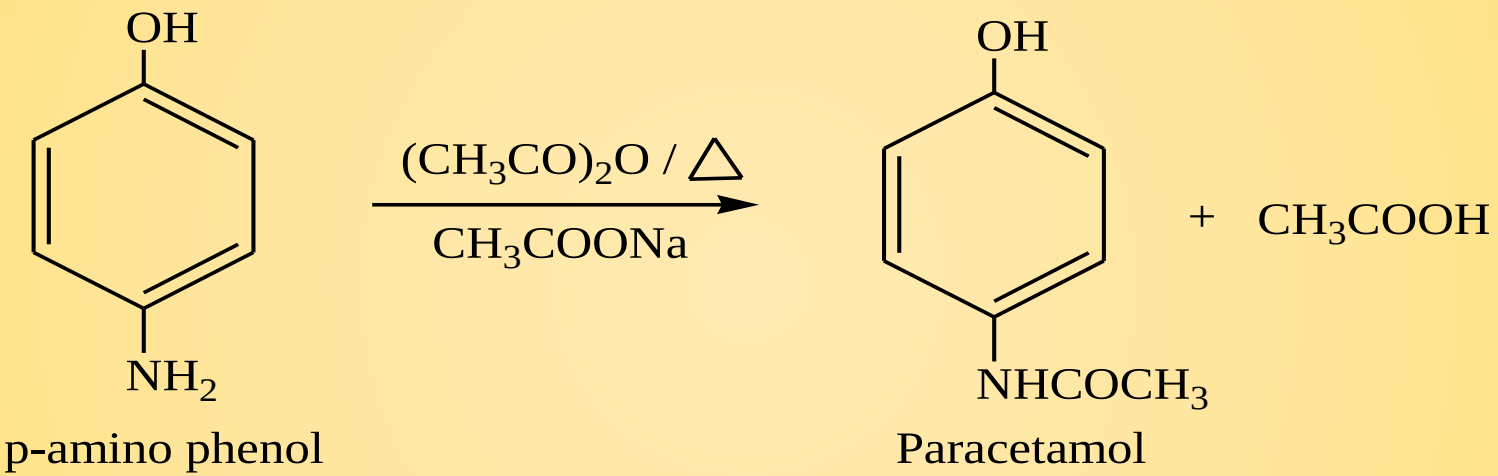
diazotised p-chloroaniline

Paludrine

Uses : i) It is used as antimalerials.

b) Paracetamol : (4-hydroxy acetanilide)

p-amino phenol on acetylation with acetic anhydride gives paracetamol or 4-hydroxy acetanilide.



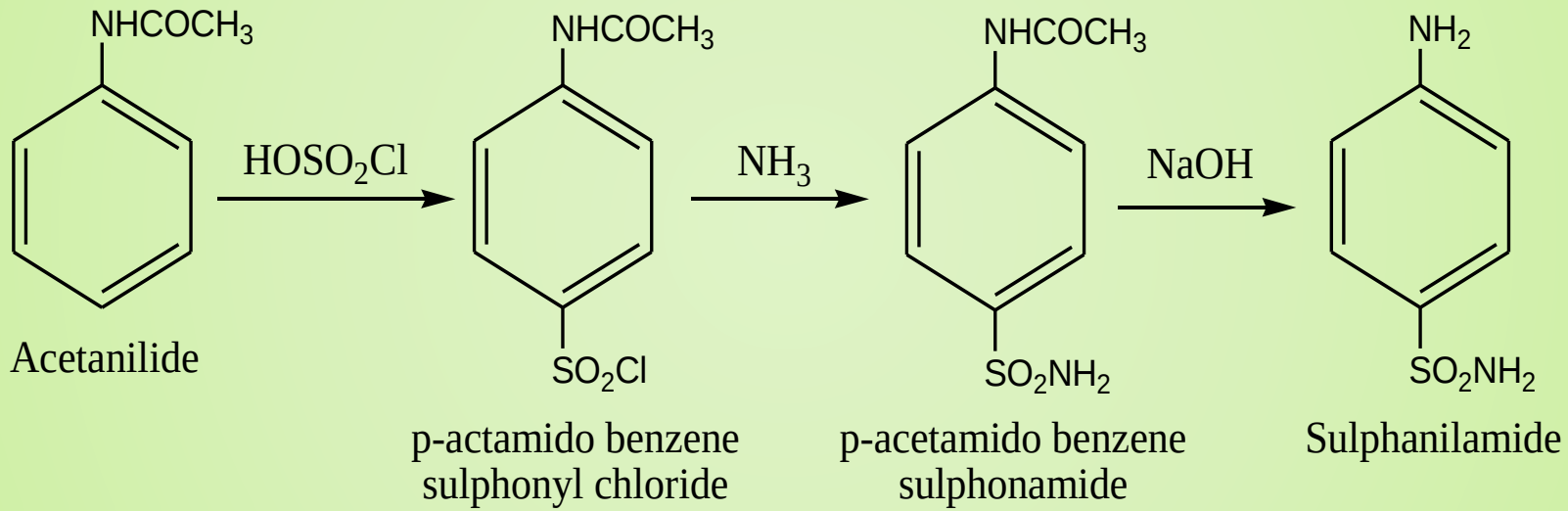
p-amino phenol

Paracetamol

Uses : i) It is used as antipyretic.
ii) It is used as analgesic.

c) Sulphanilamide (p-aminobenzene sulphonamide) :

Acetanilide is treated with chlorosulphonic acid it gives p-actamido benzene sulphonyl chloride, which on react with NH_3 gives p-actamido benzene sulphonamide. Which on hydrolysis with NaOH gives sulphanilamide.

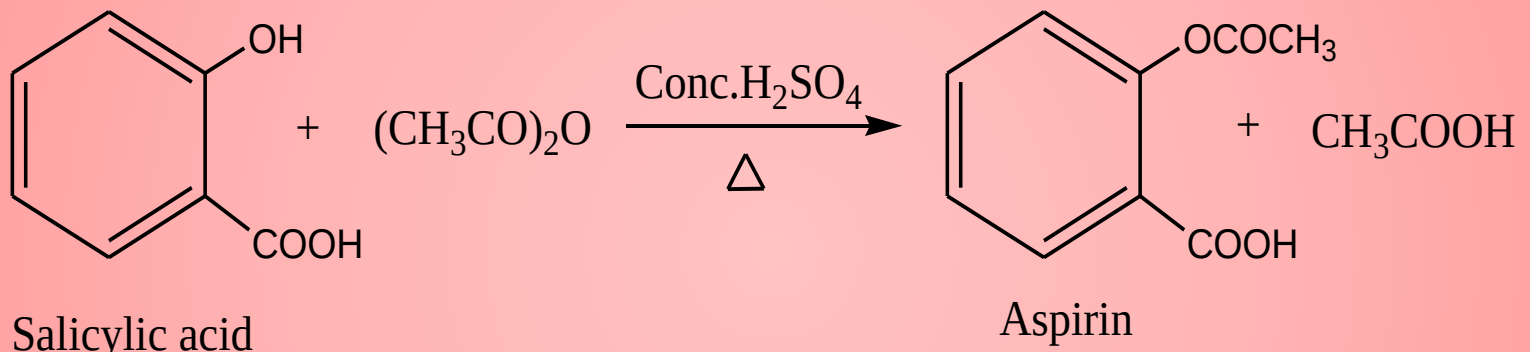


Uses : i) It is used as bacteriostatics .

ii) It is cheapest drug among all sulpha drug.

d) Aspirin (Acetyl salicylic acids) :

Salicylic acid on Acetylation with acetic anhydride in the presence of conc.H_2SO_4 gives Aspirin.



