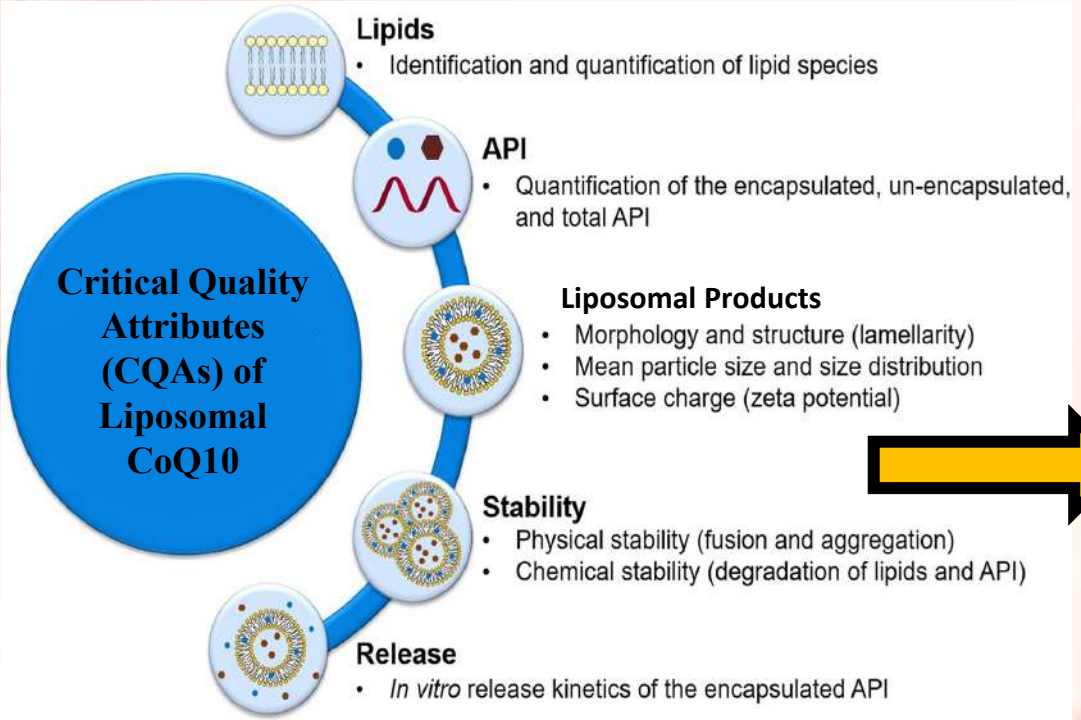
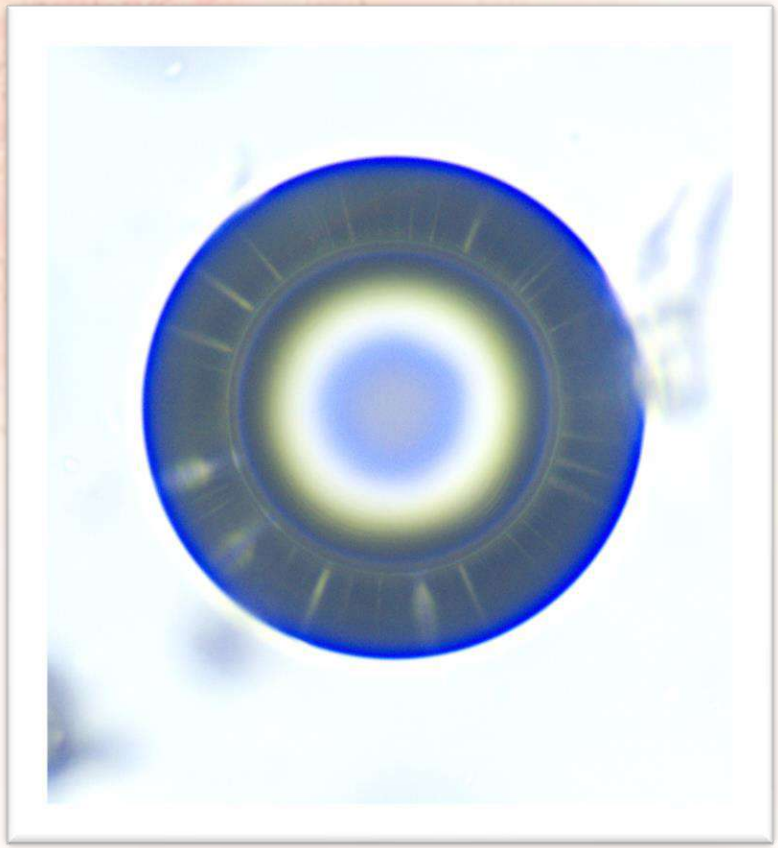
West Bengal Chemical Industries Limited

