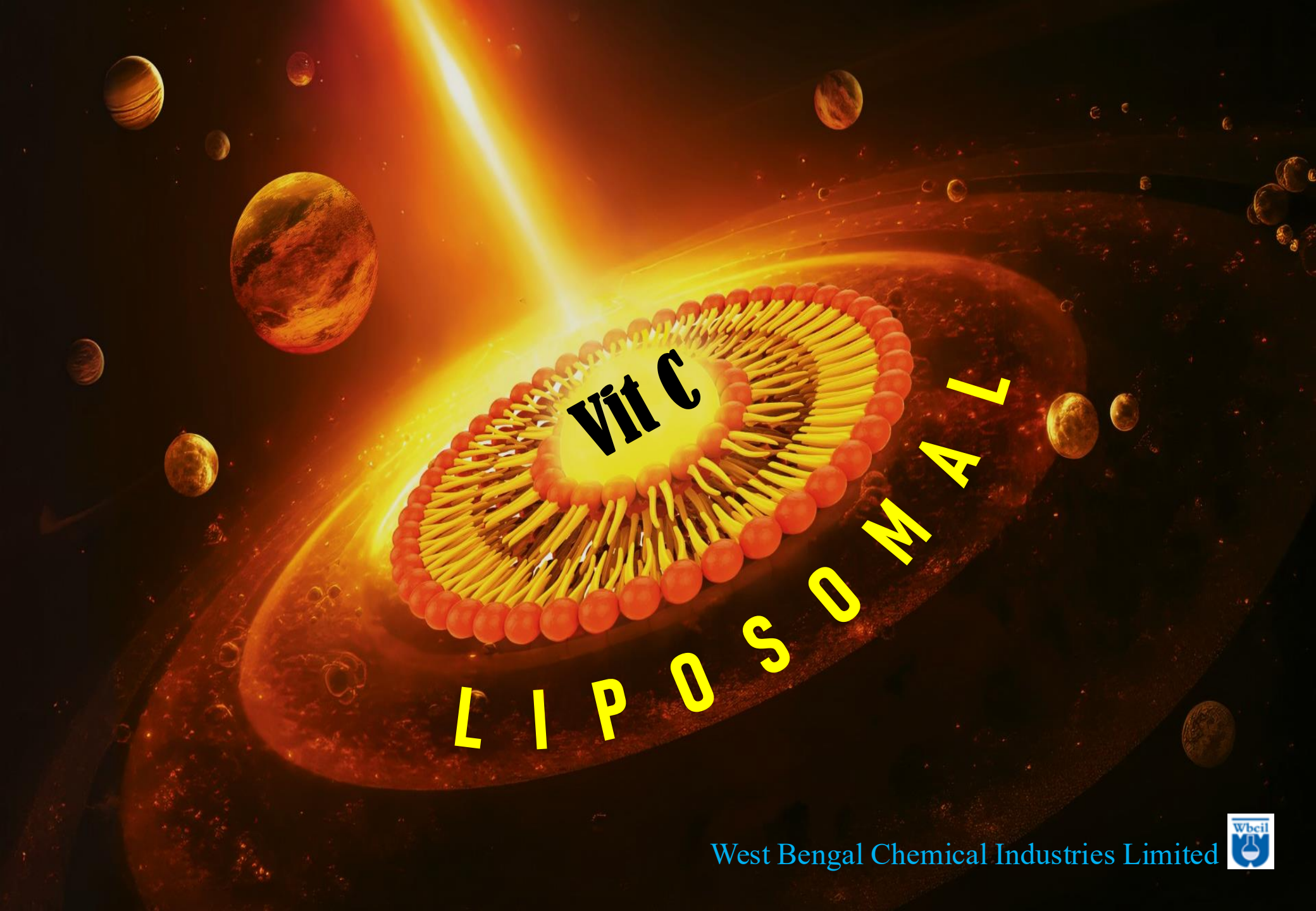

West Bengal Chemical Industries Limited

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A USA FDA-Aligned Framework for Quality & Stability Determination

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Challenges with Standard Vitamin C

Rapid Clearance

Standard Vitamin C leaves the body quickly. Excess amounts are rapidly filtered out by the kidneys before your cells can absorb them.

Digestive Distress

High doses of standard, unencapsulated Vitamin C are highly acidic, often causing stomach irritation, bloating, and cramps.

Oxidative Degradation

Standard Vitamin C crystals are highly sensitive to light, heat, and moisture, losing their potency before you even swallow them.