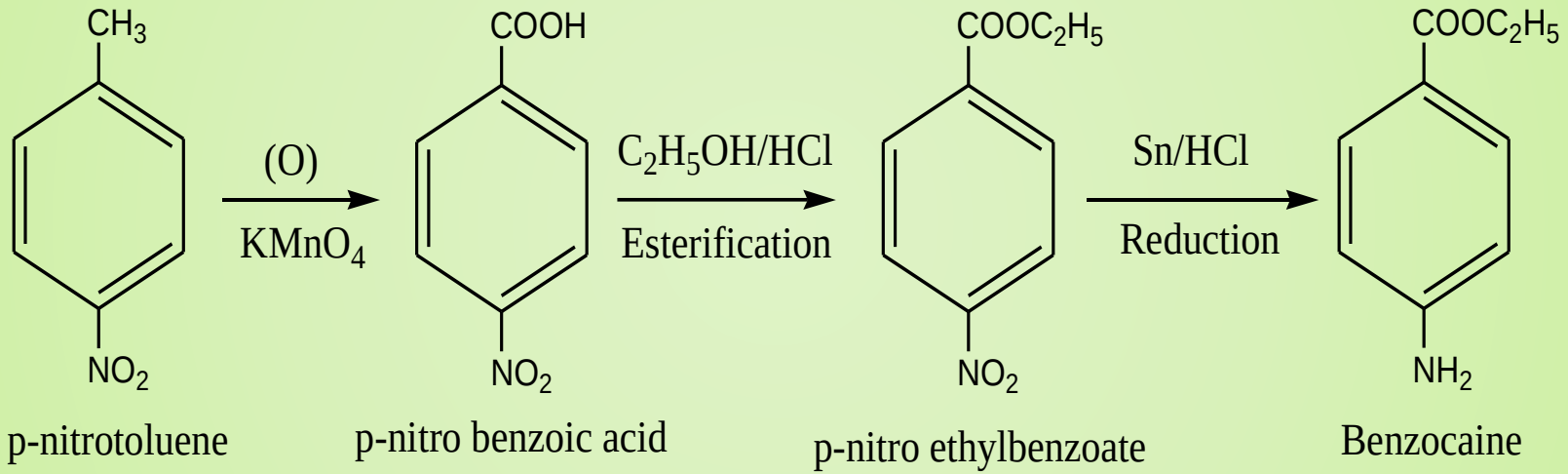
Salicylic acid

Aspirin

Uses : i) It is used as analgesic.
ii) It is used as antipyretic.
iii) It is used as anti inflammatory.

e) **Benzocaine** (Ethyl ester of p-amino benzoic acid) :

p-nitro toluene on oxidation with $KmnO_4$gives p-nitro benzoic acid. Which on esterification with ethyl alcohol & HCl gives p-nitro ethyl benzoate. This p-nitro ethyl benzoate on reduction with Sn/HCl gives benzocaine.

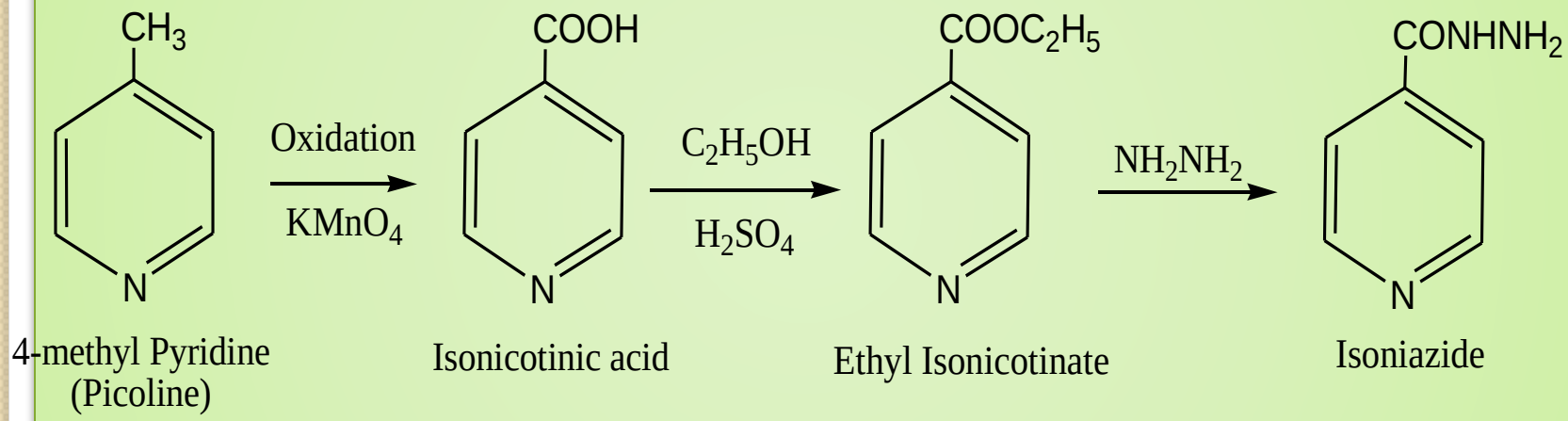


p-nitrotoluene — p-nitro benzoic acid — p-nitro ethylbenzoate — Benzocaine

Uses : i) It is used as local anaesthetics.
ii) It is used to prevent nausea and vomiting.

f) Isoniazide :

4-methyl pyridine (picoline) on oxidation with $KmnO_4$ yields isonicotinic acid. Which on esterification with C_2H_5OH/H^+ gives ethyl isonicotinate. Further react with NH_2NH_2 gives isoniazide



