



19CH101- ENGINEERING CHEMISTRY

Unit-4 FUELS AND COMBUSTION

FLUE GAS ANALYSIS BY ORSAT METHOD

The mixture of gases (like CO₂, O₂, CO, etc.,) coming out from the combustion chamber is called flue gases. The analysis of a flue gas would give an idea about the complete or incomplete combustion process. The analysis of flue gases is carried out using orsat's apparatus.

Description of orsat's apparatus

It consists of a horizontal tube. At one end of this tube, an U-tube containing fused CaCl₂ is connected through a 3-way stop cock. The other end of the tube is connected with a graduated burette. The burette is surrounded by a water jacket to keep the temperature of gas as a constant. The lower end of the burette is connected to a water reservoir by means of a rubber tube. The level of water in the burette can be raised or lowered by raising or lowering the reservoir.

The horizontal tube is also connected with three different absorption bulbs I, II and III for absorbing CO₂, O₂ and CO.

I - bulb : It consists of 'potassium hydroxide' solution and it absorbs only CO₂.

II - bulb : It consists of 'alkaline pyrogallol' solution and it absorbs only CO₂ and O₂.

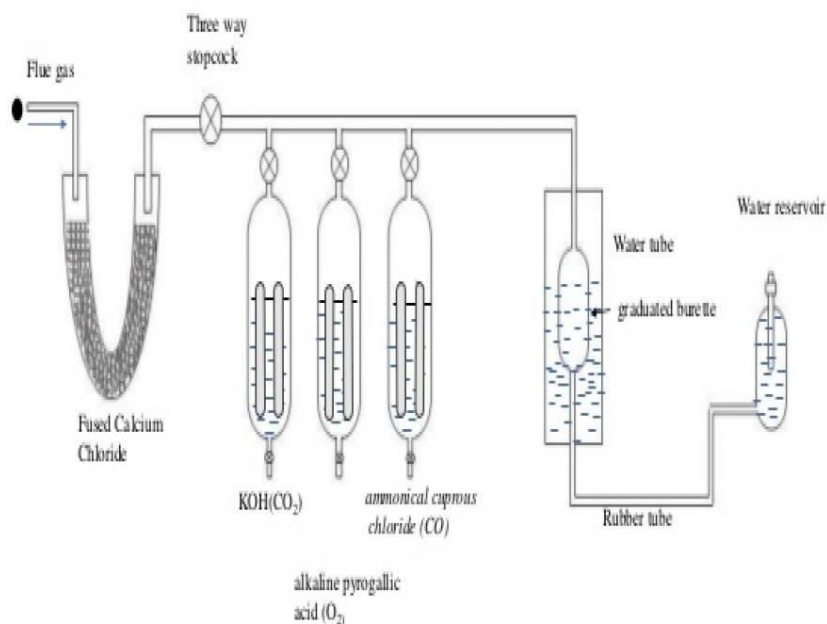
III - bulb : It consists of 'ammoniacal cuprous chloride' solution and it absorbs CO₂, O₂ and CO.

Working

The 3-way stop cock is opened to the atmosphere and the reservoir is raised, till the burette is completely filled with water and air is excluded from the burette. The 3-way stop cock is now connected to the flue gas supply and the flue gas is sucked into the burette and the volume of flue gas is adjusted to 100 cc by raising and lowering the reservoir. Then the 3-way stop cock is closed.



ORSAT APPARATUS



a) Absorption of CO₂

The stopper of the absorption bulb-I, containing KOH solution, is opened and all the gases is passed into the bulb-I by raising the level of water in the burette. The gas enters into the bulb-I, where CO₂ present in the flue gas is absorbed by KOH.

The gas is again sent to the burette. This process is repeated several times to ensure complete absorption of CO₂. The decrease in volume of the flue gas in the burette indicates the volume of CO₂ in 100 cc of the flue gas.

b) Absorption of O₂

Stop cock of bulb-I is closed and stop cock of bulb-II is opened. The gas is again sent into the absorption bulb-II, where O₂ present in the flue gas is absorbed by alkaline pyrogallol. The decrease in volume of the flue gas in the burette indicates the volume of O₂.



c) Absorption of CO

Now the stop cock of bulb-II is closed and stop cock of bulb-III is opened. The remaining gas is sent into the absorption bulb-III, where CO present in the flue gas is absorbed by ammoniacal cuprous chloride. The decrease in volume of the flue gas in the burette indicates the volume of CO. The remaining gas in the burette after the absorption of CO₂, O₂ & CO is taken as nitrogen.

Significance (or) uses of flue gas analysis

1. Flue gas analysis gives an idea about the complete or incomplete combustion process.
2. If the flue gases contain considerable amount of CO, it indicates that incomplete combustion is occurring and it also indicates that the short supply of O₂
3. If the flue gases contain considerable amount of O₂, it indicates that complete combustion is occurring and also it indicates that the excess of O₂ is supplied.