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Preparation and Thermodynamic Characterization of Nanoliposomes for Cosmeceutical Applications

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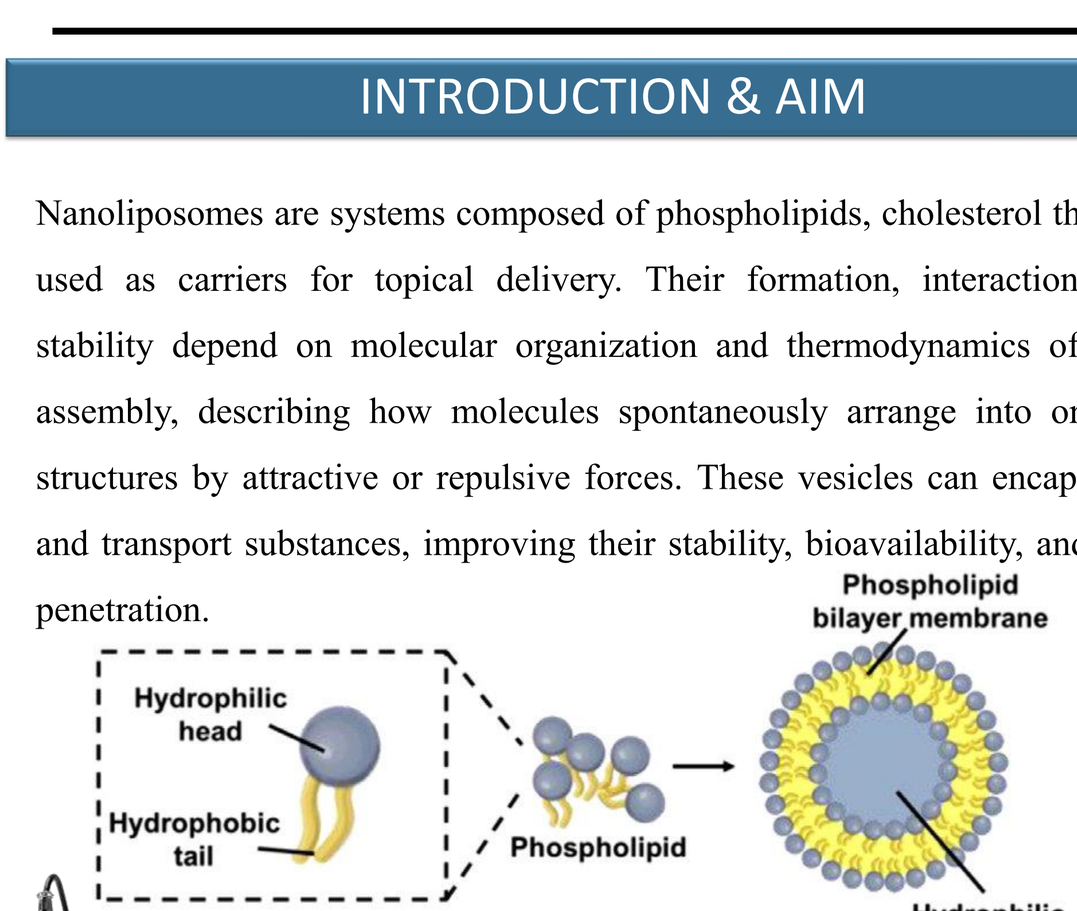
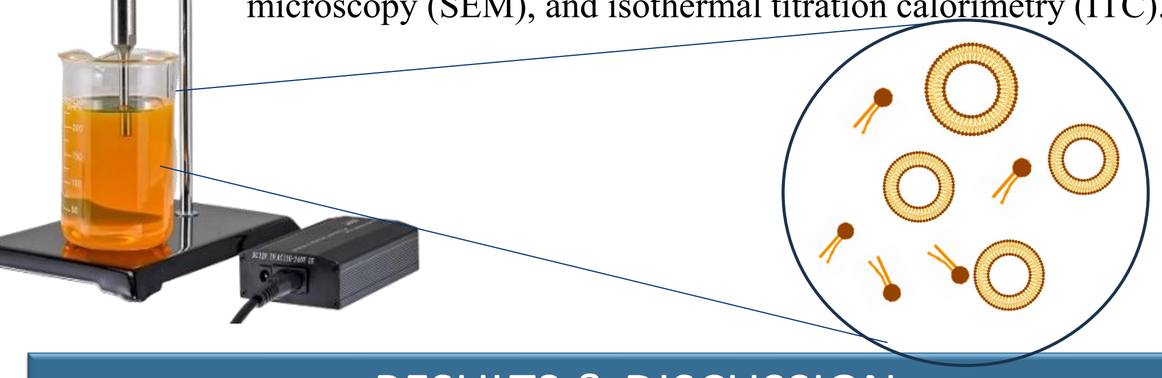
INTRODUCTION & AIM

Nanoliposomes are systems composed of phospholipids, cholesterol that are used as carriers for topical delivery. Their formation, interaction, and stability depend on molecular organization and thermodynamics of self-assembly, describing how molecules spontaneously arrange into ordered structures by attractive or repulsive forces. These vesicles can encapsulate and transport substances, improving their stability, bioavailability, and skin penetration.



