Experiment 6: Estimation of percentage of available chlorine in the given sample of bleaching powder (Iodometric method)

Significance of the experiment : Bleaching powder, also known as chlorinated lime, is a yellowish-white powder having a smell of chlorine and is readily soluble in water. It is prepared by passing chlorine gas over slaked lime at a temperature of 35-45°C and consists of a mixture of calcium hypochlorite $Ca(OCl)_2$ and calcium chloride $CaCl_2$; in addition some amountof free slaked lime i.e. $Ca(OH)_2.H_2O$ is generally present. Of these, $Ca(OCl)_2$ is responsible for the bleaching action of bleaching powder . On treatment with glacial acetic acid, it liberates chlorine gas (Cl_2).The amount of chlorine liberated by the action of an acid on bleaching powder $(CaOCl)_2$ is termed as available chlorine. The chlorine content of bleaching powder varies from 35 – 40%. Besides bleaching action it has got strong germicidal and disinfectant properties also. Accordingly, it finds application as a disinfectant for drinking water or swimming pool water. Industrially, the bleaching powder finds major use in chemical, paper, textile and oil industries. The bleaching, oxidizing or disinfecting potential of a sample of bleaching powder depends on the percentage of chlorine liberated on action of acid. We may define available chlorine to be the grams of chlorine liberated from 100 g of the bleaching powder on treatment with dilute acid. Due to its hygroscopic nature, bleaching powder absorbs moisture from atmosphere and evolves chlorine. Due to this deterioration, a sample of bleaching powder may always contain lesser amount of chlorine than expected and therefore a sample of bleaching powder needs to be analysed for its effective or available chlorine.

Aim: To determine the available chlorine in the given sample of bleaching powder by the iodometric method.

Principle : Bleaching powder is commonly used as a disinfectant. The chlorine present in the bleaching powder gets reduced with time. So, to find the exact quantity of bleaching powder required, the amount of available chlorine in the sample must be found out.The main constituent of bleaching powder is calcium hypochlorite $[Ca(OCl)_2]$ which supplies chlorine $[Cl_2]$ with dilute acids.

$$Ca(OCl)_2 + 4HCl \longrightarrow CaCl_2 + H_2O + 2Cl_2$$

The available chlorine present in bleaching powder sample is determined iodometricaliy by treating its solution with an excess of potassium iodide solution in the acidic medium.

$$OCl^- + 2H^+ + 2I^- \longrightarrow I_2 + H_2O + Cl^-$$

The liberated iodine (I_2) is treated with sodium thiosulphate ($Na_2S_2O_3$) solution using freshly prepared starch solution as indicator to be added near the end point.

$$I_2 + 2Na_2S_2O_3 \longrightarrow Na_2S_4O_6 + 2NaI$$

Procedure: Pipette out 25 ml of sample into a clean conical flask. Add 5 ml glacial acetic acid followed by 10mL of potassium iodide solution. Titrate this solution against sodium thiosulphatesolution until the yellow colour of the liberated iodine is almost disappears. Add1 ml of starch solution into this andtitrate until the blue colour is changed to white. Repeat the same procedure for concordant values.

Result: Available chlorine of sample is …….mg/L.

Links to the external sources of information about the topic:

1. https://en.wikipedia.org/wiki/Calcium_hypochlorite
2. https://www.britannica.com/technology/bleaching-powder

Experiment 6: Observation and Calculations

Burette reading	**Trial** I	**Trial** II	**Trial** III
Final reading			
Initial reading			
Volume of $Na_2S_2O_3$ run down (mL)			

Volume of water taken for titration = V = ….. ml

Volume of thiosulphate solution consumed =…… ml (a)

Normality of sodium thiosulphate solution = …. N (z)

1000 mL of 1N $Na_2S_2O_3$ = 35.46 g of chlorine

1 mL of 1N $Na_2S_2O_3$ = 35.46 mg of chlorine

`a' mL of `z' N Na_2EDTA = a X z X 35.46 mg of chlorine

therefore, residual chlorine content of the water (mg per litre) = $\frac{a\ X\ z\ \ X\ 35.46\ X\ 1000}{V}$ mg/litre

Result : Available chlorine of sample is …….mg/L.