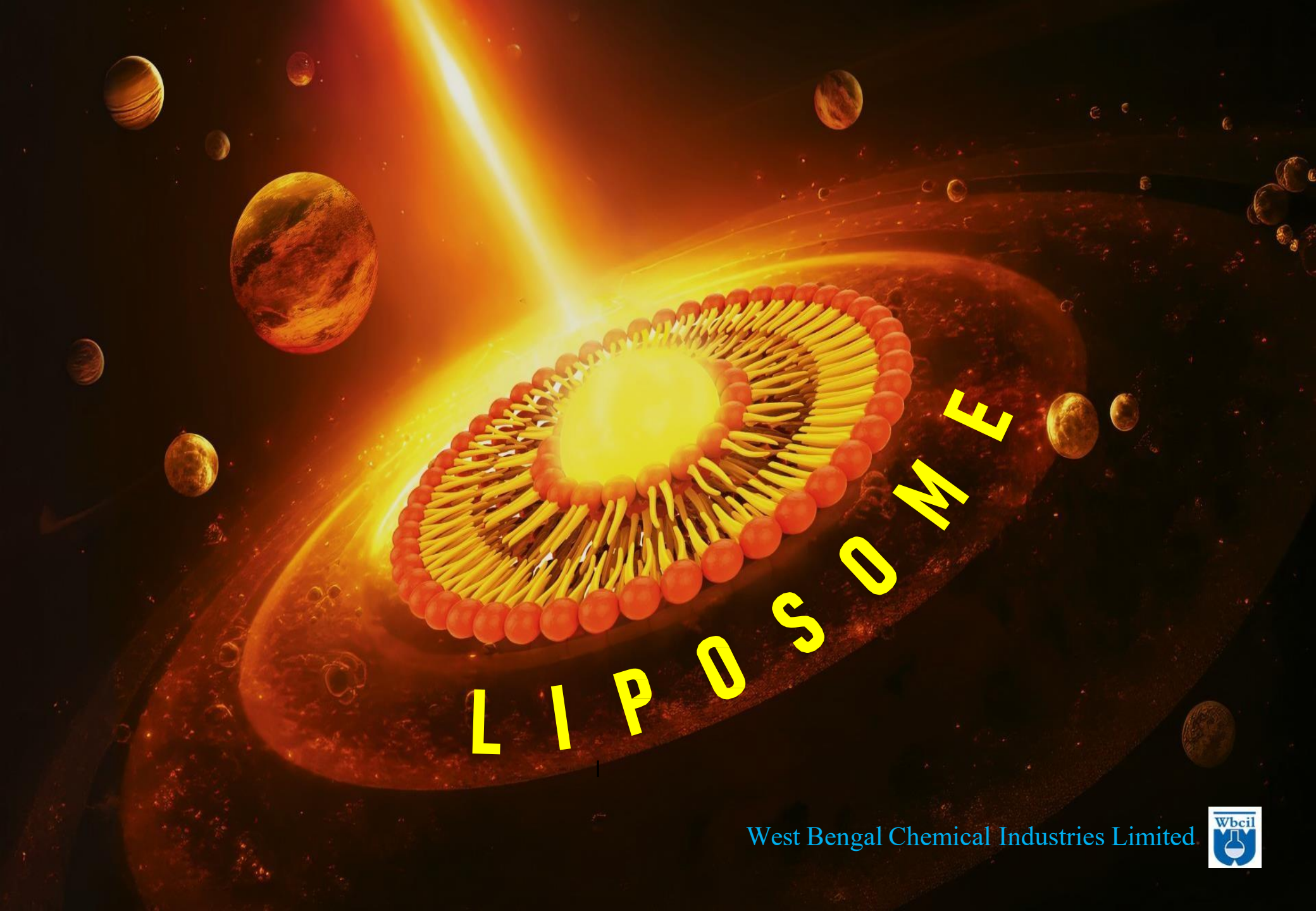


West Bengal Chemical Industries Limited

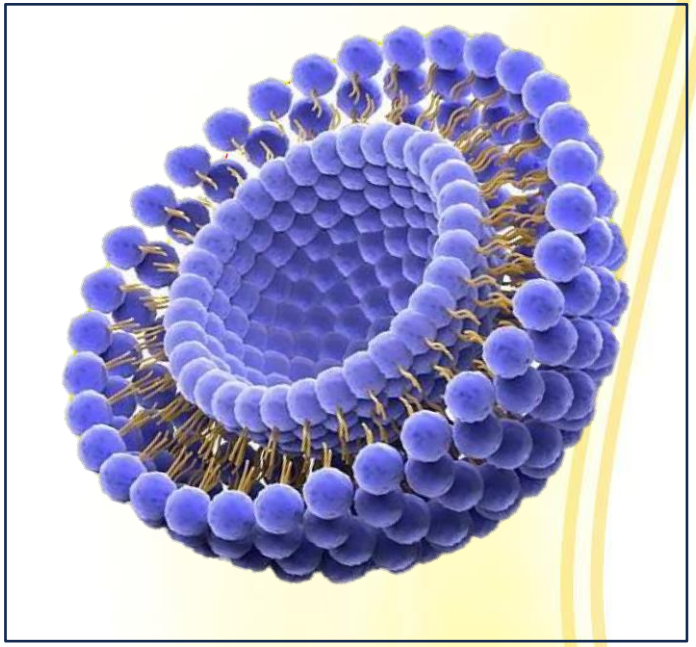
I. Lecithin – A Gateway to Liposomes

Sunflower

Lecithin

- **Sunflower** seeds are used to extract lecithin.
- **Lecithin** is purified to obtain phospholipids.
- **Phospholipids** form liposomes in aqueous media.