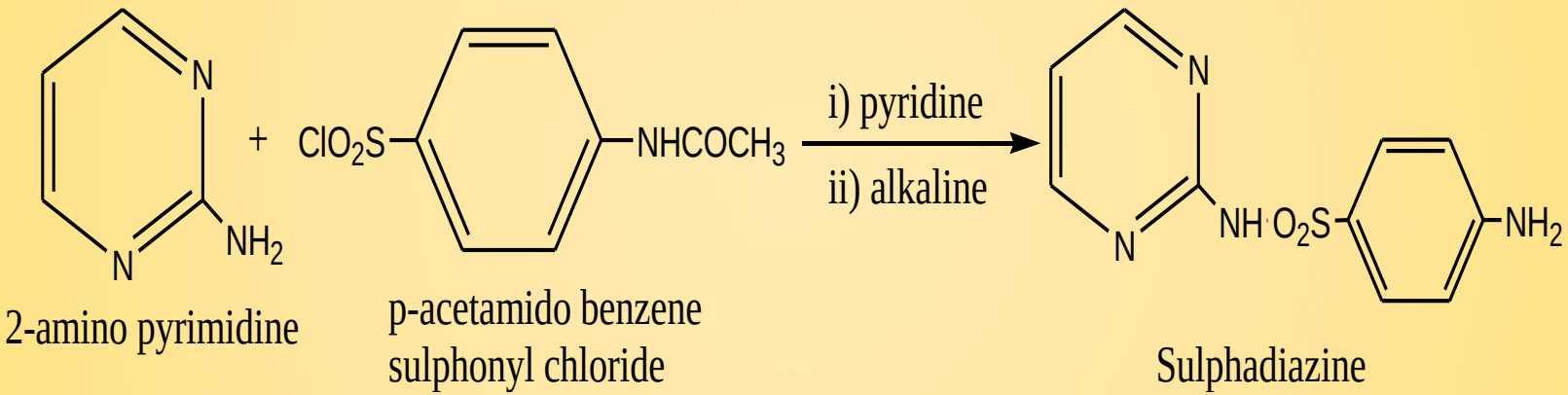
4-methyl Pyridine (Picoline) | Isonicotinic acid | Ethyl Isonicotinate | Isoniazide

Uses :

i) It is used as antitubercular drug.

g) Sulphadiazine (2-sulphanilamidopyrimidine) :

2-amino pyrimidine react with p-acetamido benzene sulphonyl chloride in the presence of pyridine followed by alkaline hydrolysis gives sulphadiazine



2-amino pyrimidine

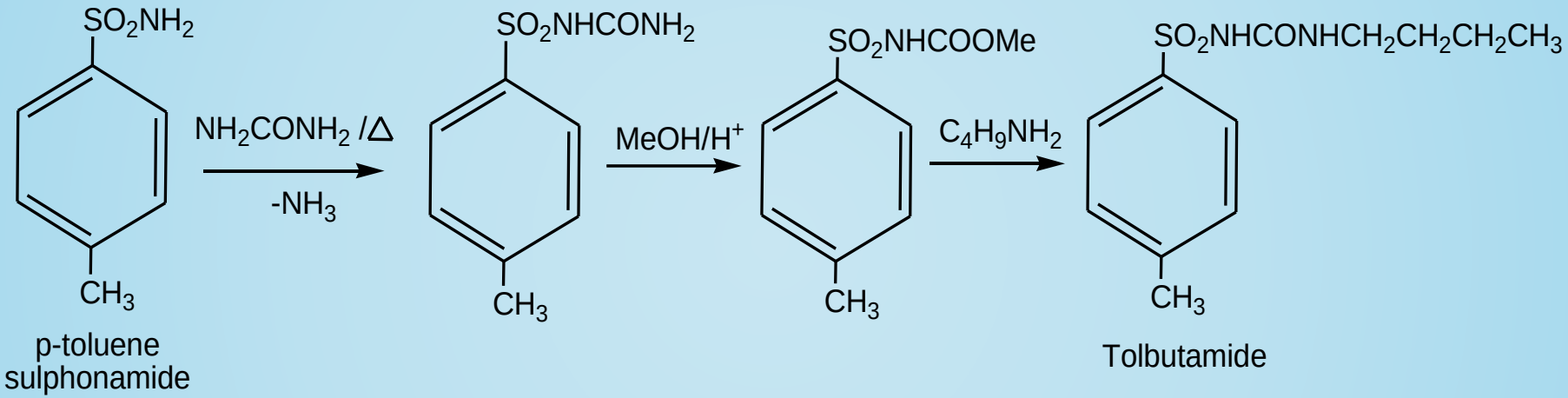
p-acetamido benzene sulphonyl chloride

Sulphadiazine

Uses : i) It is used as antibacterials.
ii) It is used in the treatment of meningitis disease.

h) Tolbutamide :

It is prepared from p-toluene sulphonamide with urea, then esterification followed by addition of n-butyl amine gives tolbutamide.



Uses : It is used as antidiabetic drug (hypoglycemic agent)

B) Synthetic dyes :

- Dyes are those coloured compounds that can be firmly fixed to the fabrics by chemical or physical bonding.
- All coloured compounds are not dyes.
- It is generally used for colouring of fibres , leathers, papers, food & medicine.
- **Classification of dyes :**

Classification of dyes on the basis of methods of applications as follows :

- **a) Direct dyes :**

These dyes can be applied by direct immersion of fabric into hot solution of the dye. Then it is removed and dried.

A direct dye contains acidic or basic auxochrome which combines with the opposite polar group present in the chemical structure of the fibre. Wool and silk are dyed by this direct method.

Ex. Martius yellow, Cango red

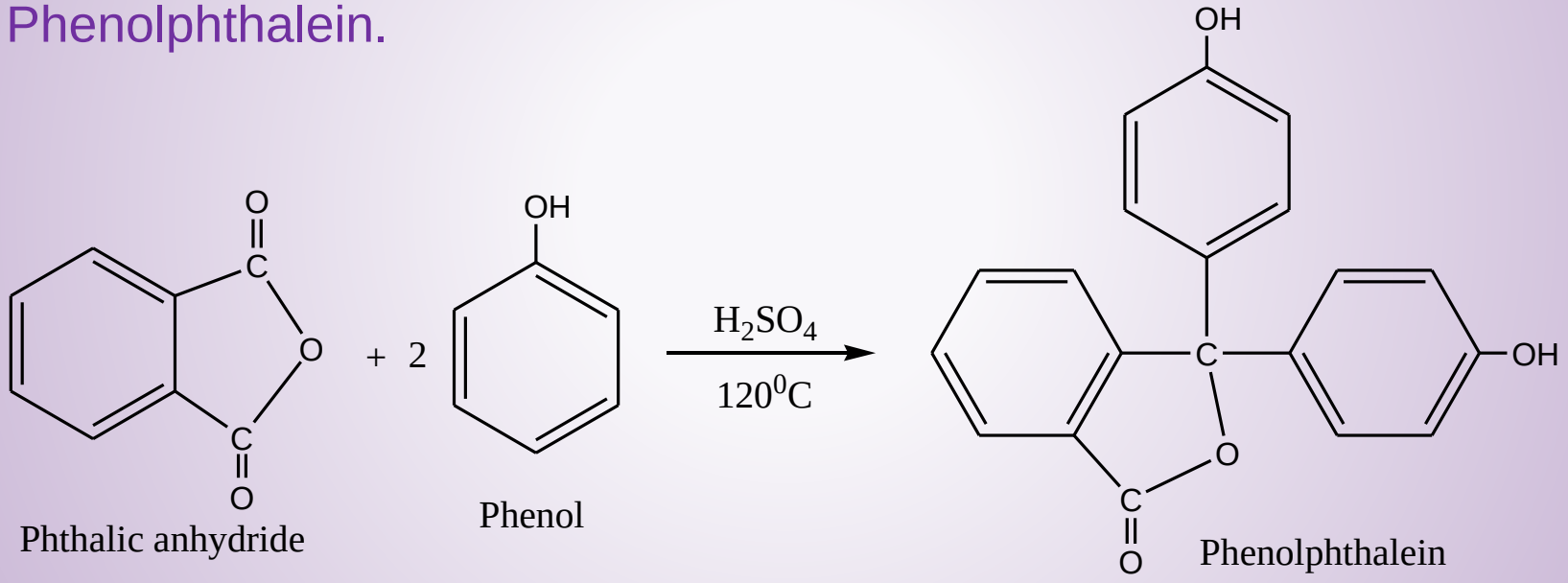
- **b) Acid dyes :**
- **The cloth or fabric are stirred in the acidic solution of dye. Then it is removed and dried.**
- Acid dyes are the sodium salt of acid. It contains sulphonic acids or phenolic acids. The colour of the acid dyes are due to the negative ions in their chemical structure.
- Ex. Picric acid, orange-II
- **c) Basic dyes :**
- **The cloth or fabric are stirred in the basic solution of dye. Then it is removed and dried.** Basic dyes containing the basic amino group ($-NH_2$) and it is protonated in the acidic condition of fibres by the formation of salt linkage with acidic group of fibres.
- Ex. Methylene blue, Methyl violet.
- **d) Vat Dyes :**
- These dyes are insoluble in water but on reduction it is soluble in water. Such dyes are used to dye the vegetables and animal fibres directly.
- Ex. Indigo dye, Anthraquinone dye.