WBCIL Liposome: The Guarantee of Purity

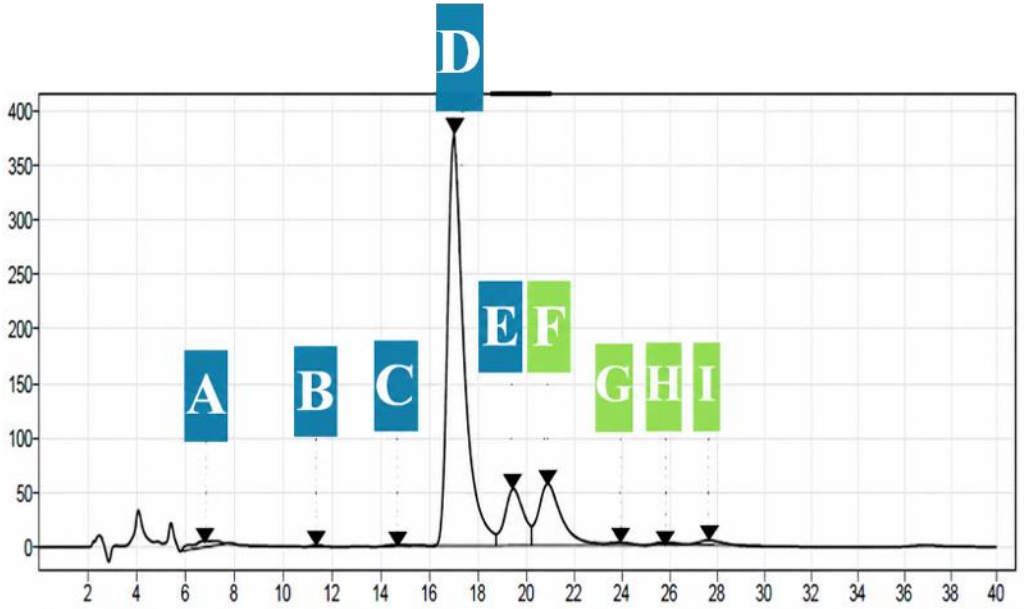

Figure 1 –The chromatogram of a phospholipid constituting a liposome

Phosphatidylcholine (PC-Peak A-E) : 90.07%

Phosphatidylethanolamine (PE-Peak F-I) : 4.39%

Stronger Shells & Cleaner Product

>90% purity ensures liposomal stability and patient safety by minimising unwanted lipids

WBCIL Achieved

> 94% phospholipid purity with > 90% PC content

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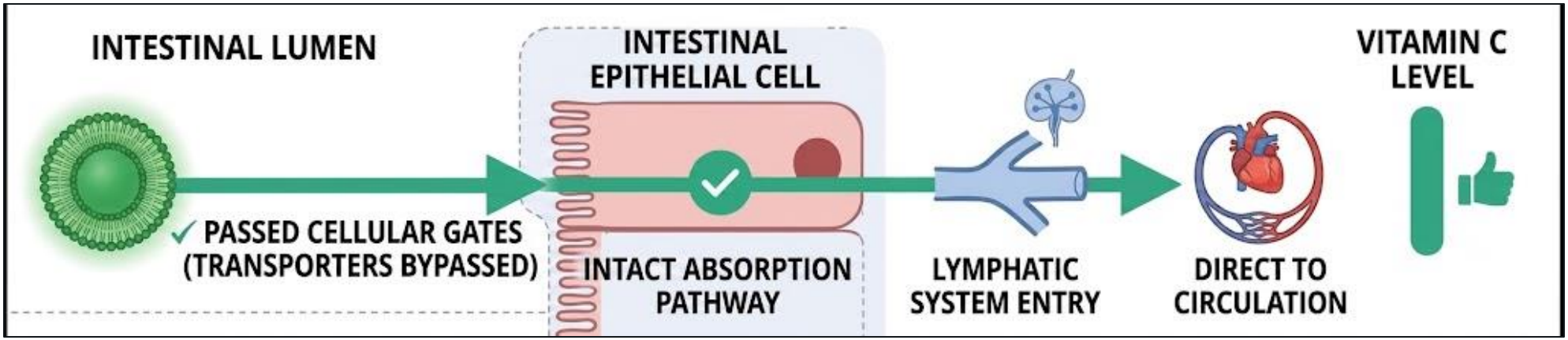
Bypassing Natural Barriers



Bypassing Transporters

Instead of struggling through standard cellular gates, intact liposomes enter directly into the lymphatic system

Direct Entry to Systemic Circulation

Liposomal vitamin C avoids first-pass hepatic metabolism, thereby safely and efficiently elevating serum vitamin C levels.