Liposome



II. Composition of Lecithin

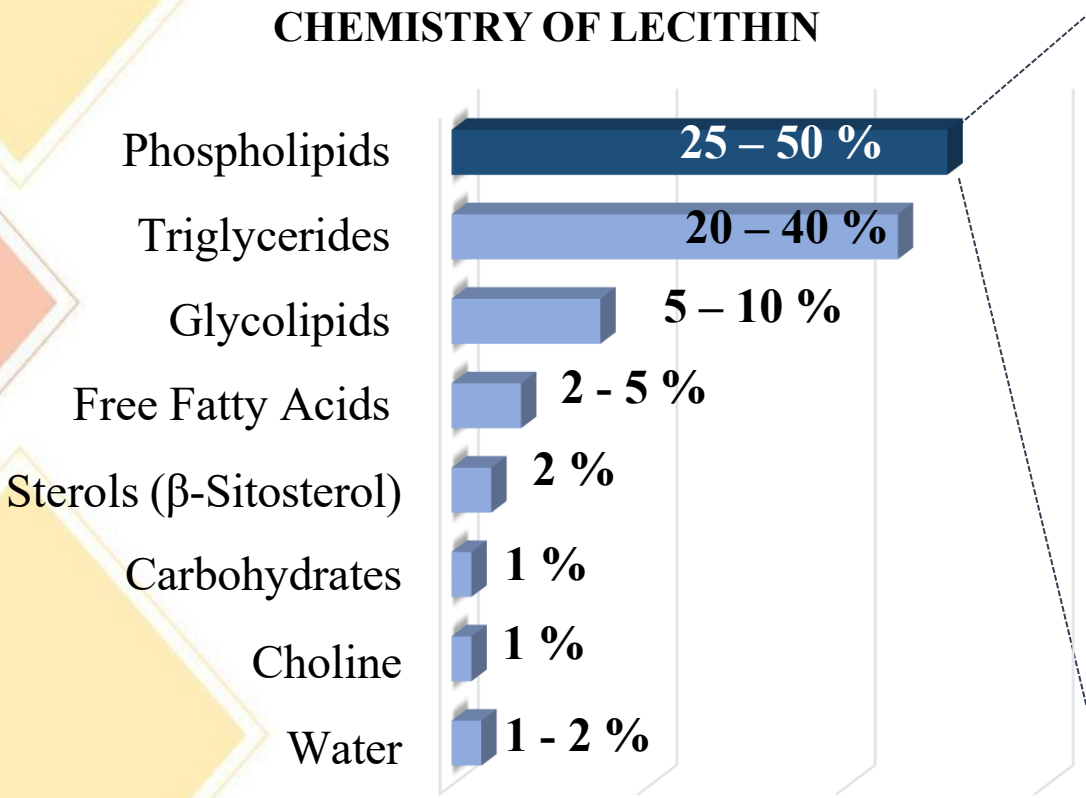


Figure 1: A representation of the composition of lecithin.

- Lecithin mostly contains phospholipids (25–50%) and triglycerides (20–40%).
- It also includes glycolipids, free fatty acids, sterols, carbohydrates, choline, and water in smaller amounts.
- Key phospholipids are PC, PE, PI, and PA, important for cell membranes and drug delivery.

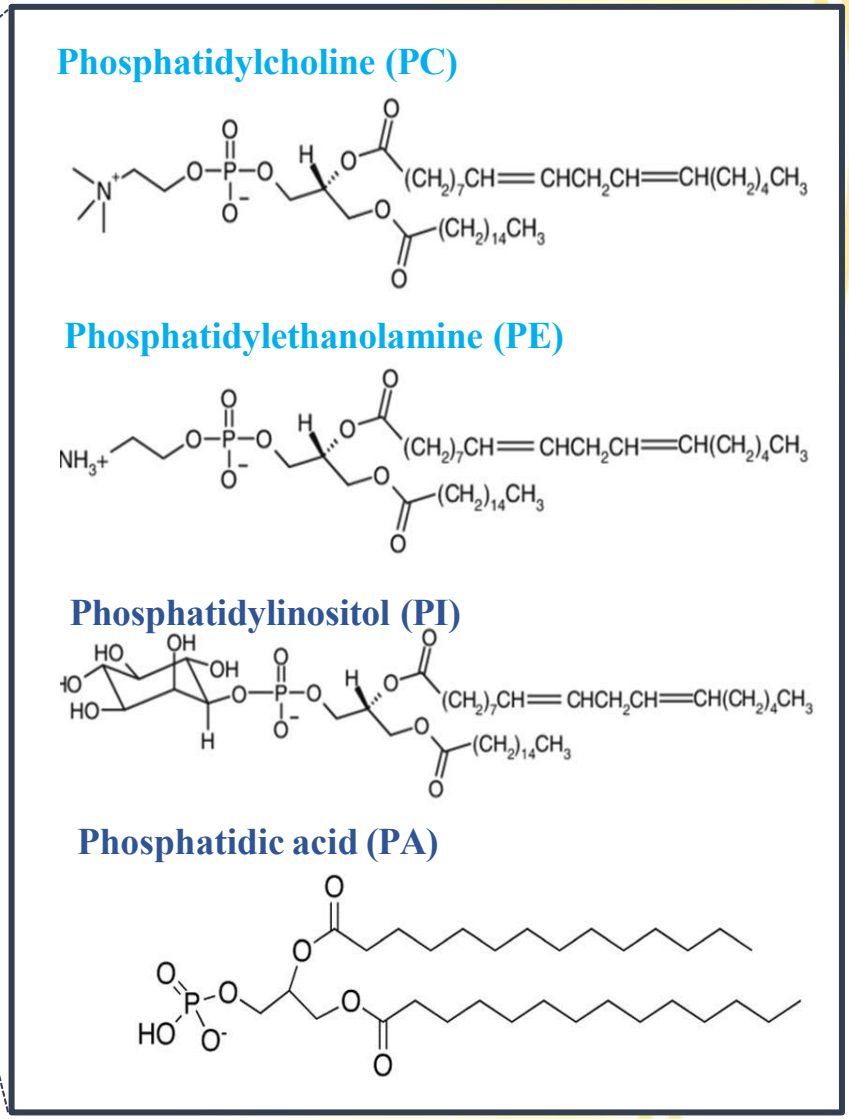
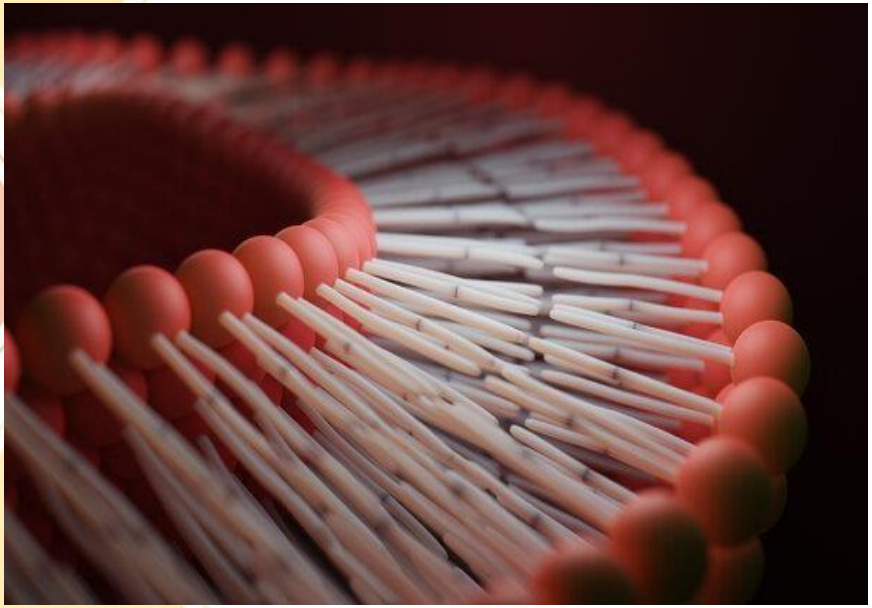