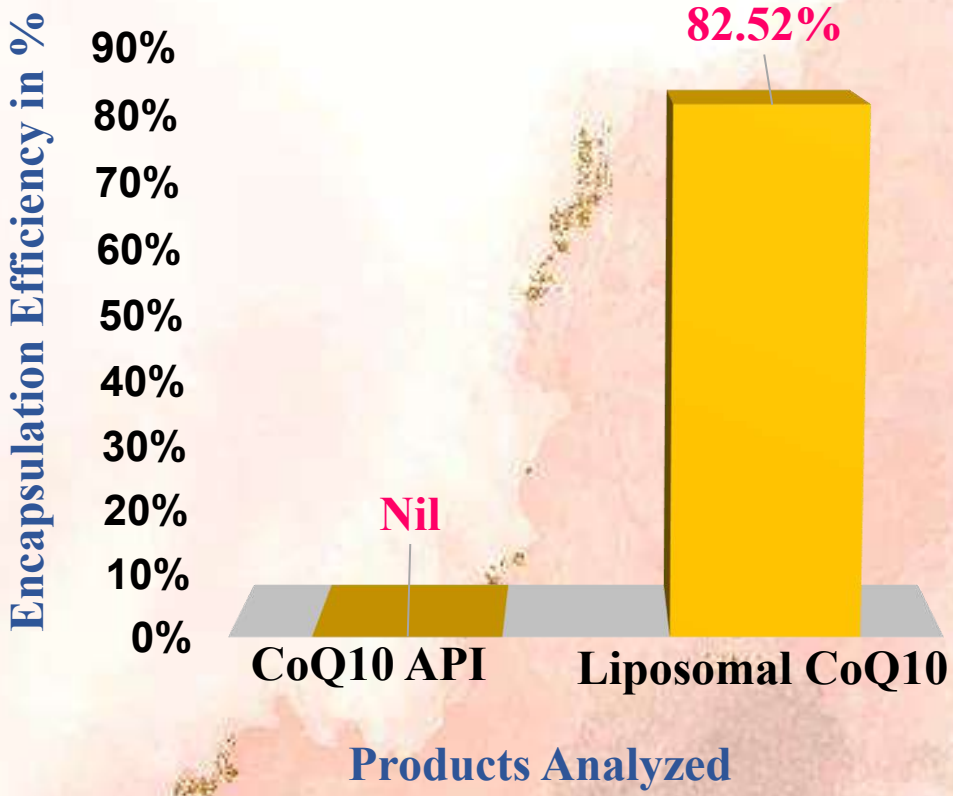
Summary of Characterizations Performed on Liposomal CoQ10



1. ***Encapsulation efficiency of Liposomal CoQ10***
2. ***Analysis of particle size and uniformity of Liposomal CoQ10 using DLS***
3. ***Behavior of Liposomal CoQ10 particles in liquid medium using DLS Zeta-sizer***
4. ***FTIR analysis of Liposomal CoQ10 composition***
5. ***Analysis of CoQ10 leakage from Liposomes***
6. ***Stability analysis of Liposomes at 105^{o} C temperature***
7. ***Endothermic study of Liposomal CoQ10 using DSC analysis***

1. Encapsulation Efficiency of 40.25% Liposomal CoQ10





- Acceptance criteria: 40 - 42% of Elemental CoQ10
- Acceptance criteria: NLT 70% Encapsulation efficiency

Encapsulation Efficiency determined via validated UV-Visible Spectrophotometry data