CLINICAL ADVANTAGE: This mimics the efficacy of an IV infusion through a simple, safe oral dose.

Encapsulation Efficiency

Encapsulation Efficiency: The percentage of the active ingredient successfully encapsulated within the protective liposome core.

>70%	85% Achieved
ACCEPTANCE CRITERIA	WBCIL PROPRIETARY PROCESS

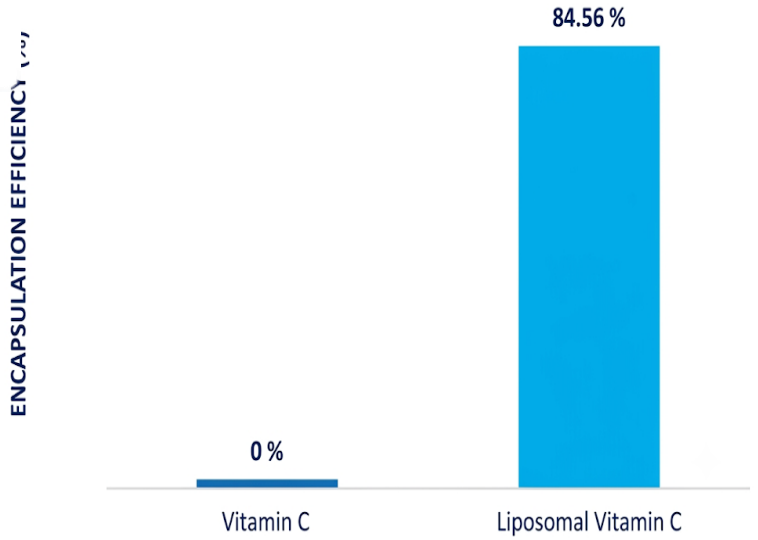


Figure 2: Encapsulation efficiency of Liposomal Vitamin C

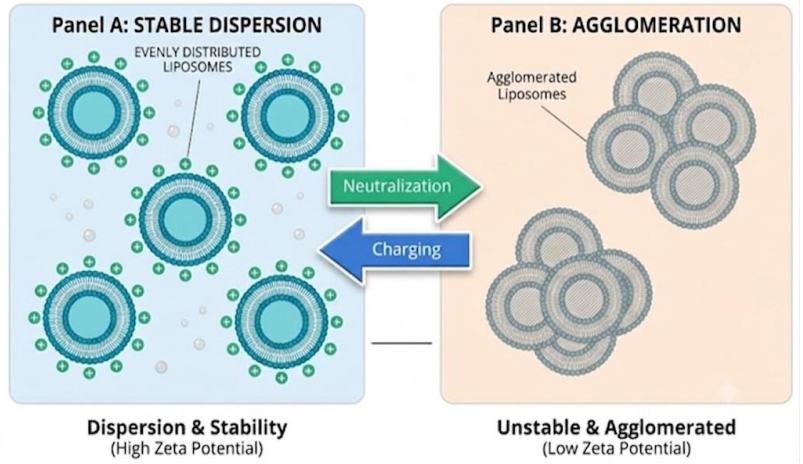
KEY ADVANTAGES

- Improves Bioavailability
- Protects Vitamin C from Oxidation
- Prevents Gastric Irritation
- Boosts Patient Compliance

Dynamic Light Scattering Analysis of Liposomal Vitamin C

A. Zeta Potential: An indicator of the Liposome's surface charge

<- 25 mV	-36 mV
ACCEPTANCE CRITERIA	WBCIL ACHIEVED ZP



KEY ADVANTAGES

- High Zeta Potential creates a strong repulsion between particles, preventing agglomeration and ensuring stability.

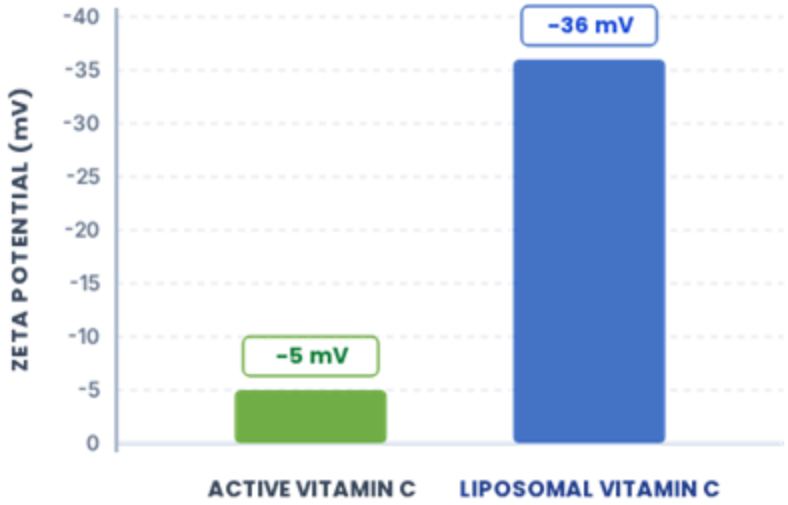


Figure 3: Determination of Zeta Potential

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B. Particle Size determination

