# **Experiment 5;**

# **Detection of Elements in Organic Compounds:**

## Backgraound:

Detection of elements present in an organic compound constitutes an important step in its analysis. All the organic compounds contain carbon. Hydrogen is also present in most of the organic compounds (the few exceptions are the compounds such as CCl4, CS2, etc.). In addition to carbon and hydrogen other elements which are generally present in organic compounds are oxygen, nitrogen, sulphur and halogens.

Since nearly all the organic compounds contain carbon as well as hydrogen it is usually not necessary to carry out tests to detect them and their presence can be assumed without testing for them. Here, we shall study the tests for the detection of nitrogen, sulphur and halogens only.

## Detection of Nitrogen, Sulphur, Chlorine, Bromine and Iodine by Lassaigne's Test:

This is the most dependable test for the detection of nitrogen, sulphur and halogens. This test is also known as sodium fusion test. In order to perform this test, first of all sodium extract or Lassaigne's extract is prepared as described below :

## **Preparation Of Lassaigne's Extract:**

Take a small piece of dry sodium in a fusion tube. Heat the tube slightly so that it melts to a shining globule. Add a pinch of the organic compound. Heat it slowly to start with so that the compound reacts with sodium metal. Now heat it strongly. Plunge the red hot tube into a china dish containing distilled water. Crush the contents with a glass rod and heat to boiling. Remove the insoluble matter by filtration. The filtrate is called Lassaigne's extract.Nitrogen, sulphur and halogens present in an organic compound are detected by making use of Lassaigne's extract.



### **Detection Of Nitrogen.**

To a small portion of Lassaigne's extract (usually alkaline), add 2 ml of freshly prepared ferrous sulphate solution and heat. Now add to it 2-3 drops of ferric chloride solution and acidify with cone, hydrochloric acid. A prussian blue colouration indicates the presence of nitrogen in the compound.

Na + $C + N$ (From organic	Fuse →	NaCN	
compound)			
$FeSO_4 + 2NaOH$	>	$ \begin{array}{c} \operatorname{Fe}(\operatorname{OH})_2 \downarrow + \operatorname{Na}_2 \operatorname{SO}_4 \\ \operatorname{Green \ ppt.} \end{array} $	
$Fe(OH)_2 + 2NaCN$ (From sodium extract)		$Fe(CN)_2 + 2NaOH$	
$Fe(CN)_2 + 4NaCN$	<u> </u>	$Na_{4}[Fe(CN)_{6}]$ Sod. ferrocyanide	
$3Na_4[Fe(CN)_6] + 4FeCl_3$	$\longrightarrow$	Fe <sub>4</sub> [Fe(CN) <sub>6</sub> ] <sub>3</sub> + 12NaCl Ferric ferrocyanide prussian blue colour)	

### **Detection Of Sulphur.**

1. Sodium nitroprusside test. To a small portion of Lassaigne's extract add a few drops of sodium nitroprusside solution. A purple colouration indicates the presence of sul¬phur in the compound.



2. Lead acetate test. Acidify a small portion of Lassaigne's extract with acetic acid and add a few drops of lead acetate solution. The formation of black ppt. indicates the presence of sulphur in the compound.

$$Na_2S + (CH_3COO)_2 Pb \longrightarrow PbS \downarrow + 2CH_3COONa$$
  
Black  
ppt.

#### **Detection Of Chlorine, Bromine And Iodine.**

1. Silver nitrate test. To a small portion about 2 ml of Lassaigne's extract add 1 ml of cone, nitric acid and boil for some time. Cool the contents and add to it silver nitrate solution.

(a) White precipitate, soluble in ammonium hydroxide, indicates the presence of chlorine in the organic compound.

(b) Pale yellow precipitate, sparingly soluble in ammonium hydroxide, indicates the presence of bromine in the compound.

(c) Yellow precipitate, insoluble in ammonium hydroxide, indicates the presence of iodine in the organic compound.

#### (a) For Chlorine



#### (b) For Bromine





2. Carbon disulphide test. Acidify a small portion of Lassaigne's extract with dil. HCl and add a few drops of carbon disulphide (or CCl4 or CHCl3). Now add freshly prepared chlorine water and shake vigorously.

(a) Appearance of orange colour in the carbon disulphide layer indicates the presence of bromine.

(b) Appearance of violet colour in the carbon disulphide layer indicates the presence of iodine

$$\begin{array}{cccc} \operatorname{Cl}_2 & + & 2\operatorname{NaBr} & \longrightarrow & \operatorname{Br}_2 + 2\operatorname{NaCl} \\ & & & & & & \\ & & & & & \\ & & & & & \\ & & & & & & \\ & & & & & & \\$$