- **e) Mordent dyes :**
- **This class of dyes have no natural affinity for direct dye to the fabric but their salts are used as dyes.** Common used mordent dyes are oxides of aluminium, iron or chromium. These salts are called as mordent dyes. Mordent dye may be used to dye wool, silk, cotton & nylon.
- Ex. Alizarin
- **f) Developed Dyes / Azoic dyes / Ingrain dyes :**
- **These dyes are synthesized within the fabric and may be applied to any type of fibre.** The cloth is first soaked in alkaline solution of phenol and dried. Then it is immersed in a cold alkaline solution of a diazonium salt. Coupling reaction take place in the fabric. Azoic dye may be used to dye cotton & other cellulose fibres.
- Ex. Azo dye

Synthesis and uses of following dyes :

i) Phenolphthalein :

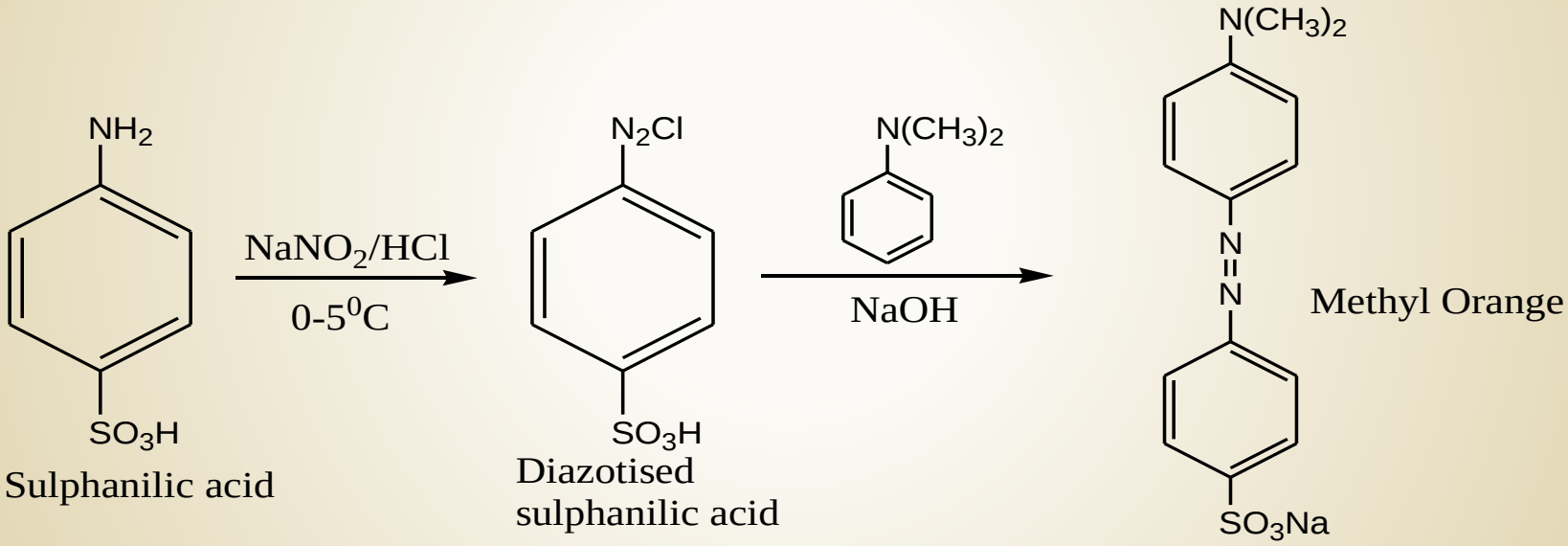
One mole of phthalic anhydride react with two moles of phenol in the presence of conc. H_2SO_4 or anhydrous $ZnCl_2$ at 120^0C gives Phenolphthalein.



Uses : i) It is used as acid base indicator.

ii) Methyl Orange :

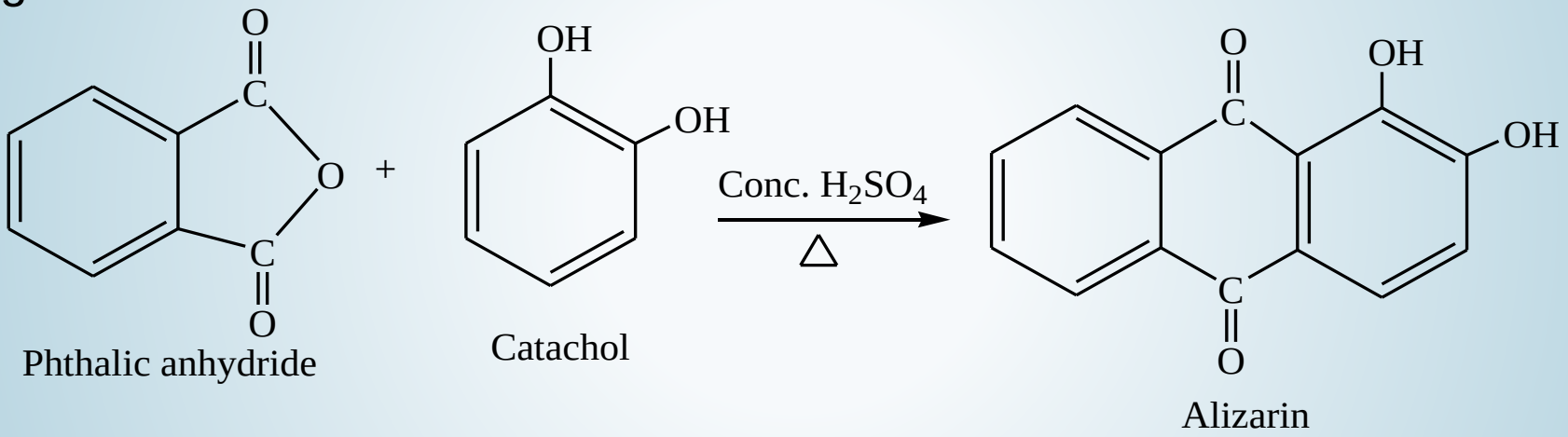
Sulphanilic acid on diazotization with $NaNO_2$/ HCl at 0-5^{0}C gives diazotized sulphanilic acid. Which on coupling with N,N-dimethyl aniline in NaOH gives methyl orange.