≤300 nm
ACCEPTANCE CRITERIA

257 nm
WBCIL ACHIEVED

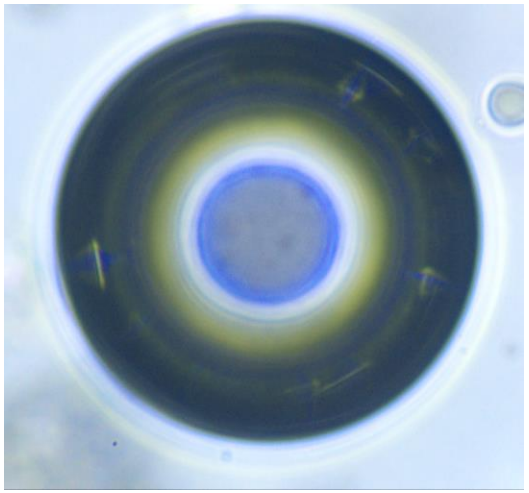

Figure 4A: Microscopic image of a liposomal Vitamin C

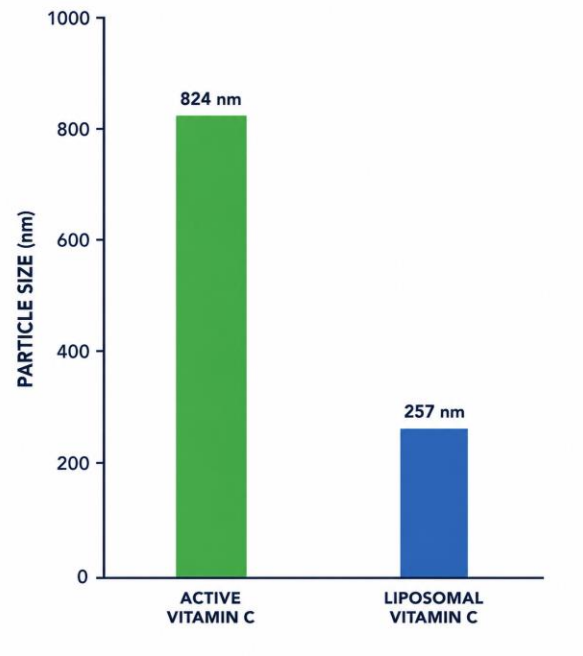

Figure 4B: Particle size of Vitamin C as active ingredient vs Liposomal Vitamin C in solution

KEY ADVANTAGES

- Increased Cellular Uptake

C. Polydispersity Index (PDI): Uniformity in size distribution of Liposomes

< 0.50	0.25
ACCEPTANCE CRITERIA	WBCIL ACHIEVED PDI

KEY ADVANTAGES

- Yields superior colloidal stability in the formulation
- Directly contributes to an improved and stable shelf life

