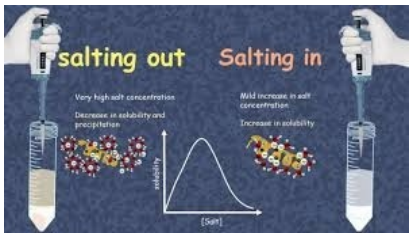
Chapter II:
Separation by Phase Rupture



Introduction:

Phase separation is a method used to isolate or purify compounds present in a liquid phase by exploiting changes in the physicochemical conditions of the system (pH, solubility, temperature, etc.). This method is particularly useful for treating homogeneous or liquid solutions.

II.1. Definition:

In a homogeneous liquid solution, the constituents are in thermodynamic equilibrium and are completely dissolved. Phase separation relies on the disruption of this equilibrium to cause the formation of a new, distinct phase (solid or liquid) containing one or more of the components to be separated.

II.2. Mechanisms of Phase Break

Phase break can be achieved by:

a) **Change in solubility:**

- Changing the temperature.
- Variation of pH to precipitate or release a component.
- Addition of an immiscible solvent.

b) **Elimination (Precipitation):**

- Transformation of a dissolved solute into a solid phase by modifying the environmental conditions.
- Example: Precipitation of salts by adjusting the pH or adding a specific precipitant.

c) **Salting Out:**

- Phenomenon by which a solute is extracted from a solution by the addition of another compound (often an electrolyte) which reduces the solubility of the solute.

II.3. Elimination (Case of a Liquid Solution):

II.3. 1. Definition: Elimination consists of transforming a dissolved component into an insoluble phase (usually solid) to separate it from the rest of the solution.

II.3. 2. **Examples:**

- Precipitation of metal ions by addition of a reagent such as ammonium oxalate.
- Formation of crystals of a solute when the solution is cooled (crystallization).

II.3. 3 **Factors influencing elimination:**

- **Temperature:** A decrease may cause precipitation of a compound that is poorly soluble at low temperature.
- **Concentration:** Too high a concentration can lead to saturation and precipitation.
- **Addition of a reagent:** A specific reagent can interact with a solute to form a precipitate (metal complexes, insoluble salts).

II.4 Salting Out (Case of a Liquid Solution):

Salting Out: Release: When a substance is in solution, each molecule (or ion) is surrounded by solvent molecules which prevent it from grouping with its congeners and therefore from returning to its "open air" form.

✓ **Definition:**

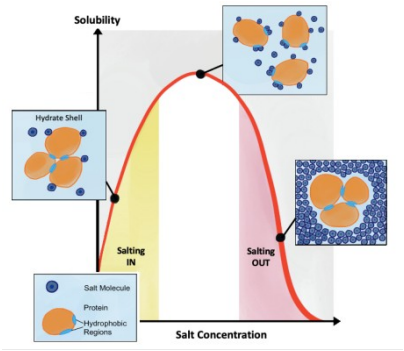


Fig.II.1: Salting Out[1]

Relargage, known as "salting out" in English, is a technique used primarily for the purification or separation of certain components from a mixture. It is commonly applied in the fields of soap production and essential oil extraction.

✓ **Salting Out in Soap Making:**

- **Definition:** In soap making, salting out is a process where a salt solution (saltwater) is added to a soap mixture to purify it.
- **Principle:** The soap is dissolved in water, and then a large amount of salt (sodium chloride) is added. Soap is less soluble in saltwater than in pure water, causing it to precipitate out as a paste, separating it from the aqueous phase (which contains impurities and glycerin).
- **Application:** This process results in a pure soap. The precipitated soap paste is then washed to remove any remaining salt traces.

✓ **Salting Out of Essential Oils:**

- **Definition:** In the context of essential oil extraction, salting out refers to the step where a saturated solution (often saltwater) is used to enhance the separation of essential oil from water.
- **Principle:** By adding a saline solution, the density of the aqueous phase increases, making it easier to separate essential oils, which are generally less dense

[1] Google : image. com

than water and float on the surface. This method is used after hydrodistillation to better recover the essential oil.

- When a substance is in solution, each molecule (or ion) is surrounded by solvent molecules which prevent it from grouping with its congeners and therefore from returning to its "open air" form.

✓ **Chemical Mechanism of Salting Out:**

- **Effect of Ions in Solution:** Salting out relies on the principle that the solubility of certain compounds changes in the presence of ions in solution. When salt is added, the ion concentration in water increases, altering the balance of forces in the solution. This pushes less soluble molecules (such as soap or certain essential oils) to separate from the aqueous phase.

- **Reduction of Solubility:** The addition of salt reduces the solubility of organic compounds in water, causing them to precipitate or float, making them easier to recover.

Conclusion

Phase separation is an essential technique for isolating and purifying compounds from liquid solutions. Whether by elimination or salting out, these methods offer great flexibility and find varied applications in many industrial and scientific sectors. Optimization of parameters such as pH, temperature and concentration is crucial to ensure high yield and optimum purity of the extracted compounds.