Uses : i) It is used as indicator in acid base titration.

iii) Alizarin :

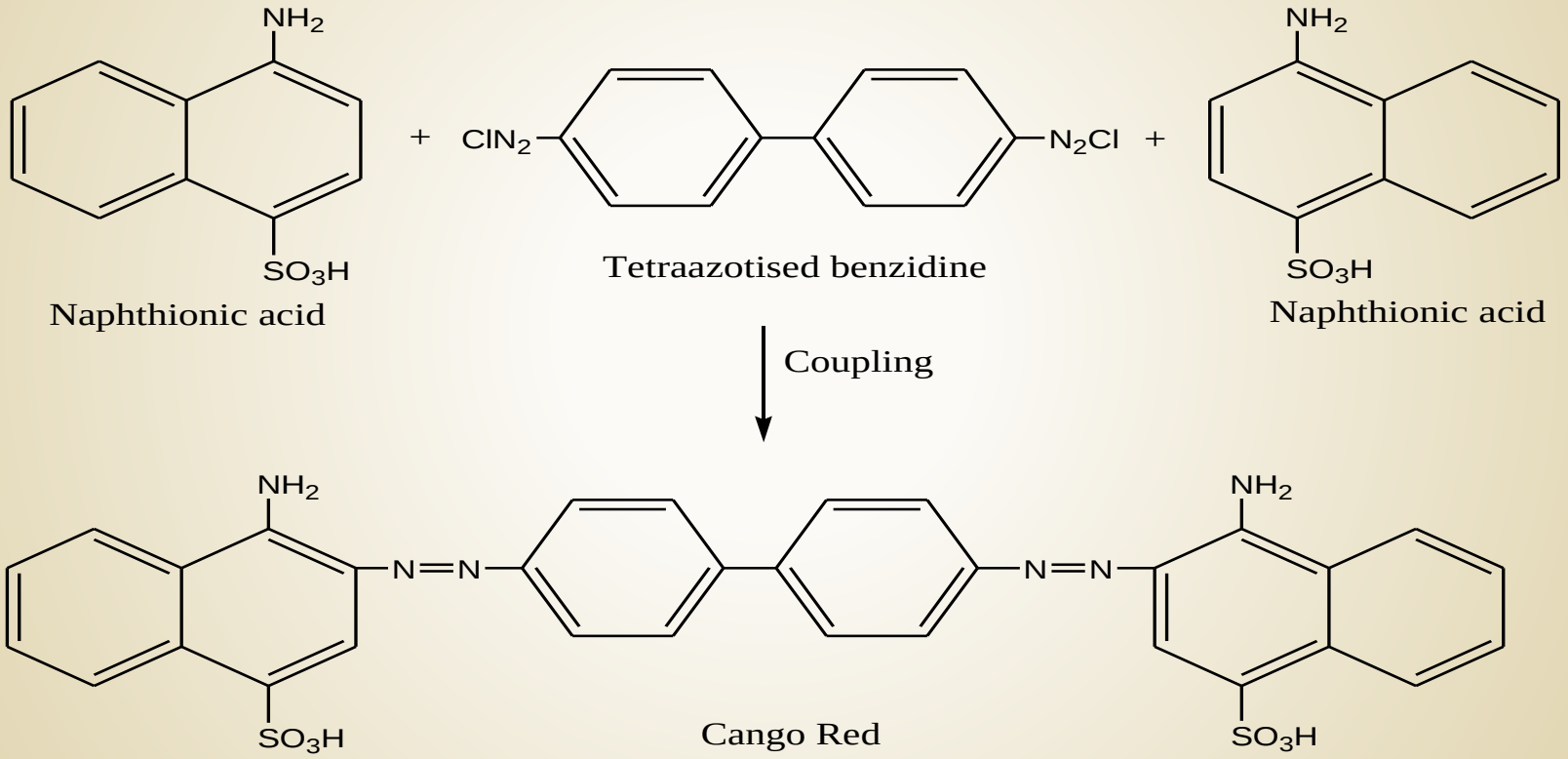
Phthalic anhydride heated with catachol in the presence of conc. H_2SO_4 gives alizarin.



Uses : i) It is used to dye wool & cotton. ii) It is used in manufacture of printing ink.

iv) Cango-Red :