2. Dynamic Light Scattering Analysis of Liposomal CoQ10

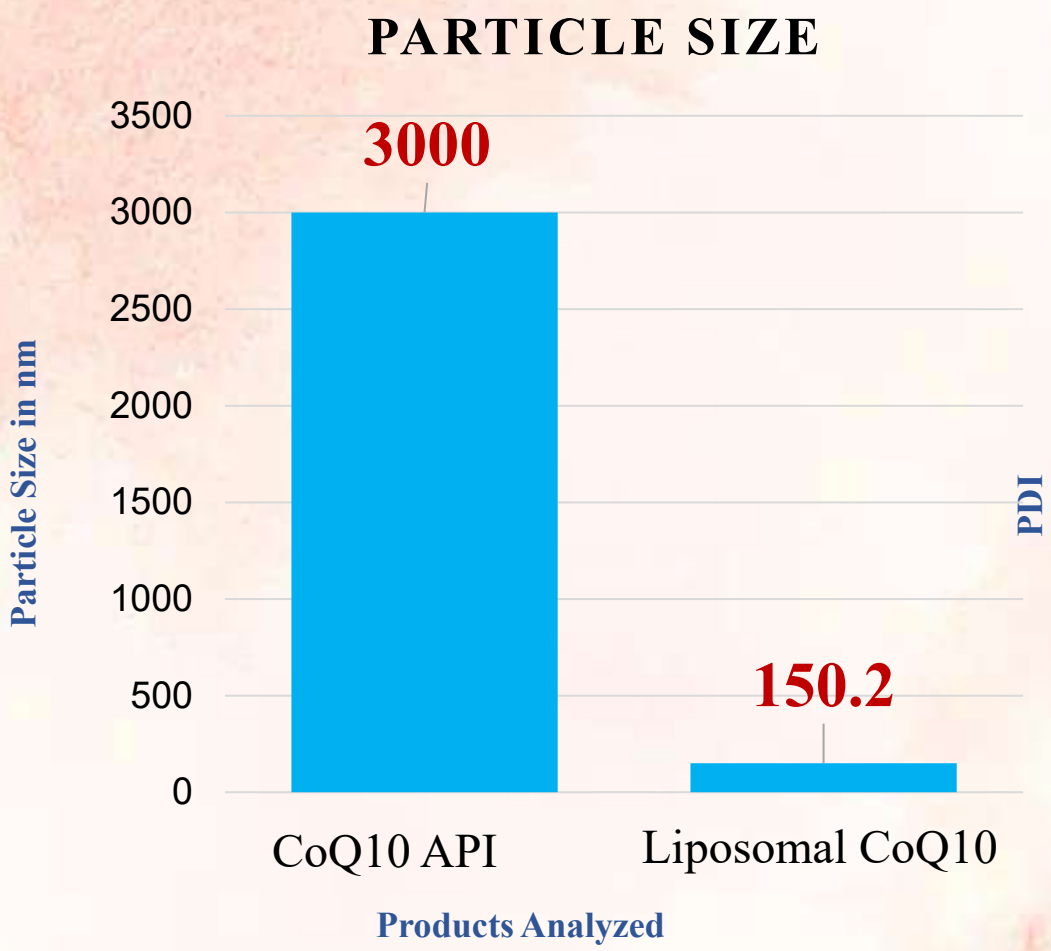


Figure 1 – Chart showing the particle size of CoQ10 API with Liposomal CoQ10

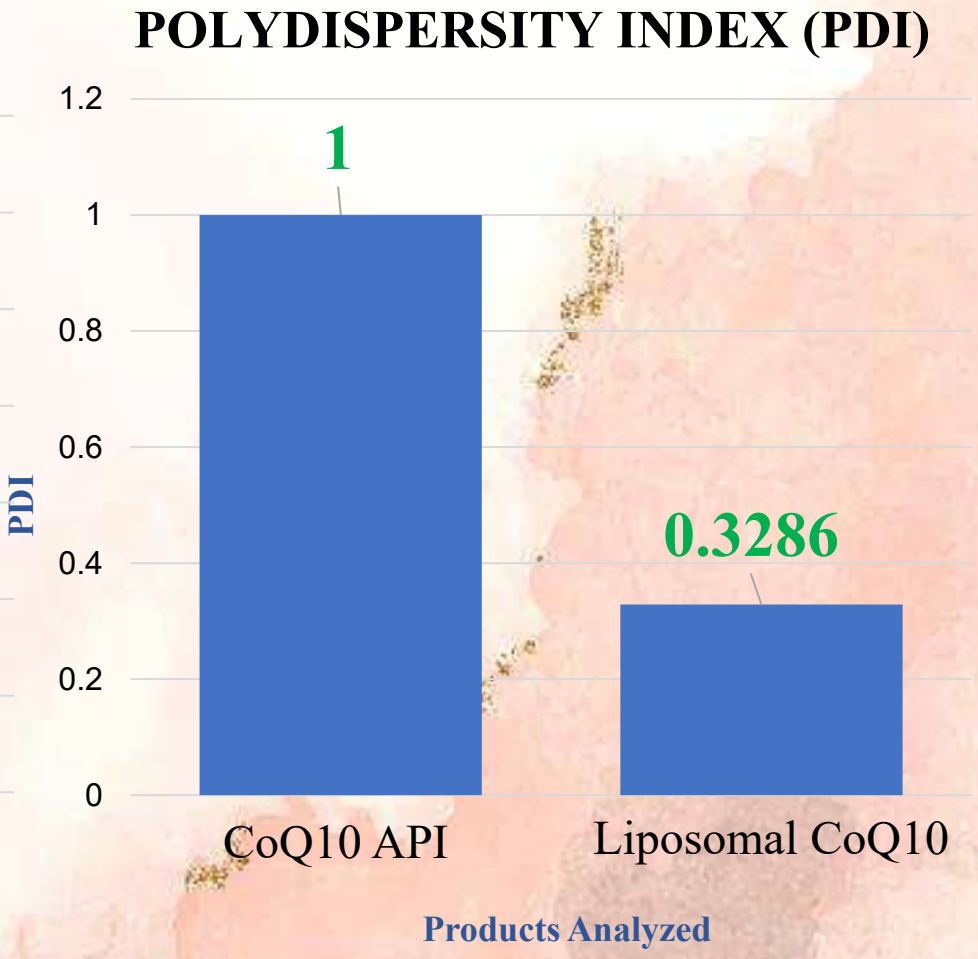