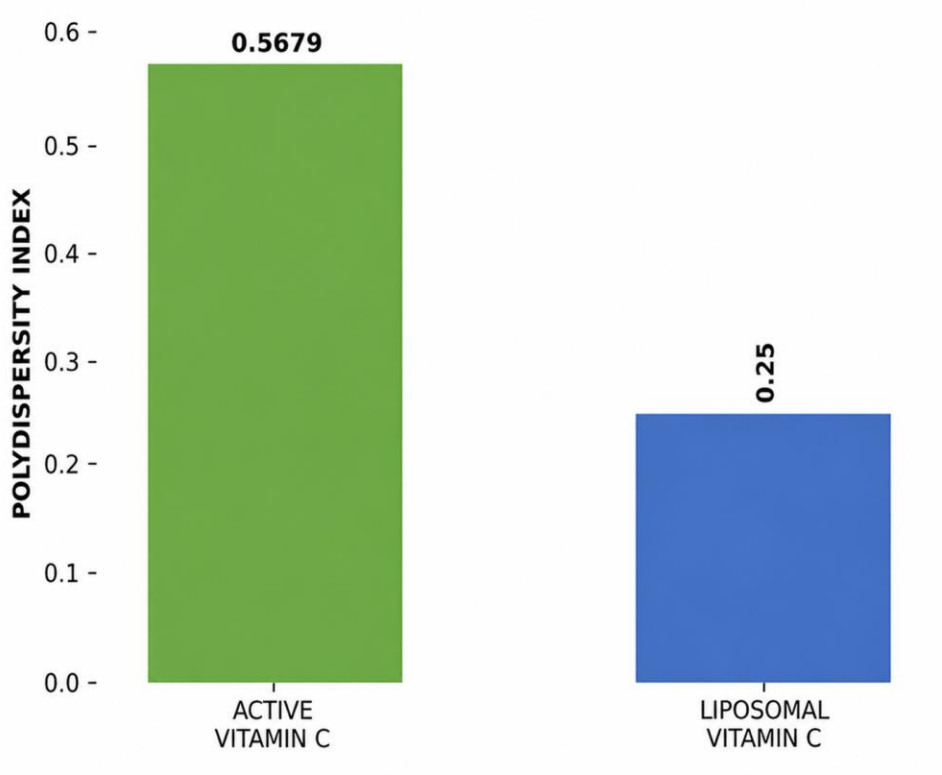

Figure 5: Polydispersity Index (PDI) of Vitamin C as Active Ingredient vs Liposomal Vitamin C in solution

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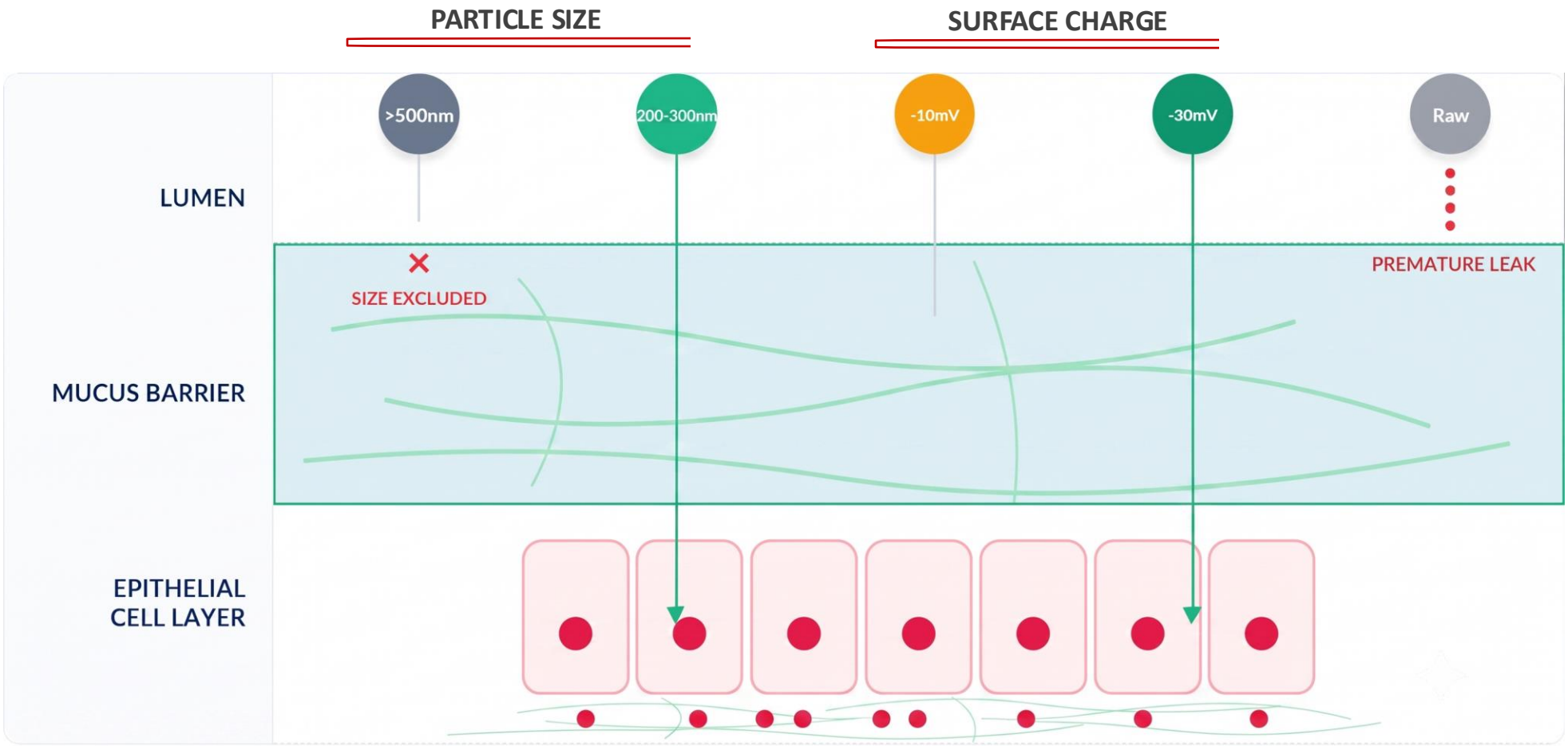
Absorption of Liposomal Vitamin C Represented Schematically on a Cellular Cross-Section