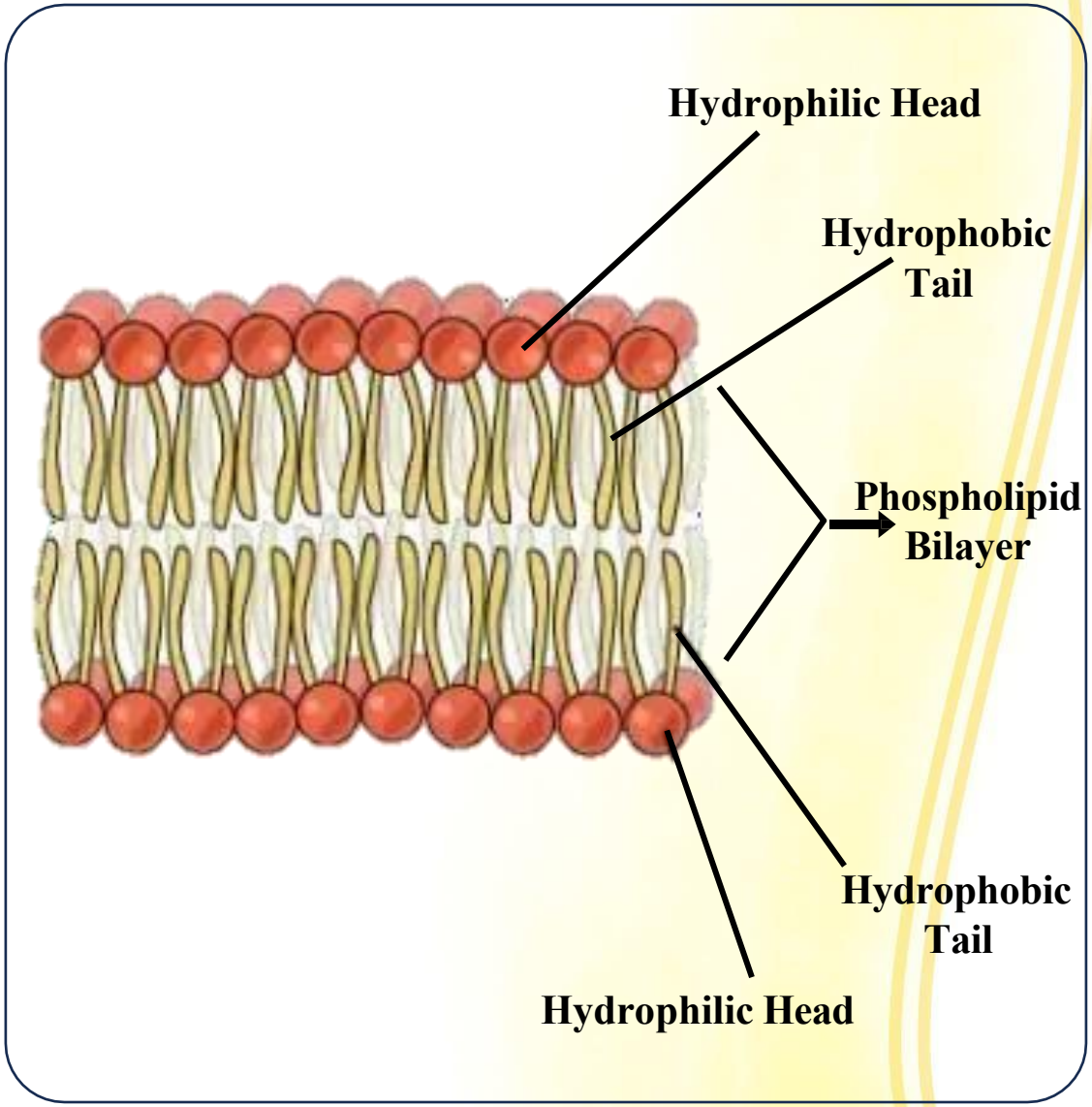
Figure 2: Chemical structures of phospholipids comprising lecithin.

III. What are Phospholipids?

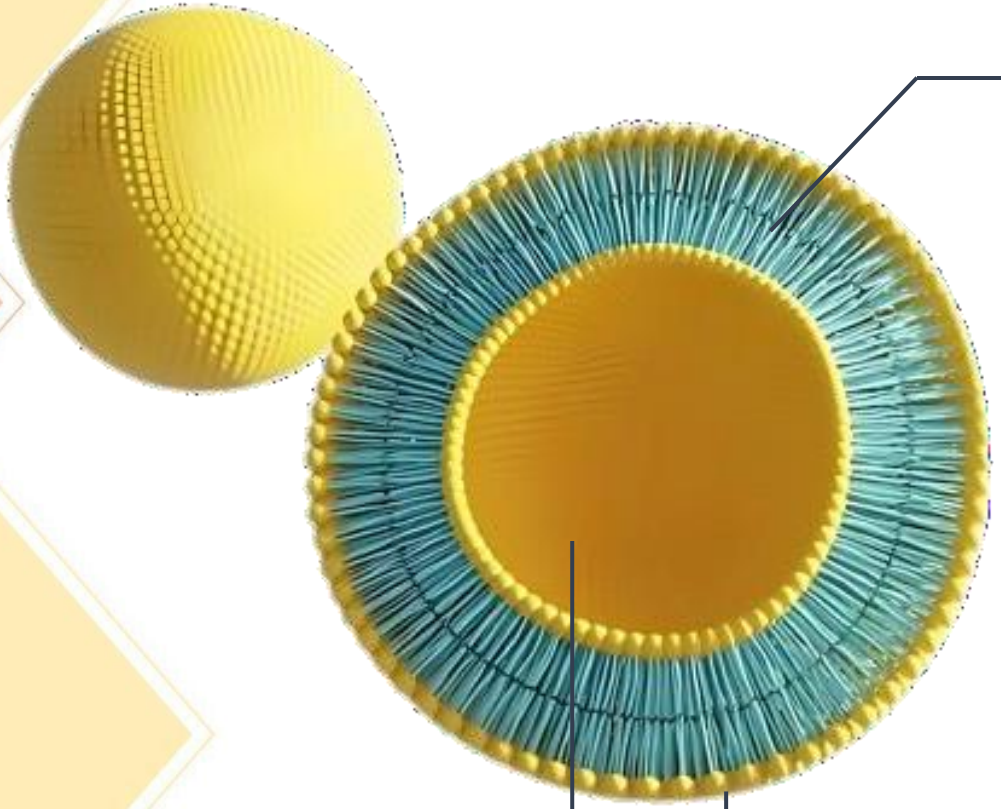


An illustration showing the arrangement of phospholipids.