Figure 2 – Polydispersity Index (PDI) of Liposomal CoQ10 in solution

3a. Behavior of Liposomal CoQ10

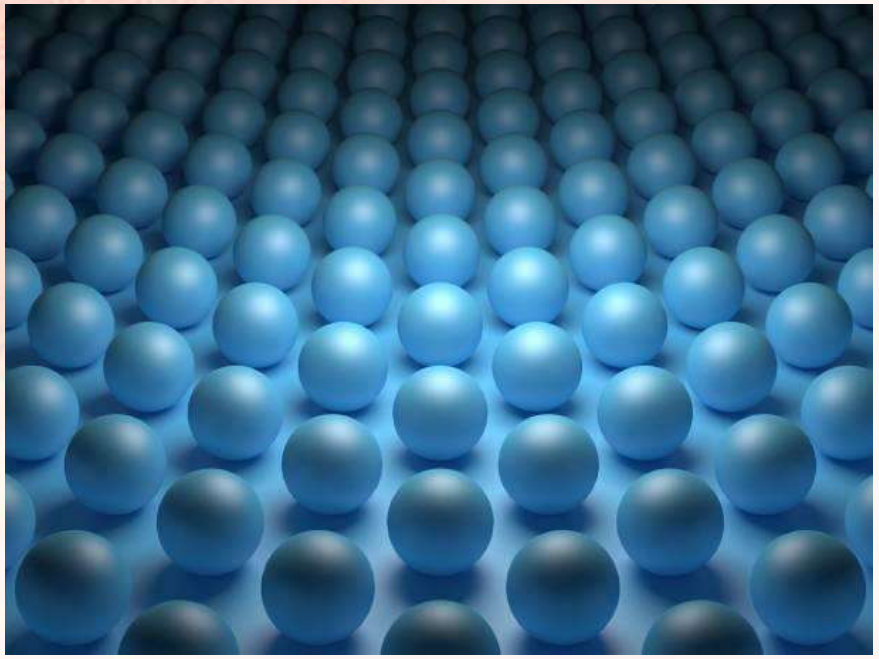
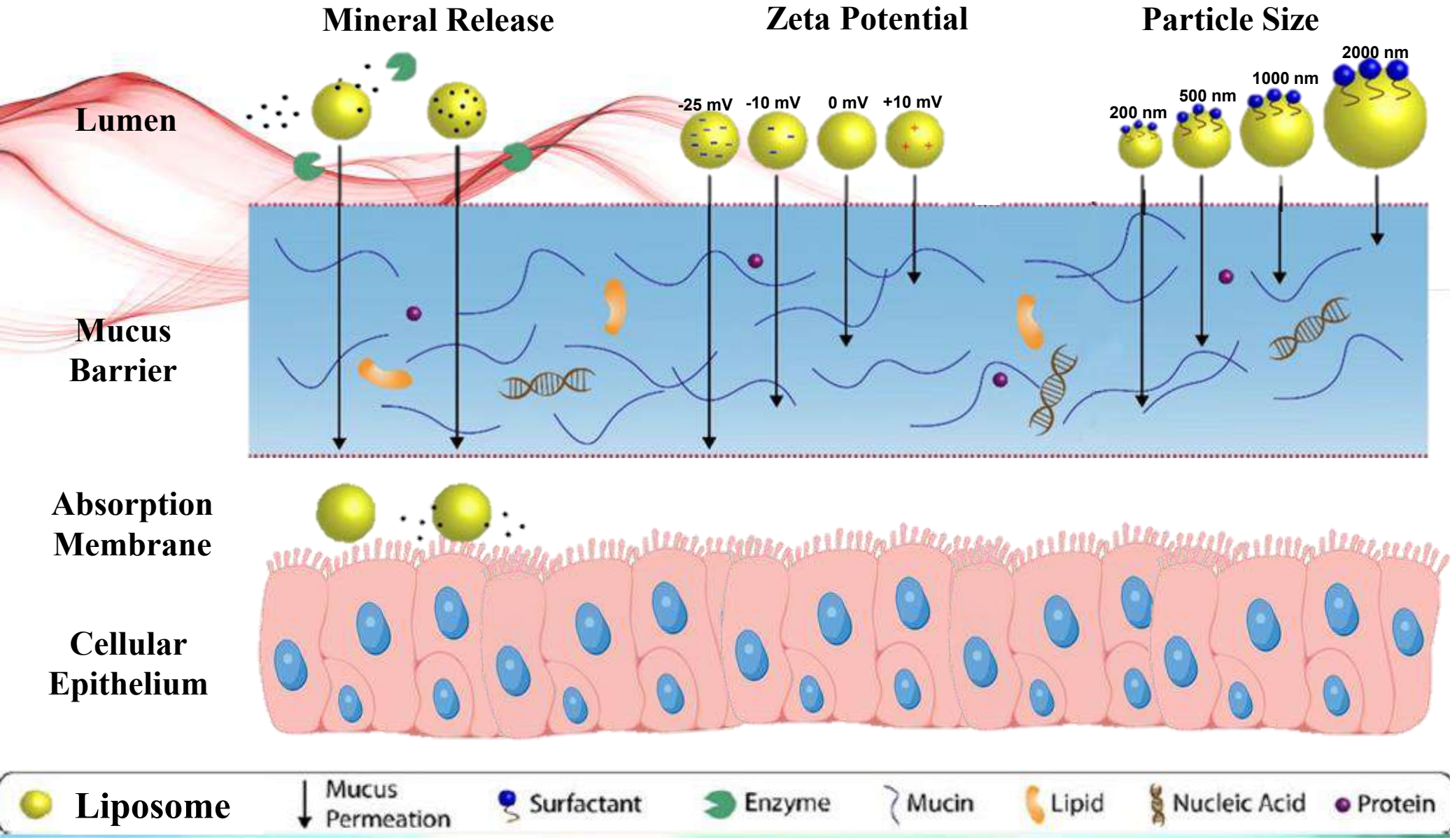