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The Fingerprint Test: FTIR

FTIR acts like a “molecular fingerprint”. Every ingredient has a unique signal.

Feature Observed	Raw Vitamin C	Empty Liposome	WBCIL Liposomal Vitamin C
Lipid Bilayer Signal	Absent	Present	Present & Verified
Carbonyl Region (~1700 cm^{-1})	Sharp & Crystalline	Absent	Modified & Broadened
Structure Proof	Physical Powder	Empty liposome	Embedded in Lipid Matrix

The "Fingerprint" Region (1700–1000 cm^{-1}) of Liposomal vitamin C shows a merged pattern, indicating that the Vitamin C is fully encapsulated within the liposome.

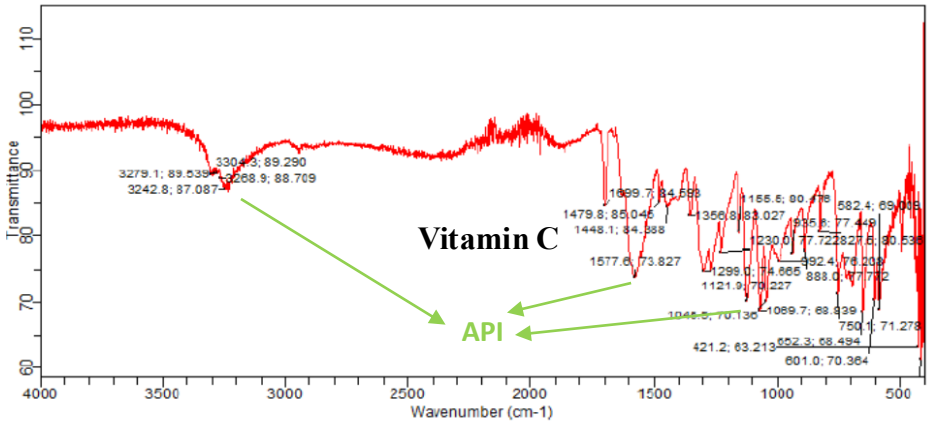

Figure 6A: FTIR Spectra of Vitamin C API

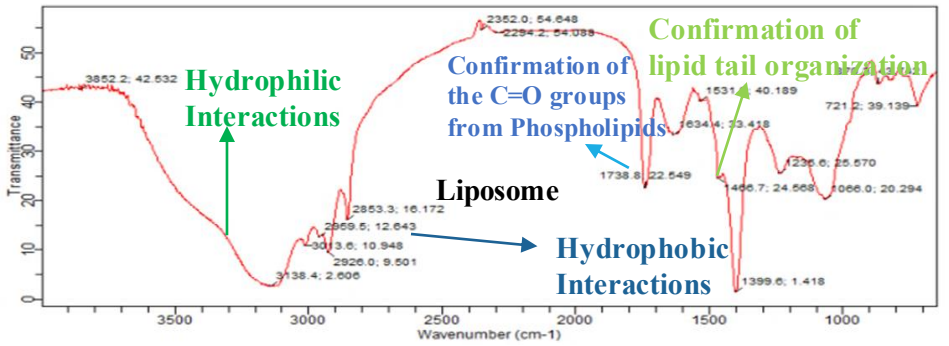

Figure 6B: FTIR Spectra of Empty Liposome

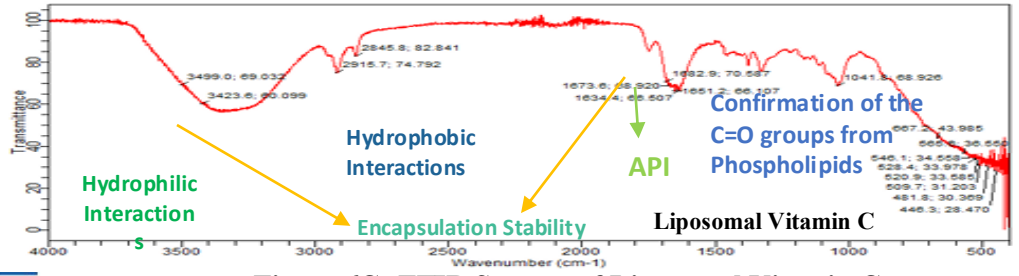

Figure 6C: FTIR Spectra of Liposomal Vitamin C

The Surface Proof: EDAX

A surface scan using **Energy-Dispersive X-ray Spectroscopy** (EDAX) examines the particle's surface.