- Phospholipids have a hydrophilic (water-attracting) head and two hydrophobic (water-repelling) tails.
- They form a bilayer, with heads facing outward and tails inward, creating a barrier in cell membranes.



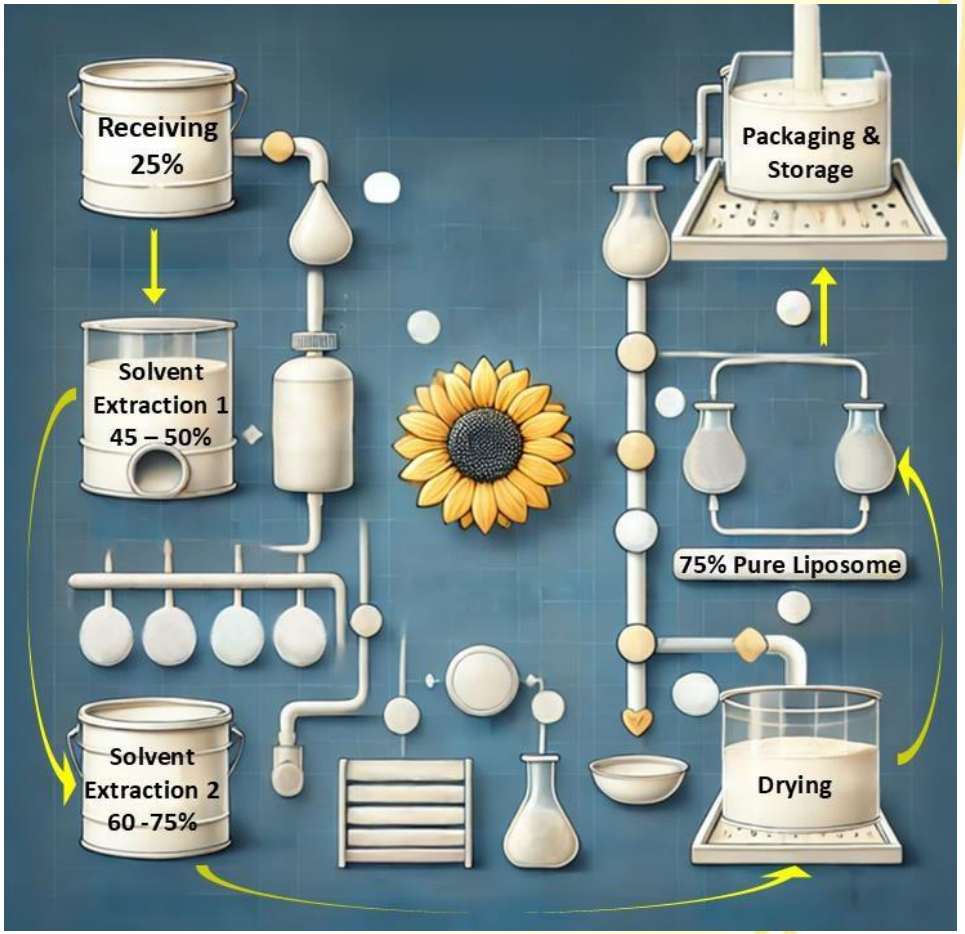
IV. Liposomal Drug Delivery: Structure and Function



- The empty Liposome matrix is systematically modified to accommodate the physicochemical characteristics of the active pharmaceutical ingredient (API).
- Stabilizers and auxiliary excipients—such as cryoprotectants, antioxidants, or surfactants—are incorporated as required to enhance the structural integrity, encapsulation efficiency, and stability of the final Liposomal formulation.

