

CHAPTER NO. 2

EXPERIMENTAL TECHNIQUES IN CHEMISTRY

Q.1. Mention the major steps involved in crystallization?

Ans: The major steps involved in crystallization are:

1. Preparation of saturated solution.
2. Choice of solvent.
3. Filtration of impurities.
4. Cooling of hot filtered solution.
5. Collecting of crystals.
6. Drying of crystals.
7. Decolourization of crystals.

Q.2: Mention various experimental techniques which are used for the purification of substances?

Ans: The experimental techniques which are used for the purification of substances are:

1. Filtration
2. Crystallization
3. Sublimation
4. Solvent Extraction
5. Chromatography

Q.3: Why is there a need to crystallize the crude products?

Ans: The crude product is impure, therefore, there is a need to purify it by crystallization from a suitable solvent.

Q.4: Which solvents are mostly used in crystallization?

Ans: The solvents which are mostly use for crystallization are:

1. Water
2. Rectified spirit
3. Absolute alcohol
4. Ether
5. Acetone
6. CCl₄
7. Chloroform
8. Acetic acid
9. Petroleum ether

Q.5: Why solid iodine sublimes? Give reason.

Ans: Solid Iodine has only dispersion force, which are the weakest force. The vapour pressure of iodine is also low. Therefore, solid iodine sublimes.

Q.6: What is the role of stationary phase in chromatography?

Ans: The role of stationary phase in chromatography is to attract the components of the mixture and allow then pass over it with different strengths of attraction?

Q.7: What is chromatography? Give its two types.

Ans: **Chromatography:**

Chromatography is a technique which is used for the separation of components of a mixture. It involves the distribution of a solute between a stationary phase and a mobile phase.

Types:

These are two types of chromatography. These are:

1. Adsorption chromatography
2. Partition chromatography

Q.8: How the decolourization of undesirable colours is carried out for freshly prepared crystalline substances?

Ans: The decolourization of undesired crystals are carried out by boiling the substance with sufficient amount of animal charcoal in the solution and then

filtering the hot solution coloured impurities are adsorbed by the charcoal and pure substance crystal are out on cooling.

Q.9: What is R_f Value? Give its formula?

Ans: ***R_f Value:***

R_f stands for retardation factor. Each component in the mixture has a specific retardation factor called R_f value. The R_f value is related to the distribution coefficient and is given by:

Formula:

$$R_f = \frac{\text{Distance traveled by a component from the original spot}}{\text{Distance traveled by the solvent from the original spot}}$$

Q.10: What is solvent extraction?

Ans: A technique in which solute is separated from a solution by shaking the solution with another solvent in which the solute is more soluble and the added solvent does not mix with the solution is called solvent extraction.

Q.11: Define sublimation with an example?

Ans: ***Sublimation:***

The process is which a solid, when heated, vapourizes directly without passing through the liquid state is called sublimation.

Example:

Naphthalene, NH_4Cl , Iodine and camphor undergo sublimation.

Q.12: What is crystallization?

Ans: The process in which a dissolved solute comes out of solution and form a crystalline solid is called crystallization.

Q.13: R_f value is always less than 1.0 comment on it?

Ans: The R_f value is related to the distribution coefficient and is given by:

$$R_f = \frac{\text{Distance traveled by a component from the original spot}}{\text{Distance traveled by the solvent from the original spot}}$$

Since the distance traveled by solvent from the original spot is greater and is in the denominator than the distance traveled by a component which is in the numerator, therefore R_f value is always less than 1.0.

Q.14: How vacuum desicator is used to dry the crystals?

Ans: The crystals are spread over a watch glass and kept in a vacuum desicator for several hours. The drying agents used in a desicator are CaCl_2 , silica gel or P_2O_5 .

Q.15: What is adsorption chromatography?

Ans: Chromatography in which stationary phase is solid, is called adsorption chromatography. In adsorption chromatography, a substance leaves the mobile phase to become adsorbed on the surface of solid phase. e.g. column chromatography.

Q.16: What should be the size of stem of the funnel used for filtration?

Ans: The stem of funnel should be long enough to extend in a few centimeters down into receiving beaker and the tip should touch the side of the beaker to avoid splashing.

Q.17: Why R_f Value has no units?

Ans: R_f value has no unit, because it is a ratio and the units in numerator and the denominator cancel each other.

Q.18: Give the main characteristics of the solvent used for crystallization.

Ans: An ideal solvent should have the following characteristics.

1. The solvent should dissolve a large amount of the substance at its boiling point but only a small amount at room temperature.
2. It should not react chemically with the solute.
3. It should not dissolve the impurities.
4. It should be cheap.
5. On cooking it should form well-developed crystals of the pure compound.
6. It should be easy to remove.
7. it should be save to use.

Q.19: How we can run the process of filtration smoothly?

Ans: To run the process of filtration smoothly, the stem of the funnel should remain continuously full of liquid as long as there is liquid in the conical portion. The stem of the funnel should be long enough and the tip should touch the side of the beaker to avoid splashing.

Q.20: Differentiate between stationary phase and mobile phase?

Ans: **Stationary Phase:** The phase over which the mobile phase flows is called stationary phase.

Mobile Phase: The solvent or mixture of solvents used for the separation of components of a mixture in chromatography is called mobile phase.

Q.21: Differentiate between sublimation and condensation?

Ans: **Sublimation:** The process in which solid is directly converted into vapour without passing through a liquid state is called sublimation.

Condensation: The change of gas to either the liquid or the solid state is called condensation.

Q.22: How does Gooch crucible increase rate of filtration?

Ans: It is made of porcelain having a perforated bottom which is covered with paper pulp. For quick filtration, Gooch crucible is placed in a suction filtering apparatus to increase the rate of reaction.

Q.23: Define adsorption and partition chromatography?

Ans: **Adsorption Chromatography:** Chromatography in which stationary phase is solid is called adsorption chromatography. e.g. column chromatography.

Partition Chromatography: Chromatography in which stationary phase is liquid is called partition chromatography. e.g. paper chromatography.

Q.24: How naphthalene can be purified?

Ans: Naphthalene can be purified by sublimation process. Impure naphthalene is placed in watch glass covered with an inverted funnel and open and is closed with a cotton plug. Naphthalene is then heated slowly over a sand bath and the funnel is cooled with wet cotton. The pure naphthalene deposits on the inner side of the funnel and thus naphthalene is purified.