Figure 1 – A figure representing the balance of attractive and repelling forces between particles to ensure uniform distribution for maximizing cellular interaction.

Table 1 – Comparison between the Zeta Potential of CoQ10 API and Liposomal CoQ10 indicating that CoQ10 in Liposomal form is stable and unlikely to agglomerate in solution.

Products	Zeta Potential
CoQ10 API	-34.06
Liposomal CoQ10	-37.21

3b. Absorption of Liposomal CoQ10 Represented Schematically on a Cellular Cross-Section



Adapted from: https://www.sciencedirect.com/science/article/pii/S0169409X21004907?via%3Dihub

4a. FTIR Spectra of CoQ10, Liposome & Liposomal CoQ10

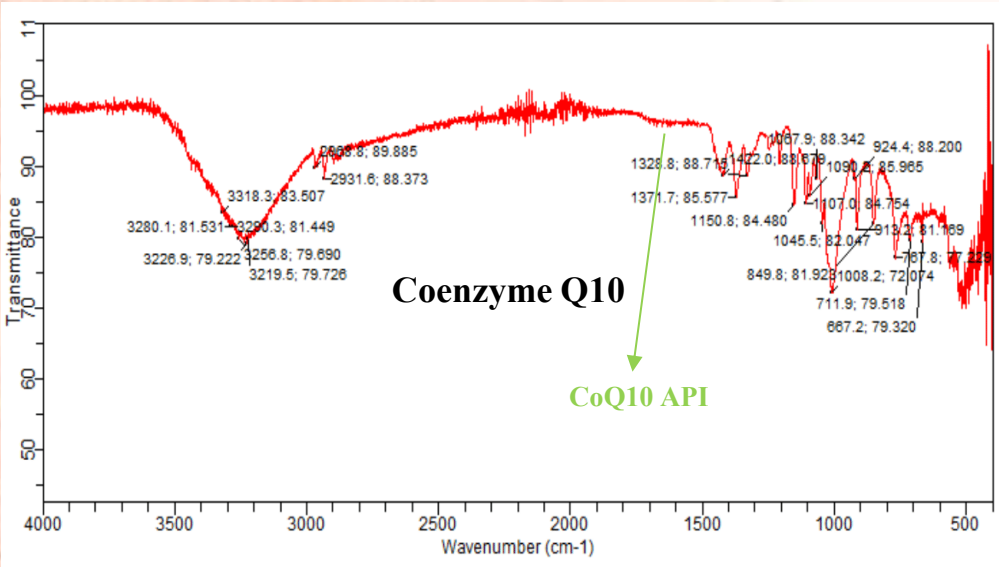


Figure 1: IR Transmission spectrum showing characteristic bands of Coenzyme Q10 API

