EXPERIMENT 4

Aim

To Study the rate of the reaction between Potassium Iodate (KIO_3) and Sodium Sulphite $Na_2S_2O_3$ using Starch Solution as indicator.

Theory

Sulphite ions react with potassium iodate producing iodide ions. Iodide ions, thus formed, are oxidized to iodine by reaction with more iodate ions. Iodine formed reacts immediately with sulphite ions forming iodide ions. When sulphite ions are completely consumed, the liberated iodine will not be consumed and would give blue colour, if starch is present. The reaction can be monitored by adding a known but limited volume of sodium sulphite solution and starch solution.

$$KIO_3 + 3Na_2SO_3 \longrightarrow KI + 3Na_2SO_4$$

Once the I_2 is formed, its presence is detected with the starch, forming a deep blue complex:

$$I_2 + \text{starch} \longrightarrow I_2 \text{ (blue complex)}$$

The potassium iodate solution is made by dissolving 4.3 g in enough water for 1l of solution. The starch-sulphite solution is made by dissolving 5 g of soluble starch in 100 g of water that is brought to a boil, allowing the solution to cool, adding 100ml of water, 1.3 g of sodium sulphite and 13 ml of 3 m sulphuric acid (a preservative) and dissolving all of that in enough water for 1 litre of solution.

Material Required

4 Conical flasks (250 ml), measuring cylinder, burette, pipette (25 ml), stop-watch, 0.01M sodium sulphite solution, 0.1 M potassium iodate solution, starch solution, 2 M H_2SO_4.

Procedure

1. Take four 250 ml conical flasks and label them as A, B, C and D.
2. Add 10 ml, 20 ml, 30 ml and 40 ml of 0.1 M KIO_3 solution to the flasks A, B, C and respectively with the help of burette.
3. Add 10 ml of 2 M H_2SO_4 to each flask.
4. Add water to make the volume of solution 100 ml in each flask.
5. Add 5 ml of freshly prepared starch solution to each flask.
6. Add 25 ml of 0.01 M sodium sulphite solution to flask A with the help of a pipette and start the stopwatch immediately.
7. Note the time when the blue colour just appears.
8. Repeat the step 7 with the solutions of flasks B, C and D.

Observations

Table.4

Flask	0.1M KIO_3 solution (ml)	2M H_2SO_4 (ml)	Water (ml)	Starch solution (ml)	0.01M $Na_2S_2O_3$ solution(ml)	Time for appearance of blue colour
A.	10	10	80	5	25	...s
B.	20	10	70	5	25	...s
C.	30	10	60	5	25	...s
D.	40	10	50	5	25	...s

Result

The rate of reaction increases with the increase in concentration of potassium iodate.

Precautions

1. Always use a freshly prepared solution of sodium sulphide because it is easily oxidized by air.
2. Concentration of KIO_3 solution should be higher than the concentration of sodium sulphilic solution.
3. Use a freshly prepared starch solution.

VIVA VOCE

Q 1. How does the rate of reaction between potassium iodate (KIO_3) and sodium sulphite (Na_2SO_3) vary when starch solution is used as an indicator?

Ans. The rate of reaction between potassium iodate and sodium sulphite, when starch solution is used as an indicator, is expected to be indicated by the appearance of a blue-black colour due to the formation of triiodide ions, with faster reaction rates leading to quicker colour changes.

Q 2. What experimental methods can be employed to measure the rate of reaction between potassium iodate and sodium sulphite using starch solution as an indicator?

Ans. Experimental methods such as spectrophotometry, titration, or visual observation of colour changes over time can be utilized to measure the rate of reaction between potassium iodate and sodium sulphite using starch solution as an indicator.

Q 3. How does the concentration of reactants affect the rate of reaction between potassium iodate and sodium sulphite when starch solution is used as an indicator?

Ans. Increasing the concentration of potassium iodate or sodium sulphite is likely to increase the rate of reaction, as more reactant molecules are available to react, leading to more frequent collisions and faster formation of triiodide ions, indicated by the appearance of the blue-black colour.

Q 4. What role does starch solution play as an indicator in the reaction between potassium iodate and sodium sulphite?

Ans. Starch solution acts as an indicator in the reaction between potassium iodate and sodium sulphite by forming a complex with triiodide ions, resulting in the characteristic blue-black colour that signals the presence of the triiodide ion and indicating the progress of the reaction.