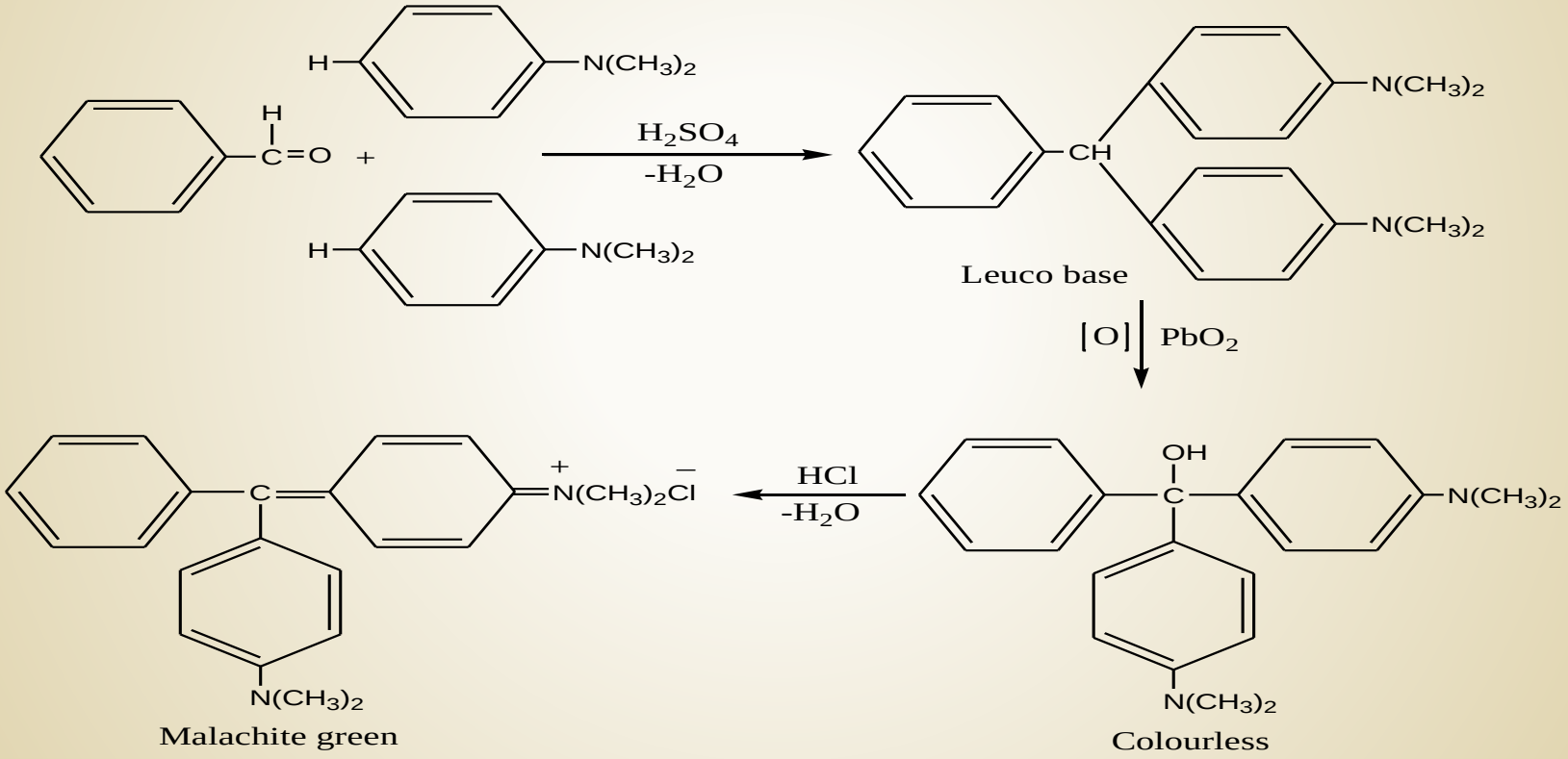
It is prepared by coupling tetraazotised benzidine with two molecules of naphthionic acid.



Uses : i) It is used as dye.
ii) It is also used as indicator.

v) Malachite green :

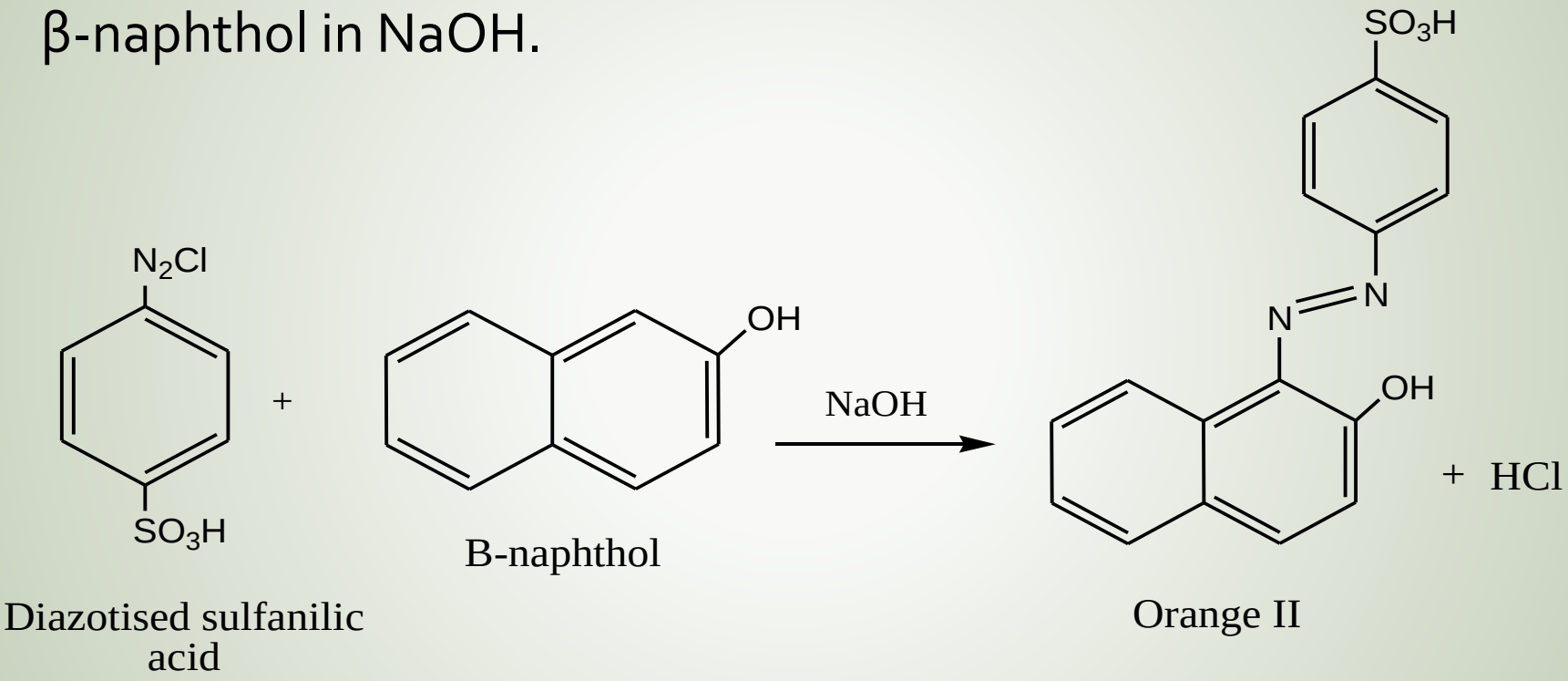
It is prepared by the reaction of one mole of benzaldehyde with two moles of N,N-dimethyl aniline in the presence of conc. H_2SO_4 followed by oxidation with PbO_2 gives malachite green.



Uses : i) It is used as direct dye for wool and silk.
ii) It is also used as mordent dye for dyeing cotton and tannin.

vi) Orange II :

It is obtained by coupling diazotized sulphanilic acid with β-naphthol in NaOH.