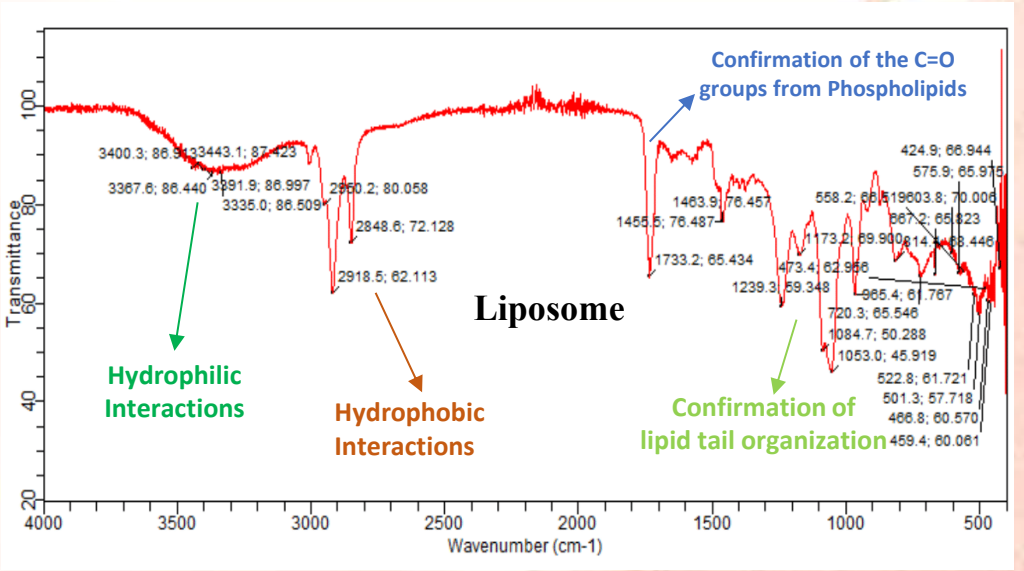


Figure 2: Hydrophobic and Hydrophilic interactions within Empty Liposome

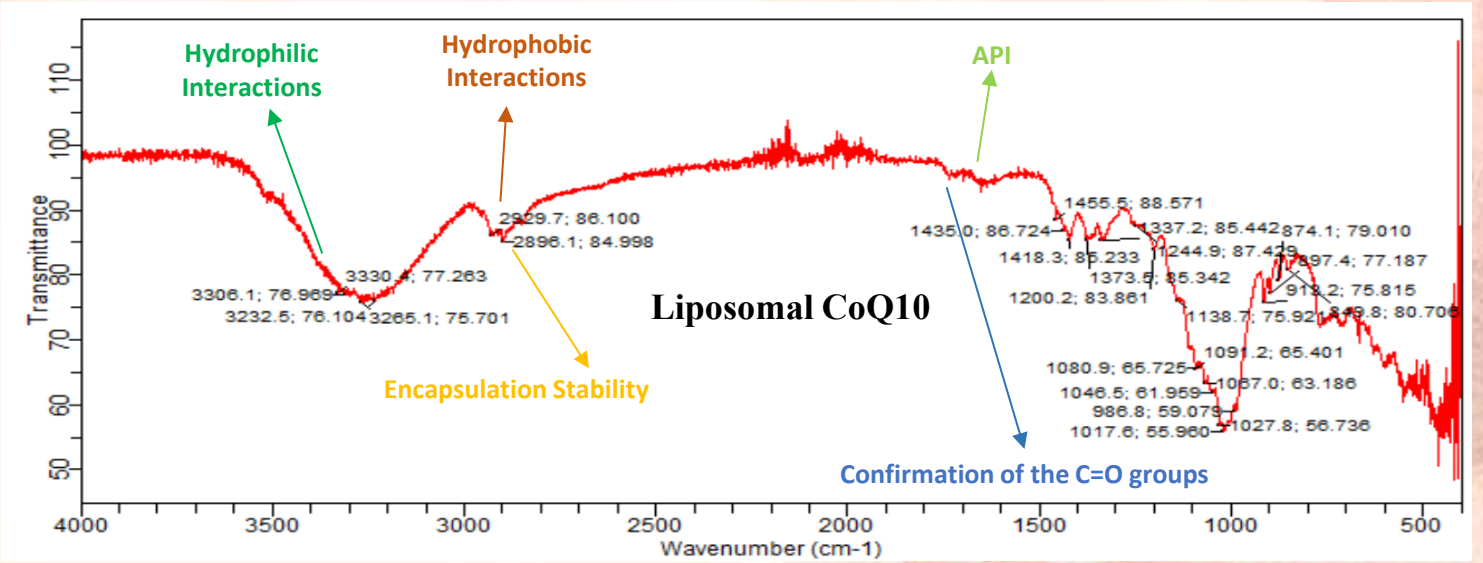


Figure 3: Successful integration of Coenzyme Q10 into Liposome

4b. Summary of FTIR Analysis of Liposomal CoQ10

1. **Confirmation of the C=O and OH groups** – Peak at **1655 cm^{-1}** confirms the presence of the carbonyl group, while the broad, intense **-OH peak** around **3370-3450 cm^{-1}** indicates sustained release due to hydrogen bonding.

2. **Hydrophobic Interactions**: Distinct peaks at **2923 cm^{-1}** and **2853 cm^{-1}** correspond to the asymmetric and symmetric stretching vibrations of aliphatic C-H bonds, confirming hydrophobic interactions.

3. **Hydrophilic Interactions**: The broad peak at **3370-3450 cm^{-1}**, overlapping with the OH stretch, also reflects hydrophilic interactions due to the presence of polar functional groups or water.

4. **CoQ10 API**: Characteristic CoQ10 peaks at **1655 cm^{-1}** (C=O stretching), **1508 cm^{-1}** (aromatic C=C), and **2954 cm^{-1}** (methyl C-H) confirm its molecular structure.

5. **Encapsulation Stability**: Slight shifts and consistent intensity of lipidic C-H stretch peaks at **2923 cm^{-1}** and **2853 cm^{-1}** indicate stable encapsulation of CoQ10 within the Liposomal matrix.

