

EXPERIMENT

Aim

Separate Co^{2+} and Ni^{2+} ions present in the given mixture by using ascending paper chromatography and determine their R_f values.

Material Required

Gas jar, glass rod, filter paper strip (Whatman No. 1 filter paper), jar cover, fine capillary tube. Sample solution containing cobalt (II) and nickel (II) ions, acetone, concentrated aqueous ammonia, Rubeanic acid spray reagent.

Procedure

1. Take a Whatman filter paper strip (20×2 cm) and draw a line with pencil above 4 cm from one end. Draw another line lengthwise from the centre of the paper.
2. With the help of fine capillary tube, put a drop of the mixture of red and blue inks at the point P. Let it dry in air. Put another drop on the same spot and dry again. Repeat 2-3 times, so that the spot is rich in mixture.
3. Suspend the filter paper vertically in a gas jar containing the solvent (eluent) with the help of a glass rod in such a way that the pencil line (and the spot) remains about 2 cm above the solvent level (50% alcohol + distilled water).
4. Cover the jar and keep it undisturbed. Notice the rising solvent along with the mixture of red and blue inks. After the solvent has risen about 15 cm you will notice two different spots of blue and red colours on the filter paper.
5. Take the filter paper out of the jar and mark the distance that the solvent has risen on the paper with a pencil. This is called the solvent front.
6. Dry the paper. Put pencil marks in the centre of the blue and red spots.
7. Measure the distance of the two spots from the original line and the distance of the solvent from the original line.
8. Calculate the R_f values of the blue and red inks by using the formula:

$$R_f = \frac{\text{Distance travelled by the blue or red ink from the point of application}}{\text{Distance travelled by the solvent from the original line}}$$

After elution and drying, place the paper in a large, dry, covered beaker containing a smaller beaker of concentrated aqueous ammonia. After about two minutes, remove the paper and spray it on both sides with rubeanic acid reagent. Allow it to dry. Nickel becomes visible as blue purple band while cobalt becomes visible as yellow orange band. Evaluate R_f values of the two ions.

Observations and Calculations

Colour of the spot	Distance travelled by different components	Distance travelled by solvent	R _f values
Blue purple Ni ²⁺	A cm	X cm	A/X
Yellow orange Co ²⁺	B cm	X cm	B/X

Result

R_f value of Ni²⁺ =

R_f value of Co²⁺ =

The above experiment can be carried by using a mixture of

- (i) Iron (II) and Cobalt (II)
- (ii) Iron (II) and Nickel (II)
- (iii) Copper (II) and Iron (II)
- (iv) Copper (II) and Nickel (II)
- (v) Iron (II) and Zinc (II)
- (vi) Lead (II) and Cadmium (II).

VIVA VOCE

Q 1. What is the objective of the experiment you performed?

Ans. The objective is to separate Co²⁺ and Ni²⁺ ions present in the given mixture using ascending paper chromatography and determine their respective R_f values.

Q 2. Explain the principle behind the separation of metal ions using paper chromatography.

Ans. Paper chromatography separates metal ions based on their affinity for the stationary phase (filter paper) and the mobile phase (solvent). The metal ions with higher affinity for the mobile phase move further up the paper strip.

Q 3. Why is ascending chromatography preferred over descending chromatography in this experiment?

Ans. Ascending chromatography allows for better separation and resolution of metal ions as the solvent moves upwards against gravity, providing more uniform migration of the metal ions.

Q 4. What factors influence the choice of solvent for separating metal ions in paper chromatography?

Ans. Factors include the polarity of metal ions, solubility of metal ions in the solvent, and interactions between the metal ions and the stationary phase.

Q 5. How can you identify Co²⁺ and Ni²⁺ ions on the chromatogram?

Ans. Co²⁺ and Ni²⁺ ions can be identified by comparing their migration distances (spots) on the chromatogram with known standards or by using suitable visualization techniques.

Q 6. Why is it necessary to perform ascending paper chromatography in this experiment rather than descending chromatography?

Ans. Ascending paper chromatography is preferred in this experiment because it allows for better separation of the metal ions due to the upward movement of the solvent, which prevents the mixing of components as the solvent front progresses.