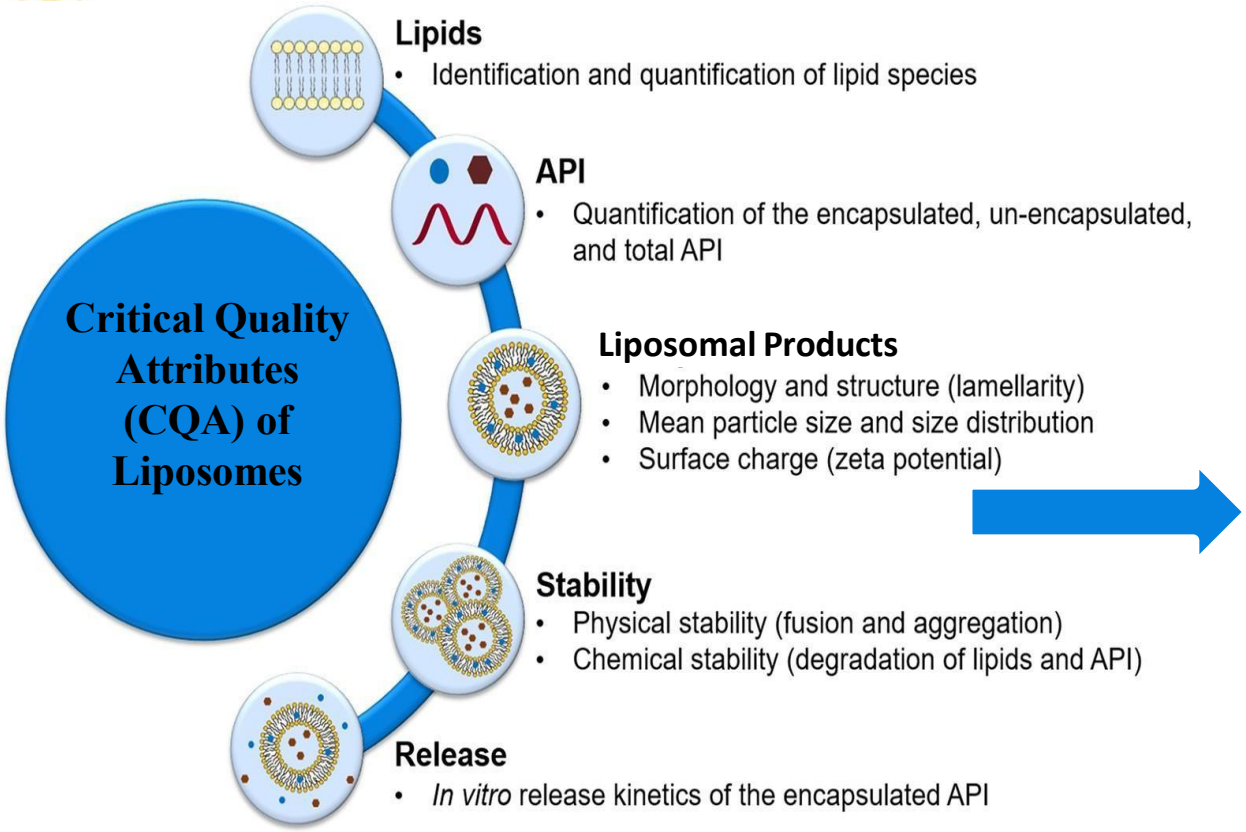
V. Process Flow of Liposome Preparation

- Receiving 25% Pure Lecithin
- Solvent Extraction – 1 (45 – 50%)
- Solvent Extraction – 2 (60 – 75%)
- Drying
- Packaging & Storage of 75% Pure Liposome from Sunflower lecithin



An illustrative image showing the preparation process of Liposome at WBCIL.

Summary of Characterizations Performed on Liposome



1. ***Liposome composition analysis using HPLC***
2. ***FTIR of Liposomes***
3. ***Energy Dispersive X-ray analysis (EDAX) of Liposomes***
4. ***Liposome particle size, uniformity and behavior using DLS***
5. ***Morphology of Liposomes as viewed under a Scanning Electron Microscope***

1. Composition of Liposome using HPLC

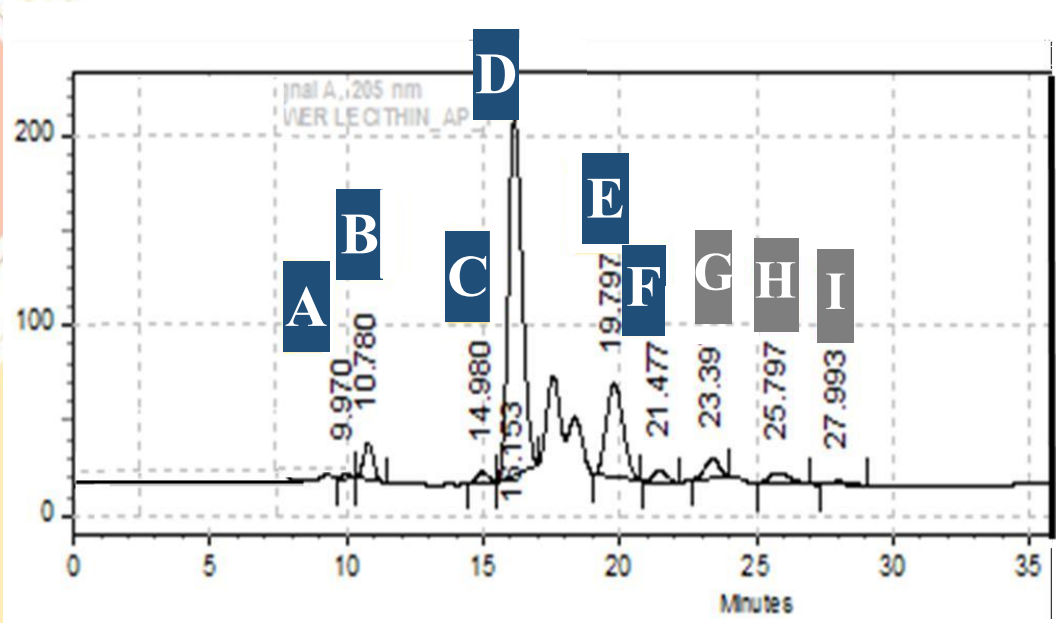


Figure 1 – An image describing the chromatogram of Liposome with peaks of PC and PE