METHOD

Phosphatidylcholine (PC)-based nanoliposomes were prepared by ultrasonication at 25–40 °C. Lipid concentration ranged from 0 to 2.5 mM. Characterization included dynamic light scattering (DLS), zeta potential (ζ), scanning electron microscopy (SEM), and isothermal titration calorimetry (ITC).



RESULTS & DISCUSSION

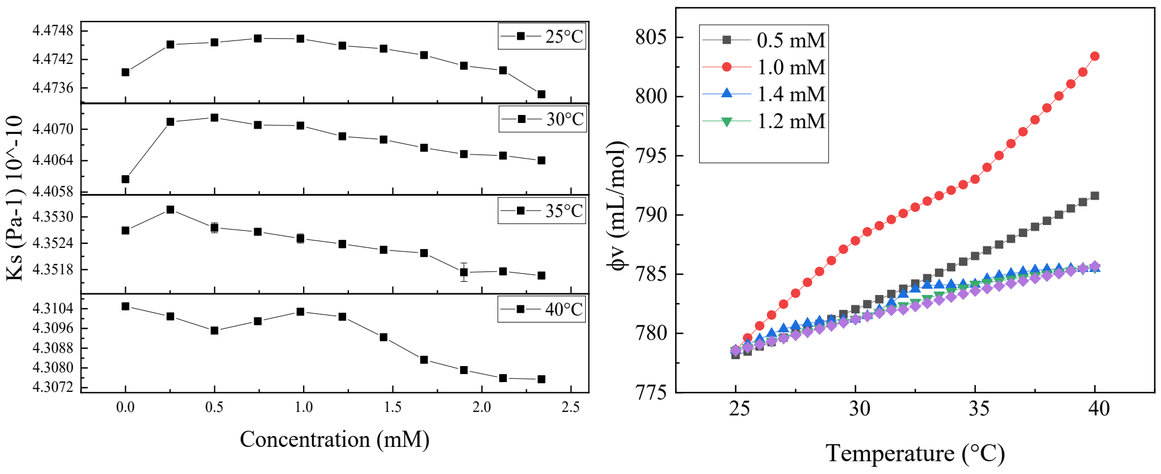


Figure 1 a) Changes in adiabatic compressibility by PC concentración changes with different temperatures b) Changes in temperature by PC different concentration

