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EXP 4

Determination of Solubility by Gravimetric Method

The purpose of the experiment:

To determine the solubility of sodium chloride in water (gravimetric method of estimation).

Principle:

Mathematically solubility is expressed as the concentration of solute in a solution, which is in equilibrium with the solute (solid). That means the concentration of solute in a saturated solution its solubility.

Though concentration can be expressed in many units, that solubility of solids in solvents is usually expressed in relation to solute and solvent that make a saturated solution. The pharmacopoeial expression of solubility is the number of milliliter of solvent in which 1 gram of solute will dissolve to make a saturated solution.

The simplest way of solubility determination is to determine the concentration of solute in a saturated solution and work out the quantity of solvent in volume and quantity of solute in weight to express solubility.

The concentration can be determined by gravimetric, titrimetric or by any instrumental method of analysis.

Sodium chloride can be estimated by simple gravimetric method.

Apparatus and Materials Required:

Conical flask, balance, evaporating dish, pipette, sodium chloride and water.

Process:

1- An increasing amount of sodium chloride is added to about 50 ml water in conical flask with shaking until the solution is saturated and a part of solid is left undissolved (around 20 gram sodium chloride is required).
2- The solution filtered and 10 ml of filtrate is pipetted out into a preweighed evaporating dish
3- The dish containing 10 ml filtrate is weighed
4- The filtrate is evaporated to dryness and further dried at about 100 C^0 in an oven, then it is cooled and weighed. Drying is continued till a constant weight obtained

Calculation:

Weight of empty dish = W1
Weight of dish with 10 ml solution = W2
Weight of dish with dry solution = W3
Weight of solute in 10 ml solution = W3- W1= W4
Weight of solvent in 10 ml solution = W2-W3= W5

$$1 \, gm \, of \, solute \, required \, solvent = \frac{W5}{W4 \times density \, of \, solvent}$$

Discussion

1- How do you that a saturated solution is prepared?
   While shaking excess solute in solvent, concentration is measured at frequent intervals. If two consecutive observations show the same concentration, it may be concluded that a saturated solution is prepared.

2- What is the need of mentioning temperature?
   Solubility depends on temperature and pressure, and the solubility differs at different temperature. It may either increase or decrease with rise of temperature depending on endothermic or exothermic dissolution.

3- How can solubility at higher or lower temperature be determined?
   For determination of solubility at higher temperature, the solvent is maintained at the temperature by keeping the container of solvent in a thermostatic water (or suitable liquid) bath.

For lower temperature the conical flask containing saturated solution, prepared at room temperature, may be kept surrounded by ice-cold water to bring down the temperature to a desired level below that of environment. The temperature may be lowered continuously by adding small but increasing quantity of ice to the cooling bath.

Then solubility at the particular temperature can be determine in the usual way.

4- What is the important of solubility in pharmacy?
Solubility data help in the selection of solvent system for making liquid medicines. In case of insolubility or low solubility, the Solubilization techniques are used to dissolve solid in water, or it may be made into a suspension.

Solubility less than 1g/ml indicates the need of a salt from the compound, if formulated as tablets or capsules in order to improve absorption.

Asst. Lec. Sarah Mohammed Ali

E-mail : Sarah.mohammed@mustaqbal-collge.edu.iq