EXPERIMENT 3

Aim

To study the rate of reaction of Iodide ions with Hydrogen Peroxide at room temperature using different concentrations of Iodide ions.

Theory

Hydrogen peroxide oxidizes iodide ions to iodine in acidic medium.

$$H_2O_2 + 2I^- + 2H^+ \longrightarrow I_2 + 2H_2O$$

$$I_2 + I^- \longrightarrow I_3^-(\text{Polyhalide ion})$$

The reaction is monitored by adding a known volume of sodium thiosulphate solution and starch solution to the reaction mixture. Iodine liberated at once reacts with thiosulphate solution and is reduced to iodide ions:

$$I_2 + 2S_2O_3^{2-} \overset{\text{Fast}}{\rightarrow} S_4O_6^{2-} + 2I^-$$

When thiosulphate ions are completely consumed, the liberated iodine reacts with starch solution and gives blue colour.

$$I_2 + \text{Starch} \longrightarrow \text{Blue complex}$$

This reaction is called indicator reaction.

The time elapsed before the appearance of blue colour, gives an idea about the rate of the reaction.

Material Required

4 Conical flasks (500 cm^3), measuring cylinder, burette, pipette (50 ml), stop-watch, 0.1M, KI solution, starch solution, '4 volume' H_2O_2 solution, 1M sodium thiosulphate solution.

Procedure

1. Take four 500 cm^3 conical flasks and label them as A, B, C and D.
2. Add 25, 50, 75 and 100 cm^3 of 0.1 M, KI solution to the flasks A, B, C and D respectively.
3. Add 10 ml of 2.5M, HCl to each flask and make up the volume in each flask to 200 cm^3 by adding water.
4. Add 5 cm^3 starch and 2 cm^3 of 1 M thiosulphate solution to each flask.
5. Add 25 cm^3 of '4 volume' hydrogen peroxide solution to flask A with the help of a pipette and start the stopwatch immediately. Stir the mixture and watch for the blue colour to appear. Note the time when the blue colour just appears.
6. Repeat the step 5 with the solutions in flasks B, C and D.

Observations

Table.3.

Flask	0.1 M KI solution (ml)	Water(ml)	Time required for appearance of the blue colour (seconds)
A.	25	125	-

B.	50	100	-
C.	75	75	-
D.	100	50	-

Room temperature = _____°C

Volume of HCl = 50 cm^3

Volume of thiosulphate = 2 cm^3

Volume of H_2O_2 = 25 cm^3

Result

The rate of the reaction increases with increase in concentration of iodide ions.

Precautions

1. Start the stop watch immediately on addition of H_2O_2.
2. Amount of sodium thiosulphate should be less than total iodine concentration produced by oxidation of I^- with H_2O_2 Each time otherwise no blue colour will be observed.
3. Use freshly prepared starch solution.

VIVA VOCE

Q 1. How does the rate of reaction between iodide ions and hydrogen peroxide vary with different concentrations of iodide ions at room temperature?

Ans. The rate of reaction between iodide ions and hydrogen peroxide is expected to vary with different concentrations of iodide ions, with higher concentrations likely resulting in faster reaction rates due to increased collision frequency between reactant molecules.

Q 2. What experimental methods can be employed to investigate the rate of reaction between iodide ions and hydrogen peroxide at room temperature using different concentrations of iodide ions?

Ans. Experimental methods such as spectrophotometry, titration, or monitoring the formation of products over time can be utilized to measure the rate of reaction between iodide ions and hydrogen peroxide at room temperature with varying iodide ion concentrations.

Q 3. How does the reaction mechanism between iodide ions and hydrogen peroxide contribute to the observed rate of reaction at room temperature?

Ans. The reaction mechanism between iodide ions and hydrogen peroxide likely involves the oxidation of iodide ions by hydrogen peroxide to produce iodine and water, with the rate of reaction influenced by factors such as reactant concentrations and temperature.

Q 4. What theoretical principles, such as the collision theory or reaction kinetics, can be applied to understand the relationship between iodide ion concentration and reaction rate at room temperature?

Ans. The collision theory suggests that increasing the concentration of iodide ions increases the likelihood of collisions between reactant molecules, leading to higher reaction rates. Reaction kinetics principles can be used to model and analyse the rate of reaction as a function of iodide ion concentration.