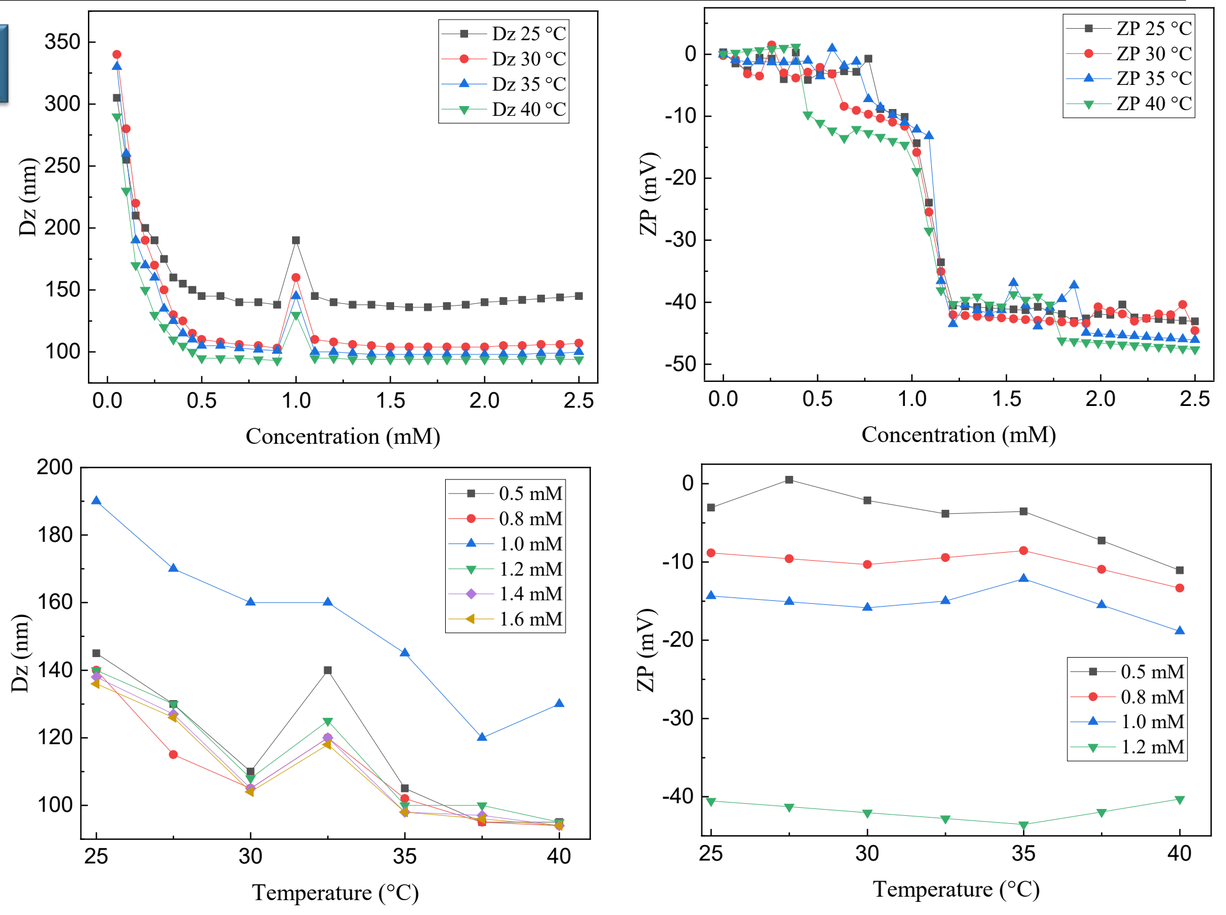


Figure 2. a) Dz changes as a function of PC concentration. b) Zeta potential changes as a function of PC concentration. c) Changes in Dz as a function of PC temperature. d) zeta potential changes as a function of PC temperature .

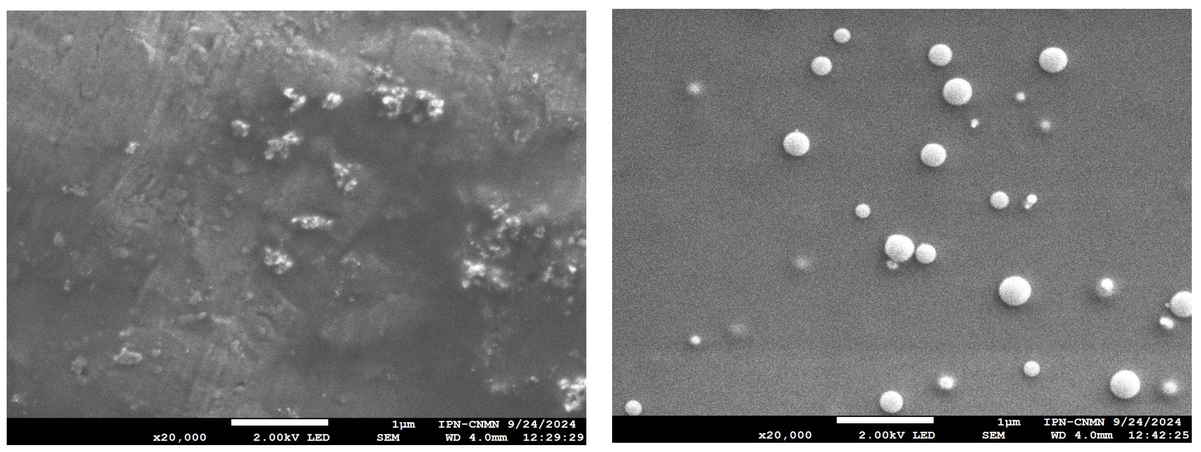


Figure 3. Micrographs of PC/AD emulsions with glutaraldehyde at ×20,000. a) 1.0 mM b) 1.2 mM

CONCLUSION

A critical self-assembly point is observed at ~1.0–1.2 mM, where the system reorganizes into stable liposomes. A phase transition temperature (Tm) is detected around 32 °C, indicating the shift from a gel-like to a more fluid bilayer state. The hydrodynamic diameter (Dz) shows a sharp reorganization at this concentration, consistent with vesicle formation. The zeta potential stabilizes near −40 mV, confirming high colloidal stability due to strong electrostatic repulsion. SEM imaging supports the presence of liposomal aggregates in this concentration range, consistent with structural stabilization.

FUTURE WORK / REFERENCES

[1] C. Tanford, “The hydrophobic effect: Formation of micelles and biological membranes1981

[2] B. Sohrabi,, “Electrolyte-cosolvent effects on the properties of micellar and monolayer phases in the cationic-rich region of catanionic mixture,” 2014, doi: 10.1016/j.fluid.2014.0

[3] M. Seijo, “Modeling the surface charge behavior and dynamic processes of colloidal particles : Application to components found in natural waters,” 2009,

[4] J. Eastman, “Colloid Stability,” *Colloid Sci. Princ. Methods Appl.*, pp. 36–49, 2009,.

[5] J. N. Phillips, “The energetics of micelle formation,” 1955, [33]