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Formulation and Characterization of *Penaeus monodon*-Derived Glucosamine Liposomal Gel

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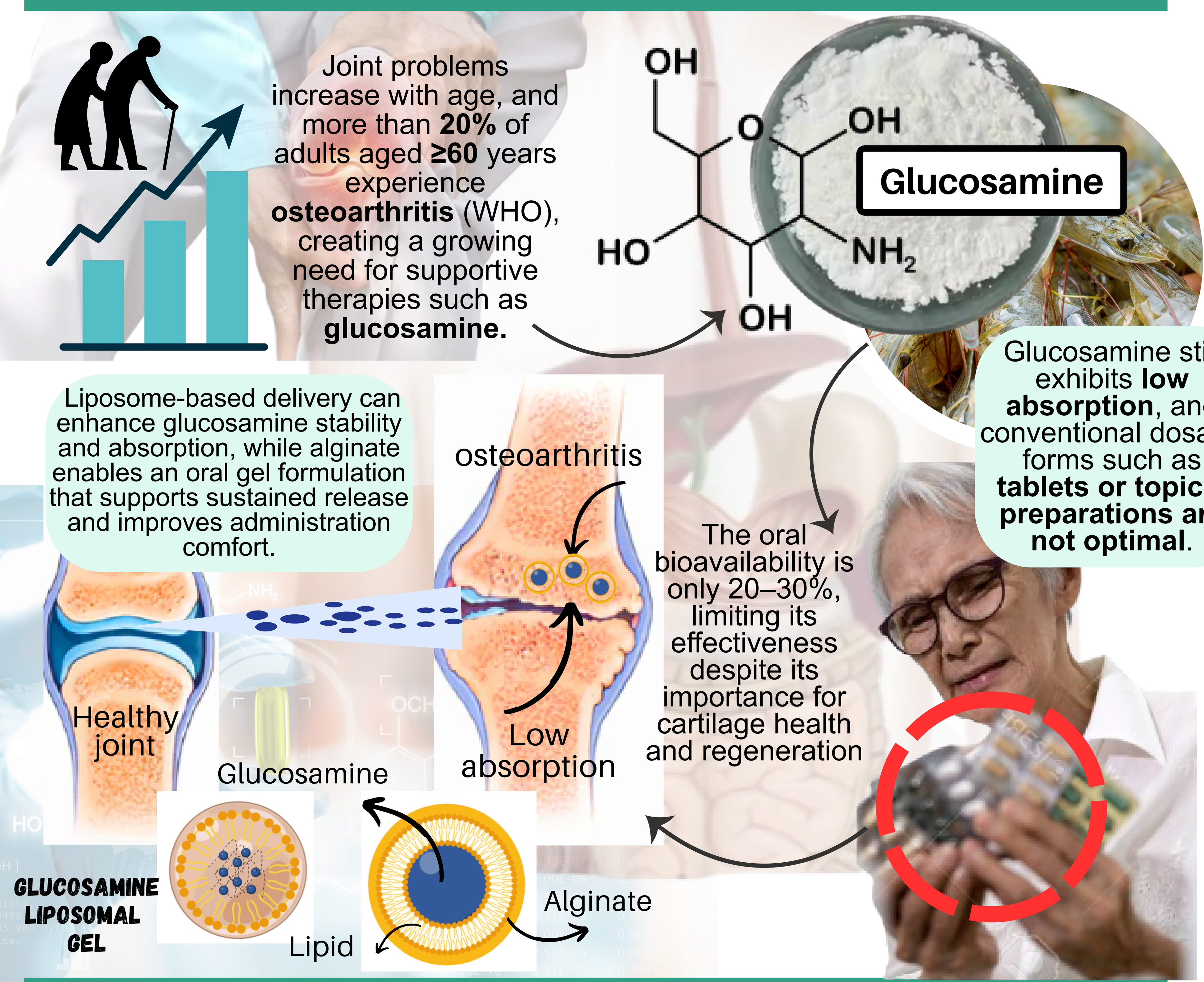
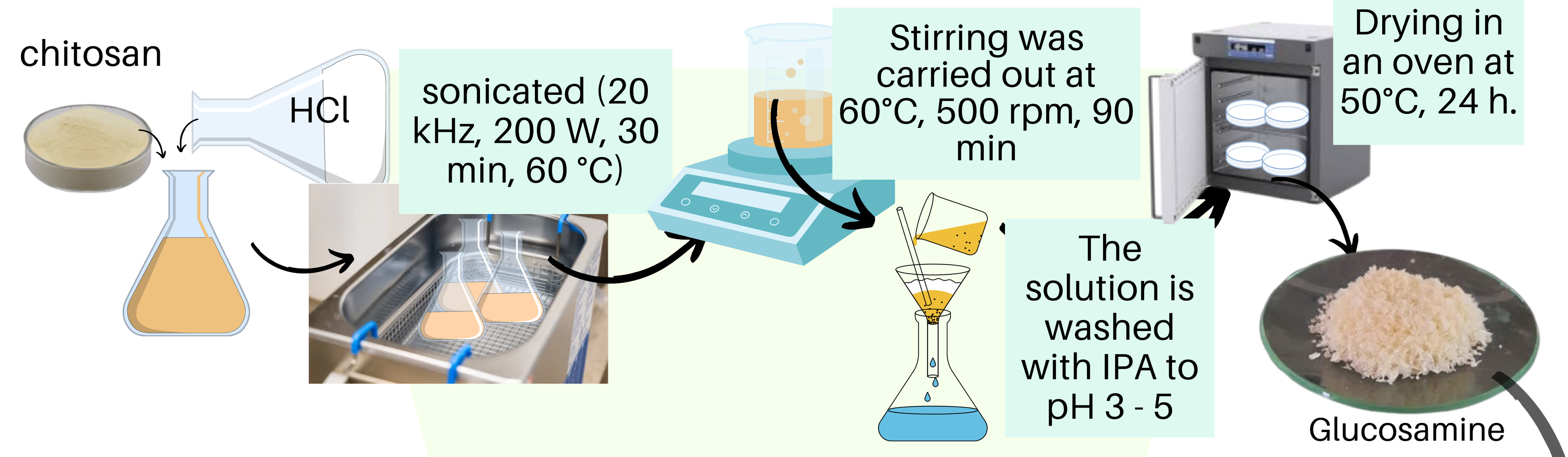
INTRODUCTION & AIM

