

Aim: To determine the solubility of salts (KCl) in water at room temperature.

Theory: Solubility is defined as the maximum amount of a solute that can dissolve in a given amount of solvent at a specified temperature to form a saturated solution. For solid–liquid systems, solubility is usually expressed as grams of solute dissolved in 100 g of water.

When a solid salt such as potassium chloride (KCl) is added to water, the solute particles interact with water molecules and dissolve due to solute-solvent interactions. Dissolution continues until the rate of dissolution equals the rate of crystallization, resulting in a saturated solution at equilibrium. The solubility of a salt depends on several factors, such as the nature of the solute and solvent, temperature, and intermolecular forces. For most ionic solids, solubility increases with an increase in temperature because the dissolution process is endothermic. Potassium nitrate shows a sharp increase in solubility with temperature, whereas potassium chloride and barium chloride show comparatively moderate changes.

Chemicals Required:

Potassium chloride (KCl)

Distilled water

Apparatus Required:

Beakers

Graduated cylinder

Stirring rod

Analytical balance

Thermometer

China dish

Funnel and filter paper

Procedure (Evaporation Method):

1. Take about 50 mL of distilled water in a beaker.
2. Add the given salt (KCl) slowly with continuous stirring at room temperature until no more salt dissolves and some solid remains undissolved.
3. Stir the solution for a few minutes to ensure saturation.
4. Measure and note the room temperature (approximately 25°C).
5. Filter the saturated solution to remove undissolved salt and collect the clear solution in a pre-weighed clean and dry china dish.
6. Weigh the dish containing the saturated solution.
7. Heat the solution gently to evaporate all the water, leaving behind the solid salt.
8. Cool the dish and weigh it again to find the mass of the dissolved salt.
9. Calculate the mass of water by subtracting the mass of salt from the total mass of the solution.

Calculations

Room temperature = _____ °C

Let,

Mass of empty dish = w_1 g

Mass of dish + saturated solution = w_2 g

Mass of dish + dry salt after evaporation = w_3 g

Then,

Mass of dissolved salt = $w_3 - w_1$ g

Mass of water = $w_2 - w_3$ g

Solubility of the salt (in g per 100 g of water) is given by:

$$\text{Solubility} = \frac{\text{Mass of dissolved salt}}{\text{Mass of water}} \times 100$$

$$\text{Solubility} = \frac{(w_3 - w_1)}{(w_2 - w_3)} \times 100$$

Result:

The solubility of the given salt (KCl) in water at room temperature is _____ g per 100 g of water.