Element Detected	Standard Vitamin C	WBCIL Liposomal Vitamin C
Carbon & Oxygen	Present	Present (Lipid Bilayer)
Nitrogen & Phosphorous (Present in lipid)	Absent	Present (Lipid Bilayer)

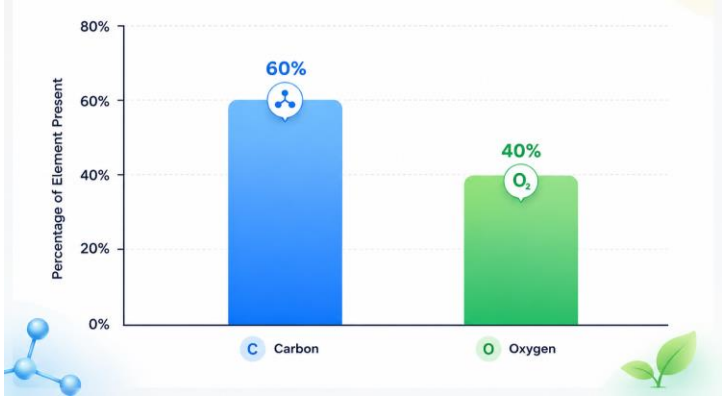

Figure 7A: EDAX of Standard Vitamin C

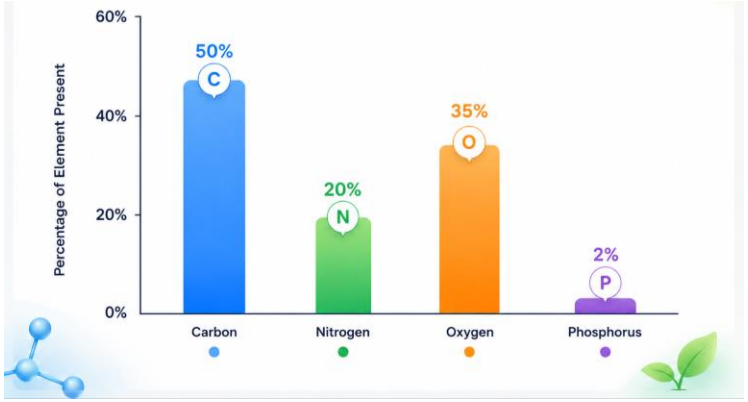

Figure 7B: EDAX of Liposomal Vitamin C

CONCLUSION: The difference in percentage of carbon and oxygen in both the samples clearly shows that vitamin C is successfully encapsulated