5. Leakage of CoQ10 from Liposomes

Figure 1 – An image representing the storage of formulations in shelves

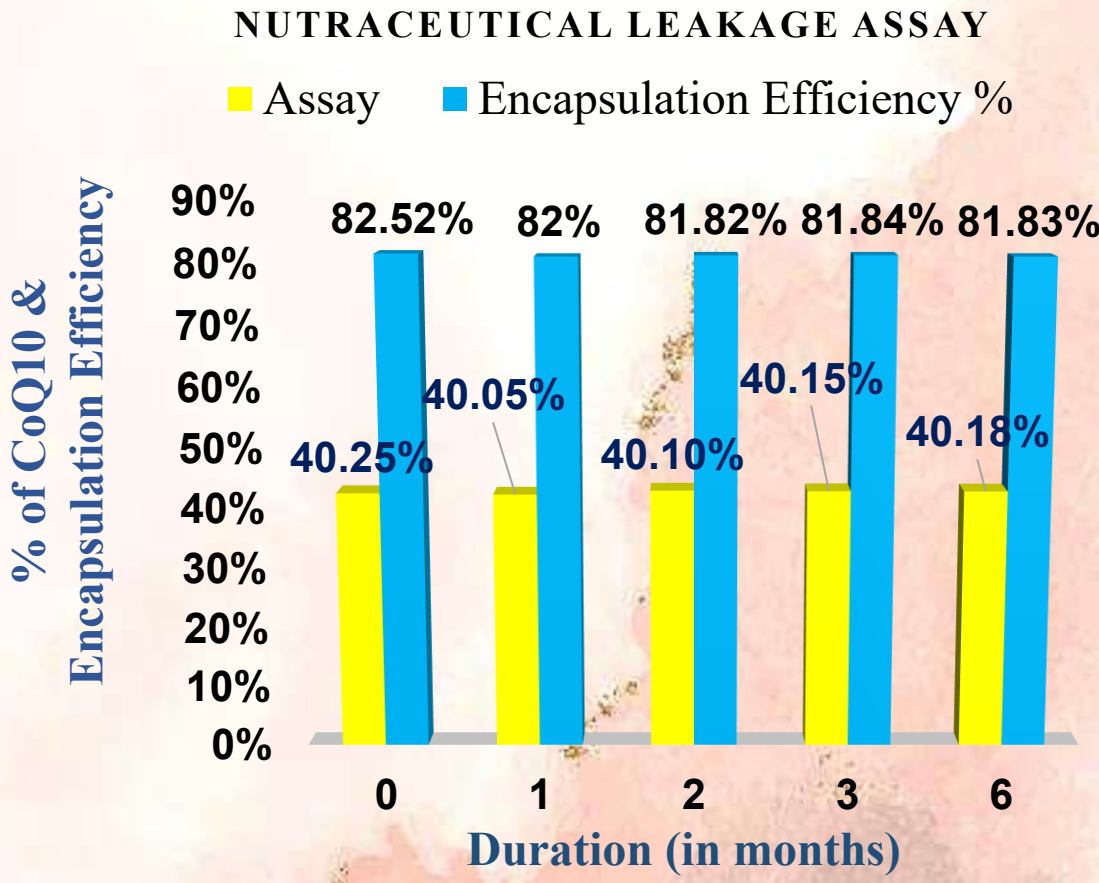


Figure 2 – Chart comparing the stability of Liposomal CoQ10 stored over a period of 6 months at 40°C ± 2°C and a relative humidity of 75% ± 5%.