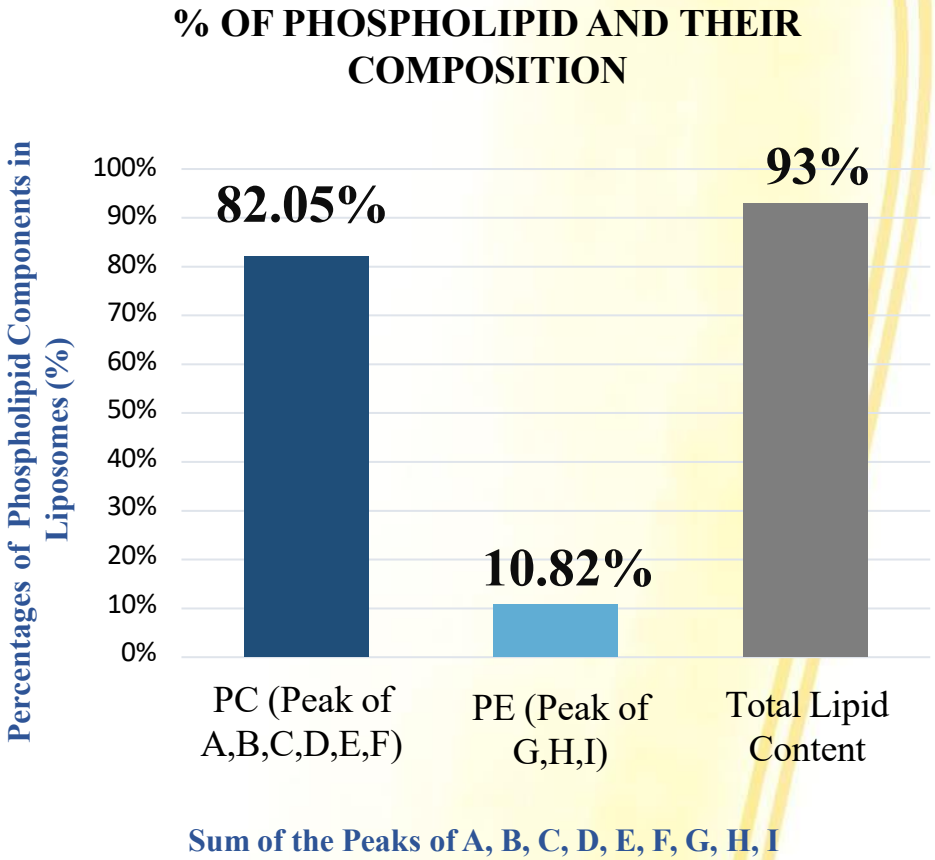
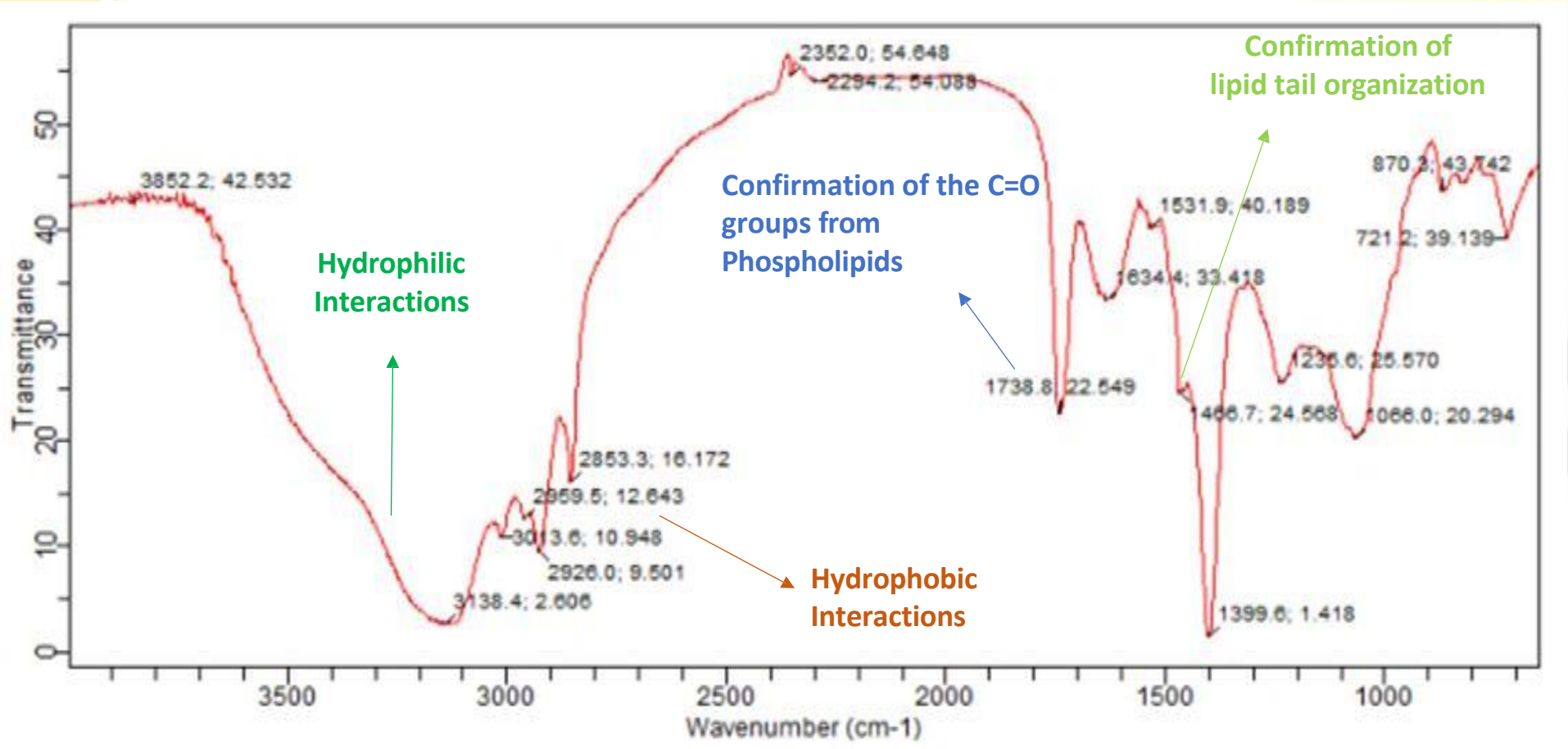


Figure 2 – Chart showing composition of Liposomes with 82.05% PC and 10.82% of PE resulting in a total phospholipids content of 93%

Phosphatidylcholine (PC) **Phosphatidylethanolamine (PE)** **Total phospholipid**

2a. FTIR Spectrum of Liposome



FTIR bands representing synergistic interactions between Hydrophilic and Hydrophobic groups

2b. Summary of FTIR Analysis of Liposomes

1. **Confirmation of the C=O and OH groups -** Peaks at **~1738 cm^{-1} (C=O)** and broad **-OH peaks (~3400 cm^{-1})** indicate the presence of ester carbonyl groups confirming the integrity of the phospholipid structure with water interactions.

2. **Hydrophobic Interactions -** Distinct **CH_2 peaks ~ 2853 and 2920 cm^{-1}** confirm ordered **lipid tail packing**.

3. **Hydrophilic Interactions - Broad -OH peaks (~ 3138 - 3320 cm^{-1})** show Water/lipid head group interactions indicating hydration and stability in aqueous environment.