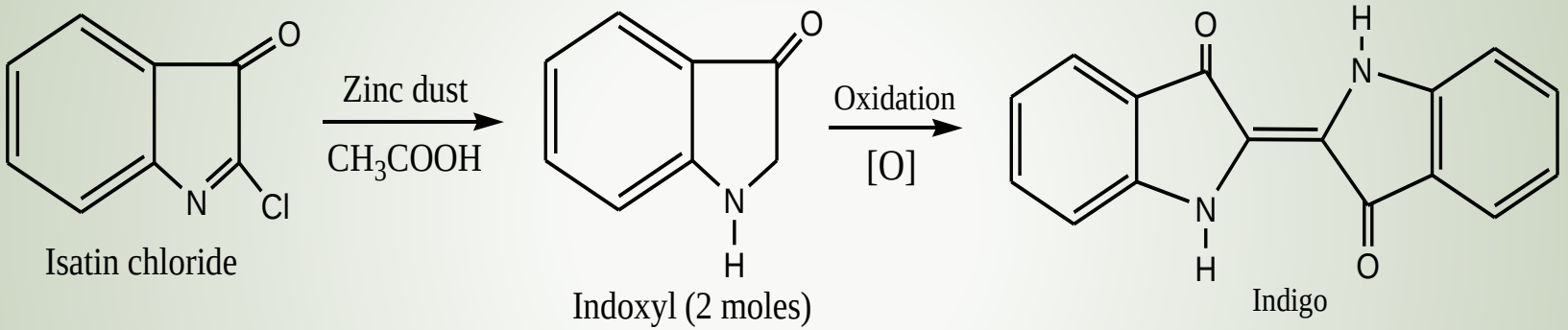


Uses :

It is used to dye for wool, silk, nylon, paper & leather.

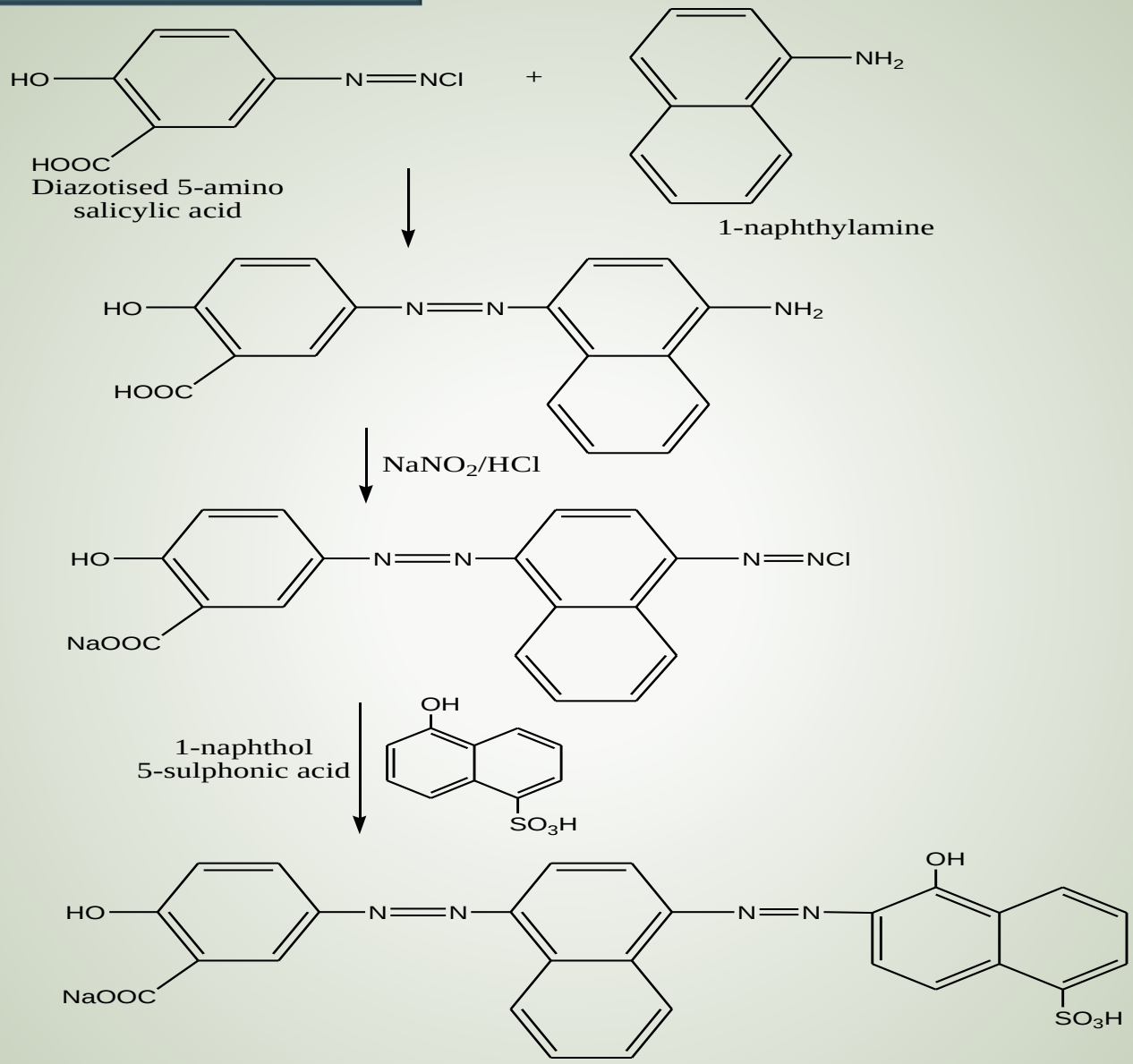
vii) Indigo dye :

It is prepared as follows.



Uses : It is used to dye for wool and silk.

viii) Diamond black – F :



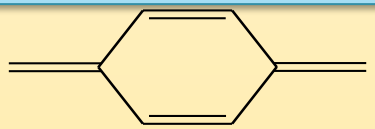
Uses : It is used to dye wool, silk, cotton & nylon.

Otto Witt Theory

According to Otto Witt theory the colour and chemical constitution of dyes are based on Chromophore and Auxochrome. Therefore this theory is also called as '**Chromophore-Auxochrome**' theory.

The colour of organic compounds is due to the presence of certain multiple bounded unsaturated functional groups called **Chromophores.**

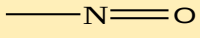
A few important chromophore groups are :



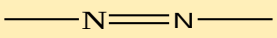
p-Quinoid

, $-NO_2$,

Nitro

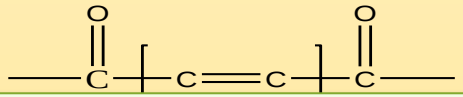


Nitroso



Azo

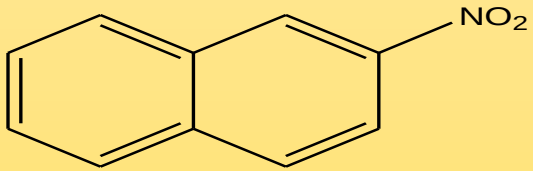
,



It has been noted that the presence of chromophore is not necessarily sufficient for colour.

To make a substance coloured, the chromophore has to be conjugated with aromatic rings. Thus, nitromethane is colourless while 2-nitronapthalene is yellow.

