Author's Name

Partner's Name

Date

Calcium Iodate

Abstract

In the experiment, it is observed that when a solution is diluted, the number of reacting ions become scarce as can be deduced from the observations. Water being polar forms permanent bonds with this ion such that they cannot take part in the reaction. Synthesis of insoluble salts can only be done through direct synthesis or the double decomposition reaction. A solute dissolve in a solvent that has similar chemical structure. That is to say that a polar dissolves polar and non- polar dissolves non- polar.

Ionic equations can give asummary of the precipitation reaction by only showing the ions which have changed to state. Ions which do not undergo any change of state during the reaction are known as spectator ions. They are said not to take part in the chemical reaction. The presence of the ions in the precipitate and filtrate was a clear indication that the two salts interchanged the anions

present.

Keywords; Precipitate; Insoluble solid, Spectator ions, Unchanged ions, Polar molecule, Synthesis, Nitrate.

Introduction:

The experiment involved the synthesis of Calcium Iodate using double decomposition method also known as precipitation reaction. This involved reacting two water-soluble salts i.e. Calcium Nitrate ($Ca(NO_3)_2$) and Potassium Iodate(KIO_3) whereby the two salts interchanged their anions leading to the formation of a soluble salt, i.e., Potassium Nitrate(KNO_3) and a precipitate of Calcium Iodate ($Ca(IO_3)_2$). The experiment involved crystallization of $CaIO_3$ using two sets of solutions. The first set of the solution had $Ca(NO_3)_2$ is more concentrated but in the second set the, it was diluted. It was, therefore, said to be the limiting factor since its concentration was varied. The equation of the reaction is as shown below;

$$Ca(NO_3)_{2(aq)} + 2KIO_{3(aq)} \longrightarrow 2KNO_{3(aq)} + Ca(IO_3)_{2(s)}$$

Experimental:

A 25mls solution of $Ca(NO_3)_2$ were mixed with a 25mls solution of KIO_3 in a 150mls and the solution stirred with a stirring rod scratching the sides and the bottom to induce crystallization. The mixture was made to stand for 15 minutes with the stirring rod remaining inside. Another set of the mixture was made with 10mls of water, 15mls of $Ca(NO_3)_2$ and 25mls Of KIO_3. Two filter papers were weighed, and filtration carried out on the two sets of mixtures.

The filtrates were set aside for the use, and the residues were rinsed with Methanol to drain all the liquid residuals from the solids. They were then placed in a watch glass and dried in an oven at temperatures of between 90-110^{0}c for about 45 minutes. After removing them, they were allowed to cool to room temperatures and weighed by placing them on filter papers.

On the filtrate, the presence of Ca^{2+} ions were done by placing 1ml of the filtrate and adding onto it 0.5mls of Sodium Phosphate($NaPO_4$). The same was repeated by first obtaining 1ml of the filtrate then adding 1ml of water and finally adding 0.5mls of $NaPO_4$("Precipitation/dissolution reactions in soils" Robarge, Wayne P. 196)

Another test for the filtrate was to test for the presence of the IO_3^-. This was done by obtaining 1ml of the filtrate and dissolving a drop of KI onto it followed by addition of 1ml of 1M HCl. The same was repeated by obtaining a drop of the filtrate and adding onto it 1ml of water then dissolving a drop of KI in it and then adding 1ml of 1M HCl.

Results and Discussion

The following were the results obtained;

Experimental mass of the precipitates

Mass of the filter paper =1.085g;1.075g

Mass of precipitate 1+ Filter paper = 1.473g

Mass of precipitate 2 + Filter paper = 1.380g

Mass of precipitate 1 = 1.473-1.085= 0.388g

Mass of precipitate 2 = 1.380-1.075= 0.305g

$$\% \text{ yield} = \frac{\text{Actual yield}}{\text{Theoretical Yield}} \times 100$$

$$\% \text{ Yield for precipitate 1} = \frac{0.388}{0.4874} \times 100$$

$$= 79.61\%$$

$$\% \text{ Yield for precipitate 2} = \frac{0.305}{0.3939} \times 100$$

$$= 77.43\%$$

This is an indication that diluting the $Ca(NO_3)_2$ lowered the percentage yield.

Qualitative tests for the ions

Qualitative test	Ca^{2+}	IO_3^-
Precipitate 1	A lot of cloudy precipitates was observed thus Ca^{2+}present.	A very dark green color observed thus the ions present.
Precipitate 2	Little cloudy precipitate observed thus a little Ca^{2+}ions present.	A slightly dark green color still observed confirming the presence of the ions.

Moles of $Ca(NO_3)_2$ $=\frac{(0.101 \text{ X } 25)}{1000}$

$= 0.002525$

Moles of KIO_3 $= \frac{(0.101 \text{ x } 10)}{1000}$

$=0.00101$

Conclusion:

Double decomposition reactions yield precipitates, and the quantity of the precipitate is determined by the concentration of the reactants. The number of moles produced is determined by the concentration of the reacting ions. The higher the concentration the higher the yield is.

Notes

1. A precipitate is an insoluble solid obtained when two soluble salts react.

2. Anions are negatively charged ions.

Works cited

Robarge, Wayne P. "Precipitation/dissolution reactions in soils." *Soil Physical Chemistry, Second Edition*. CRC Press, 2018. 193-238.