3. Energy Dispersive X-ray analysis (EDAX) of Liposomes

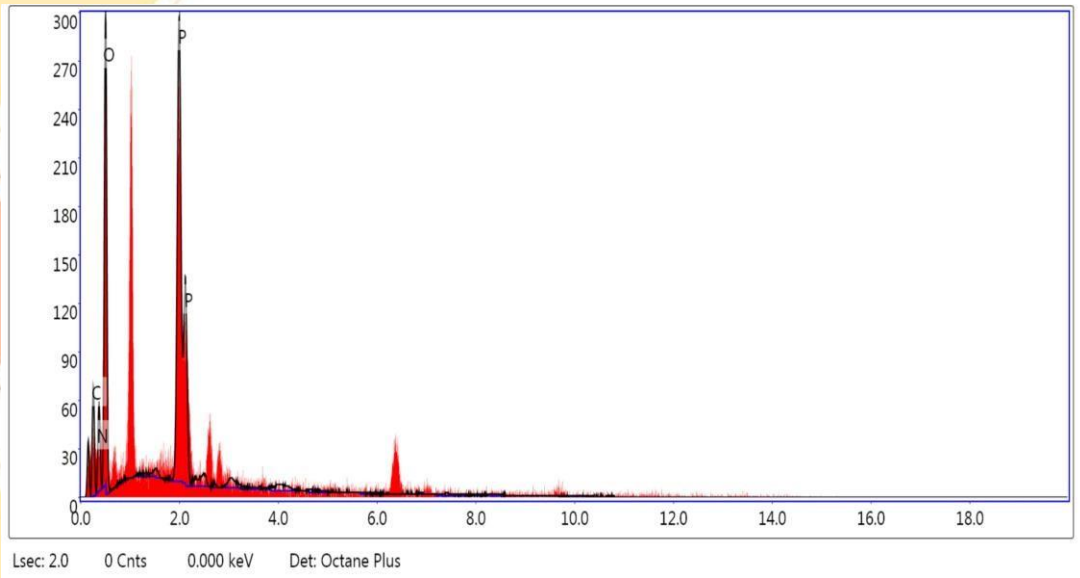


Figure 1 – Energy Dispersive X-ray Analysis (EDAX) spectrum of liposomes showing characteristic peaks for carbon (C), nitrogen (N), oxygen (O), and phosphorus (P), confirming the elemental composition typical of phospholipid-based structures.

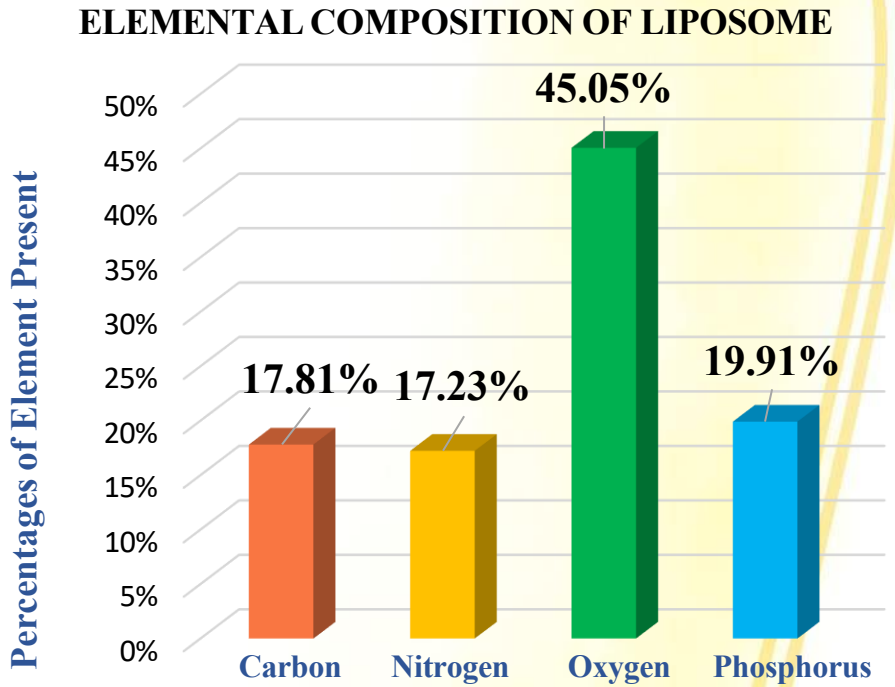


Figure 2: Quantity of elements present in Liposome.

- **Element Detection**: The EDAX spectrum (Figure 1) shows that the liposomes contain carbon, nitrogen, oxygen, and phosphorus—elements commonly found in phospholipids.
- **Element Amounts**: As shown in Figure 2, oxygen is the most abundant element (45.05%), followed by phosphorus (19.91%), carbon (17.81%), and nitrogen (17.23%).
- **What It Means**: The high levels of oxygen and phosphorus suggest that the liposomes are mainly made of phospholipids, which are important for forming the liposome's structure.

4. Liposome – Particle Size, Uniformity & Behavior

PARTICLE SIZE (nm)

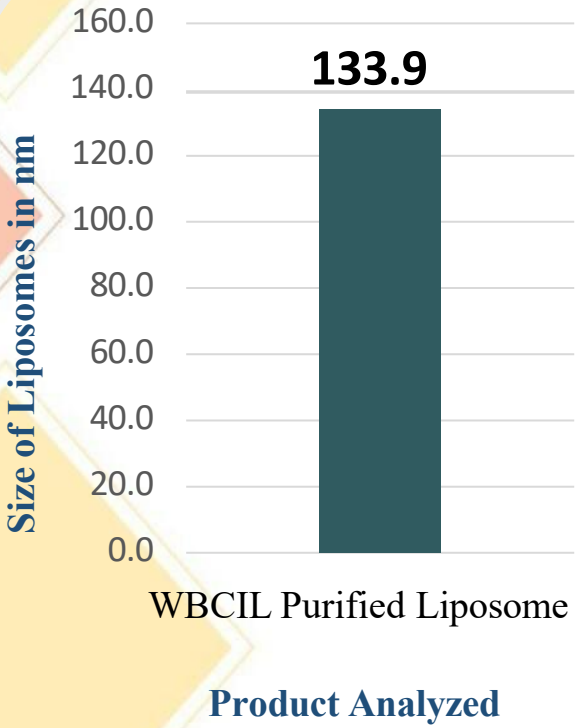


Figure 1 – Particle size of Liposomes produced at WBCIL containing more than 75% phospholipids.

POLYDISPERSITY

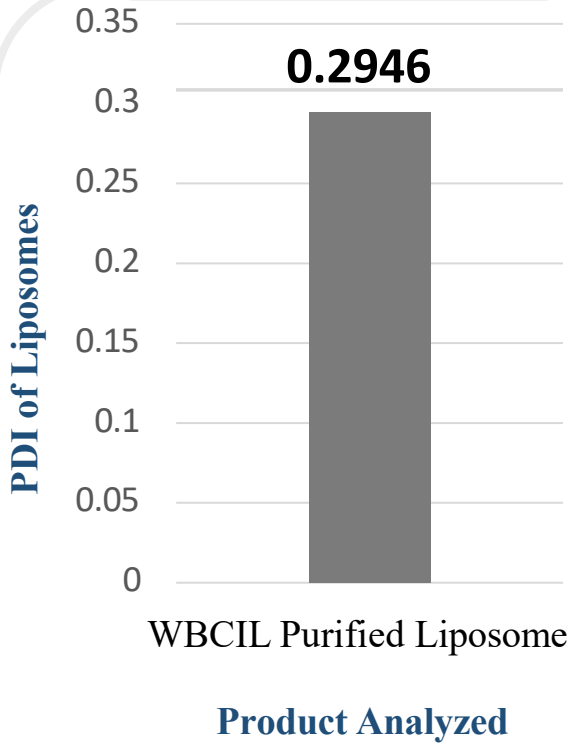


Figure 2 – Polydispersity Index of Liposomes in solution.