Scanning Electron Microscope (SEM) Image of Liposomal Vitamin C

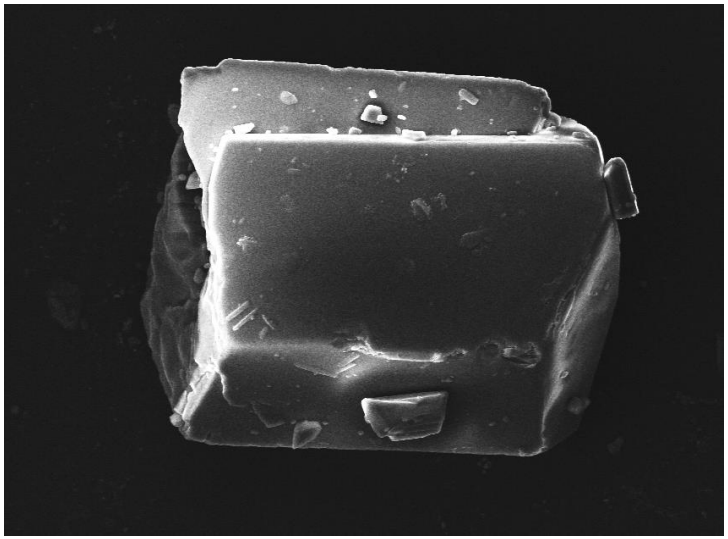

Figure 8A: SEM image of Vitamin C Active Ingredient

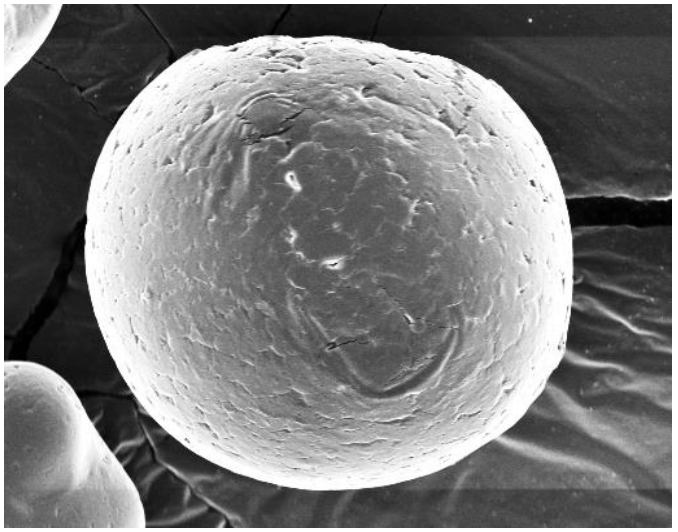

Figure 8B: SEM image of Liposomal Vitamin C

WBCIL Liposomes are perfectly smooth spheres. This morphology:

- Enhances overall stability
- Ideal for efficient drug delivery

The Accelerated Stability Test

We tested our **liposomal Vitamin C** under Extreme Conditions (40°C ± 2°C and 75% ± 5% Humidity) for 6 months to see if it would leak or lose power, resulting in a decrease in vitamin C content

98.43%
ACTIVE RETENTION

1.5%
TOTAL ASSAY LOSS

OUTCOME: Complete structural preservation ensures longer shelf-life

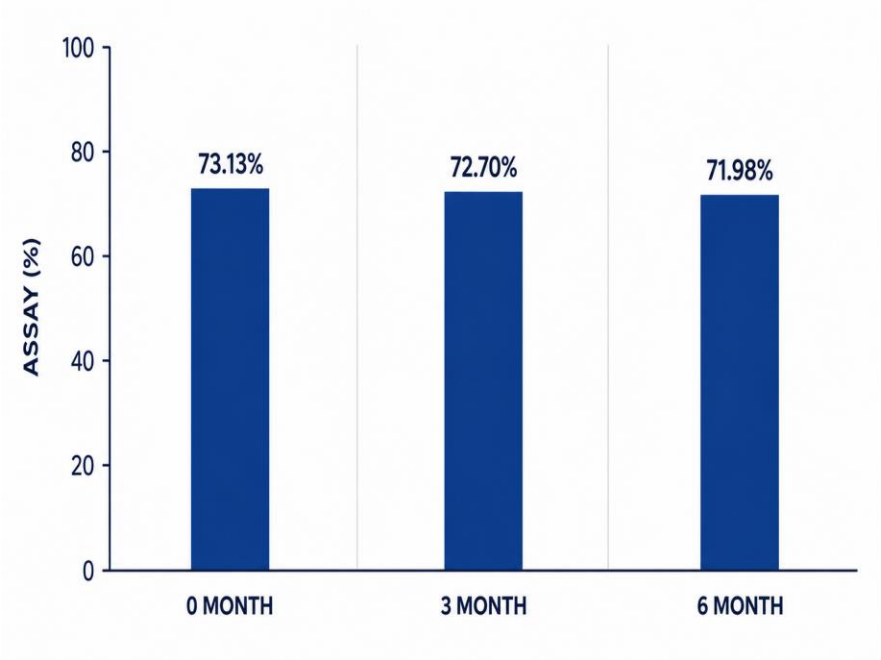

Figure 9: Determination of the Assay% of Liposomal Vitamin C observed under accelerated condition (40°C ± 2°C and 75% ± 5% Humidity) for 6 months

Summary

1. Encapsulation Efficiency & Capacity

a. Encapsulation Efficiency:	**85%**	Minimal loss & taste masking

2. Particle Characteristics & Stability

a. Zeta Potential:	**-36 mV**	Liposomal stability
b. Particle Size:	**257 nm**	Improved cellular uptake
c. PDI:	**0.25**	Uniform, stable liposomes

3. Structural & Chemical Confirmation

a. FTIR:	**Spectral shift**	Vitamin integrated, not physically mixed
b. EDAX:	**No surface Vitamin C**	Vitamin encapsulated within a liposome
c. SEM:	**Smoother, spherical particle**	Successful encapsulation

4. Thermal Stability & Integrity

a. Leakage & Stability:	**< 3% leakage**	Long-term product stability

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THANK YOU

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