6. Stability of CoQ10 Liposomes at Elevated Temperatures

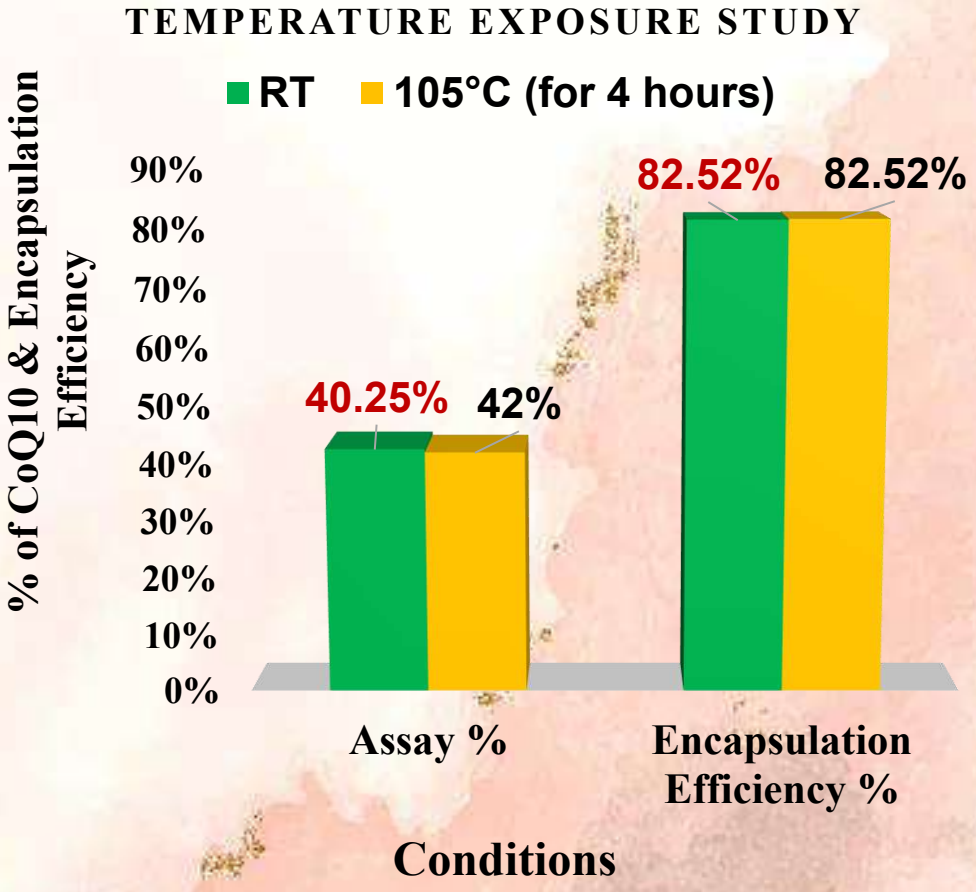


Figure 1 – An image representing the transport of formulations at elevated temperature.

Figure 2 – Chart comparing the stability of Liposomal CoQ10 both at room temperature (RT) and at 105°C for 4 hours of exposure.

7. Endothermic Study of Liposomal CoQ10 Using Differential Scanning Calorimetry Analysis

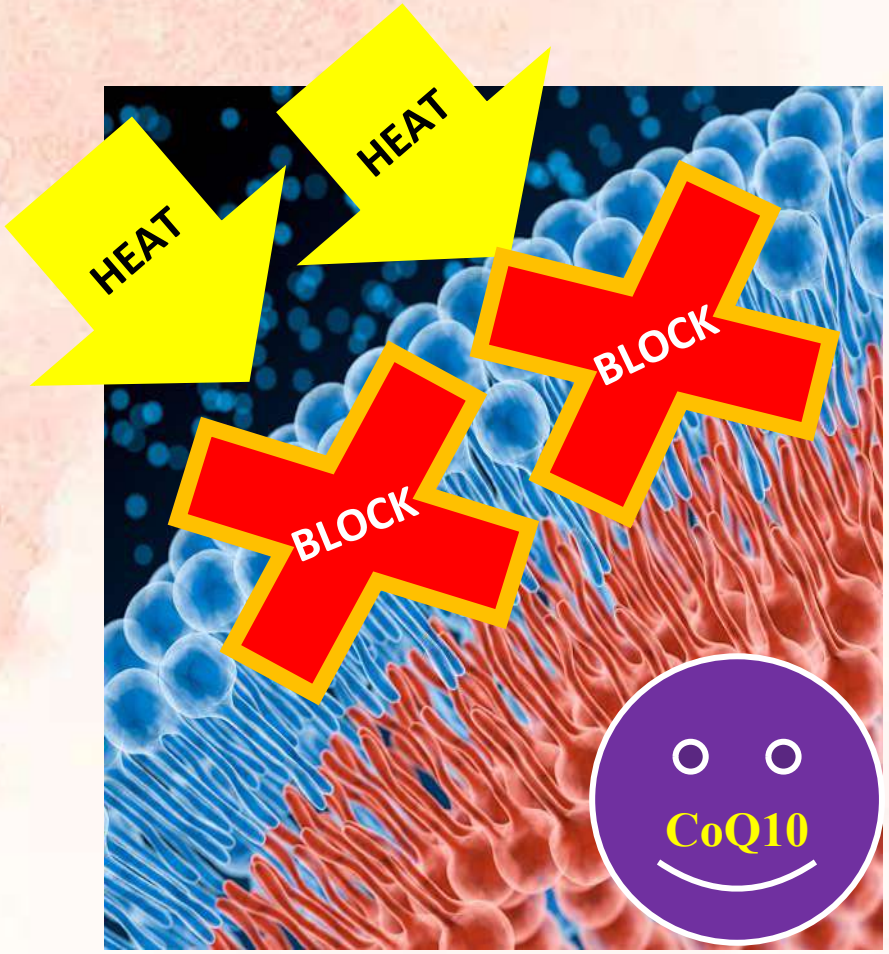


Figure 1 – An illustration showing how the phospholipid bilayer is hindering the heat from reaching CoQ10 API which improves thermal stability of Liposomal CoQ10.

Sample	Thermal Events (Peak Temperatures, °C)	Interference / Observations
Coenzyme Q10 API	81.72 / 157.95	Sharp peaks show melting of crystalline CoQ10. Absence of broad transitions confirms pure crystalline form.
Liposome	94.23 / 288.16	Peak at ~94 °C suggests lipid bilayer phase transition; high-temp peak indicates lipid degradation.
Liposomal CoQ10	84.81 / 153.99 / 225.67	Shifted and broadened peaks show reduced crystallinity, interaction with lipid bilayer, and stable encapsulation.

**Thermograms available for reference*

Thank You!

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