ZETA POTENTIAL (mv)

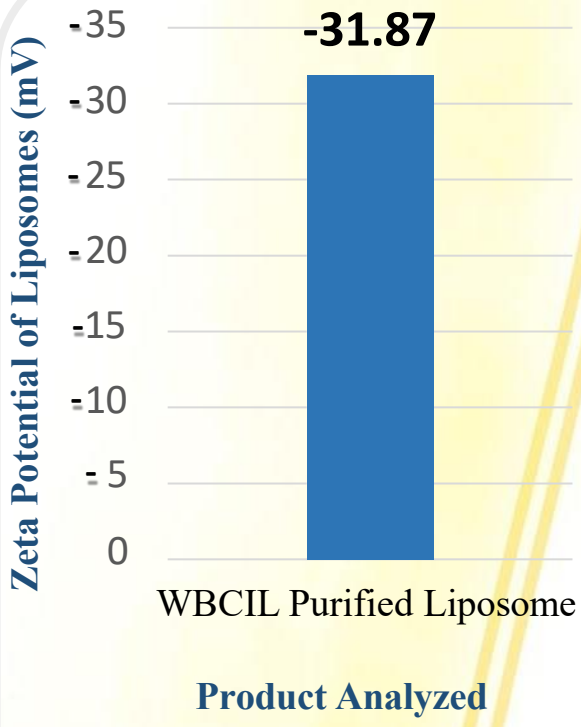


Figure 3 – Chart showing -31.87 mV Zeta Potential of Liposomes.

❖ **Acceptance criteria:**

➢ **Particle Size : < 200 nm** ➢ **Polydispersity Index : < 1** ➢ **Zeta Potential: < -30 mV**

5. Morphology of Liposomes as Viewed Under a Scanning Electron Microscope

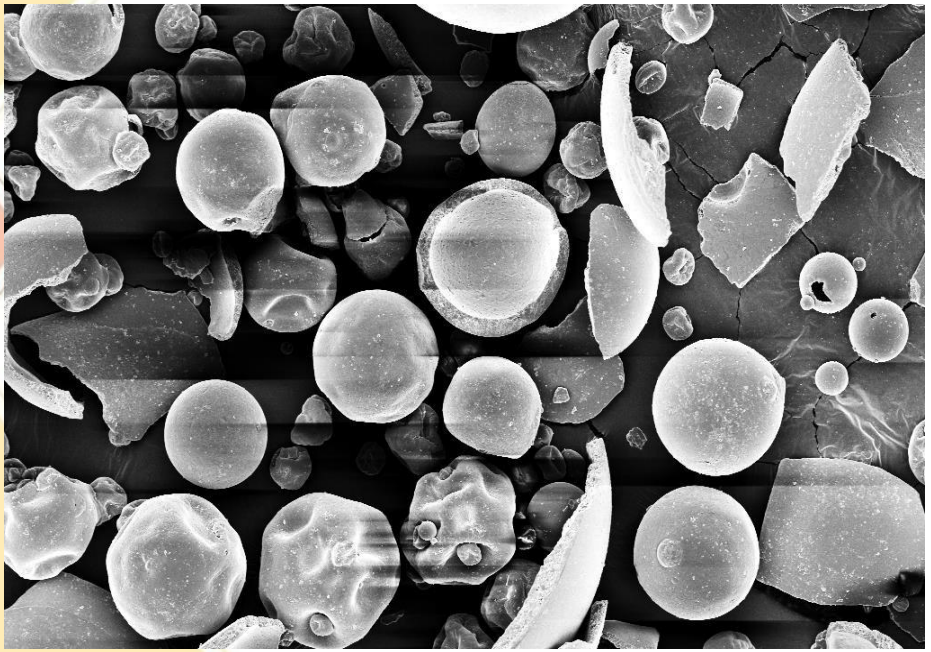


Figure 1 – SEM image of Liposomes

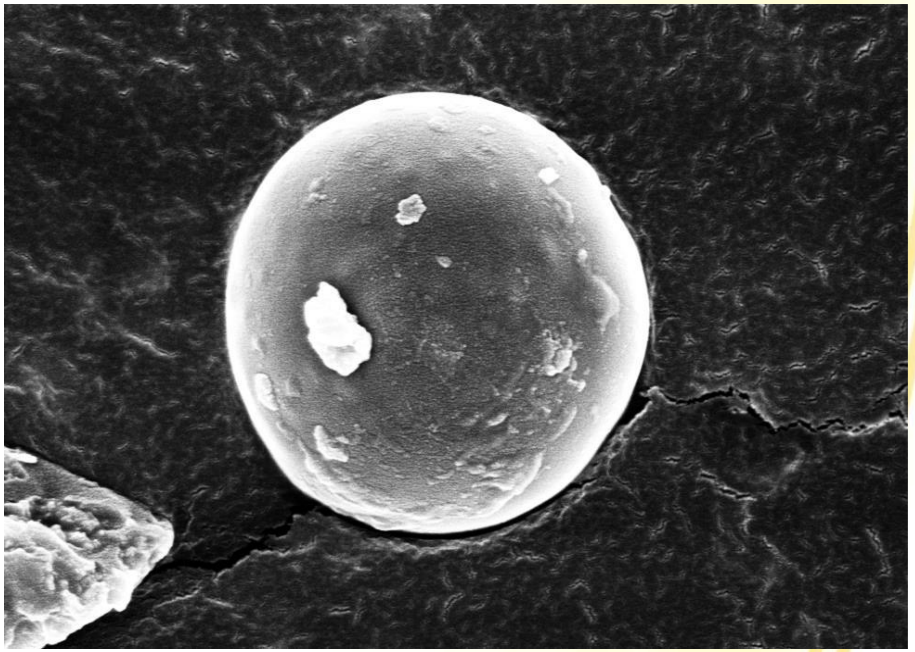


Figure 2 – Zoomed in view of a Liposome

- SEM images show liposomes as spherical structures with smooth surfaces.
- Liposomes vary in size, as seen in the clustered SEM view.
- The zoomed image highlights the detailed outer morphology of a single liposome.

Thank You !

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