CH_3-NO_2 Nitromethane (Colourless)



2- Nitronapthlene (Yellow)

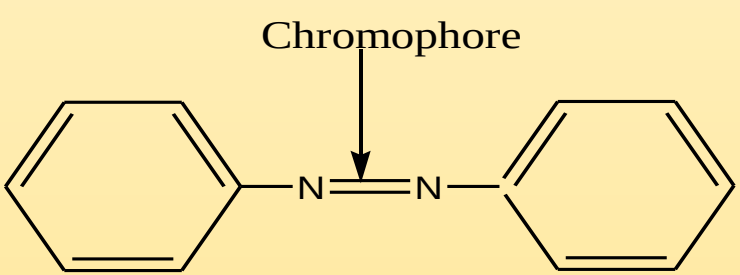
Certain functional groups (which are not chromophores) along with chromophores, increases the intensity of colour. Such groups are called **auxochrome.**

The auxochrome are two types i.e. acidic and basic as follows.

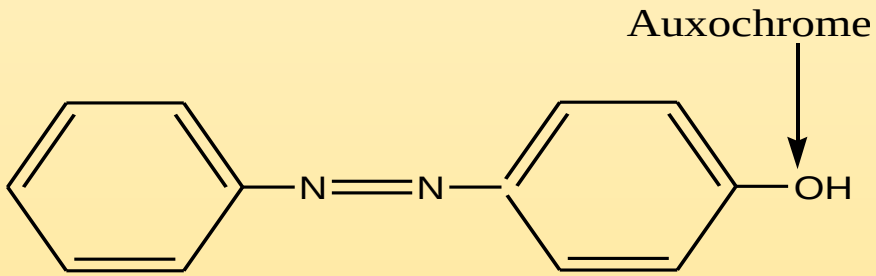
Acidic auxochromes : -OH, $-SO_3H$, -COOH

Basic auxochromes : $-NH_2$, -NHR, $-NR_2$

Ex. 1) Azobenzene has red colour, while p-hydroxy azobenzene is bright red.

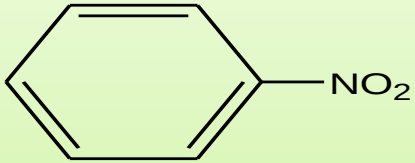


Azobenzene
(Red)

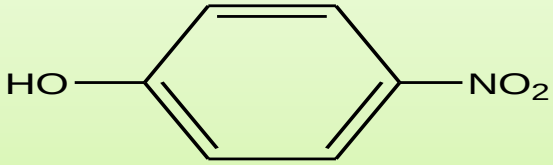


p-hydroxy azobenzene
(Bright Red)

2) Nitrobenzene is a pale yellow coloured but when the auxochrome –OH is attached to para position, the product becomes deep yellow.



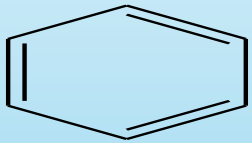
Nitrobenzene
(Pale yellow)



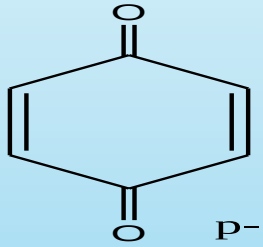
p-nitro phenol
(Deep yellow)

Armstrong theory (Quinonoid theory)

Armstrong, in 1885 suggested that all colouring matters may be represented by quinonoid structures. He said that the compound containing quinonoid structure then it produces colour otherwise it is colourless. On the basis of this theory we can say that benzene is colourless whereas benzoquinone is coloured compound.

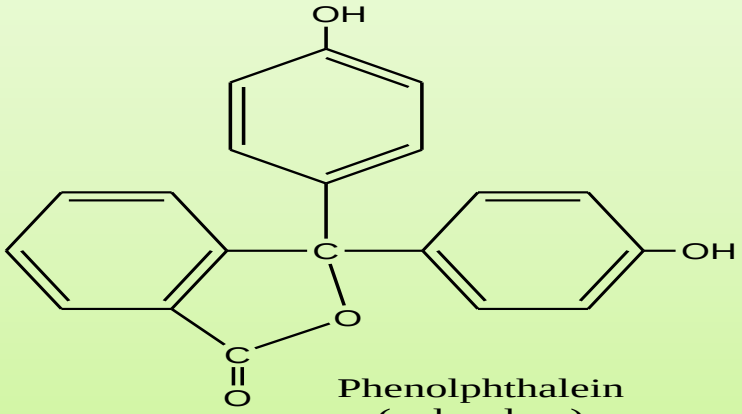


Benzene
(Colourless)

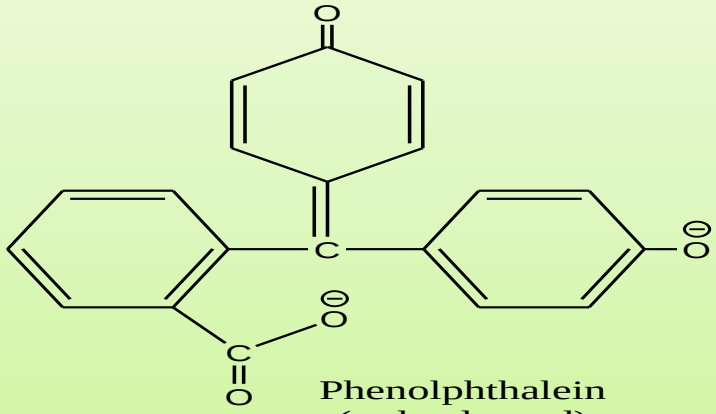


p- Benzoquinone
(yellow)

This theory explains very well the colouring properties of phenolphthalein. Phenolphthalein is coloured when present in p-quinonoid structure but colourless when p-quinonoid structure is absent.



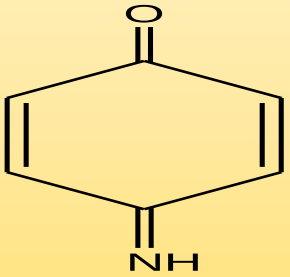
Phenolphthalein
(colourless)



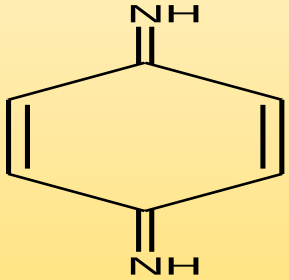
Phenolphthalein
(red coloured)

Limitations :

i) This theory can not be explain colouring characteristics of all the compounds Ex. Iminoquinone & di-iminoquinone both possess a quinonoid structure but they are colourless.

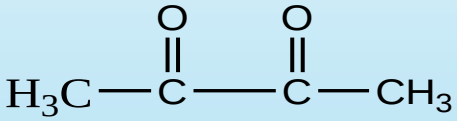


Iminoquinone

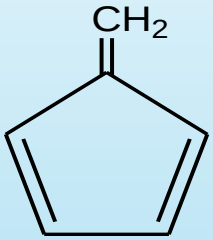


di-iminoquinone

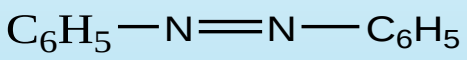
ii) A number of compounds shows colour without quinonoid structure.
Ex.



diacetyl



fulvene



azobenzene

Thank You ……