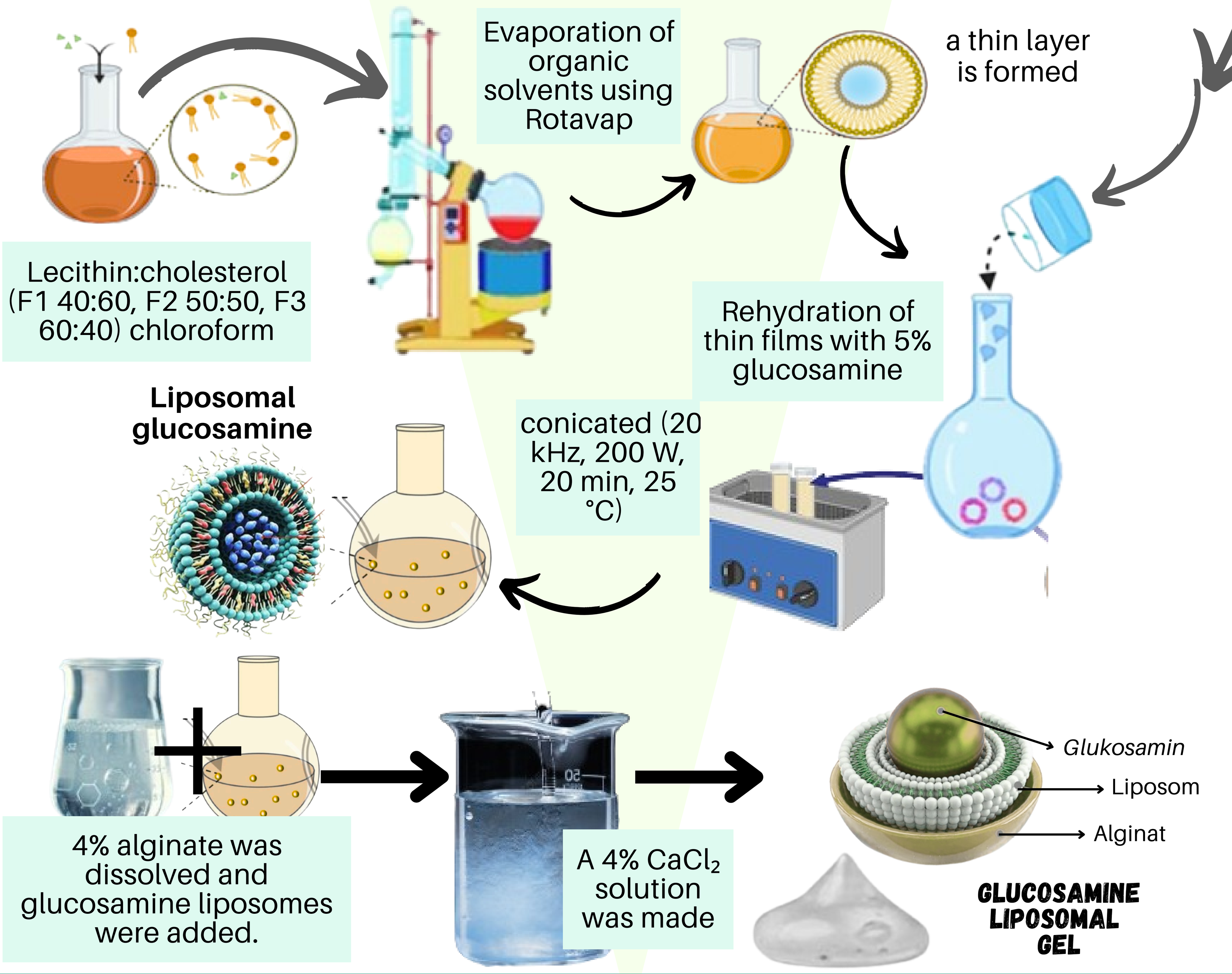


METHOD

- **Glucosamine extraction from Penaeus monodon shrimp shell chitosan**



- **Determining the best formula ratio variation for liposomal glucosamine gel characteristics (Rasheed et al., 2022) Modification**



RESULTS & DISCUSSION

Figure 1 Glucosamine hydrochloride (A) 8%; (B) 6%; (C) 4%.

The 4% HCl extraction gave the highest glucosamine yield, while GlcN-HCl liposomes showed time- and temperature-dependent turbidity increases.

Table 1 Characteristics of glucosamine hydrochloride

Sample treaments (%)	Appearance	Color	Yield (%)	pH	Particle size (nm)
Chitosan	-	-	-	-	866.5
4	Powder	Yellowish	86.20±8.83^a	3.64±0.38^a	239.6±39.4^a
6	Powder	Yellowish	78.95±5.15^a	3.62±0.30^a	155.5±12.6^a
8	Powder	Yellowish	79.5±6.66^a	3.59±0.36^a	26.0±92.8^a

Numbers followed by different superscript letters indicate significant differences ($p<0.05$).

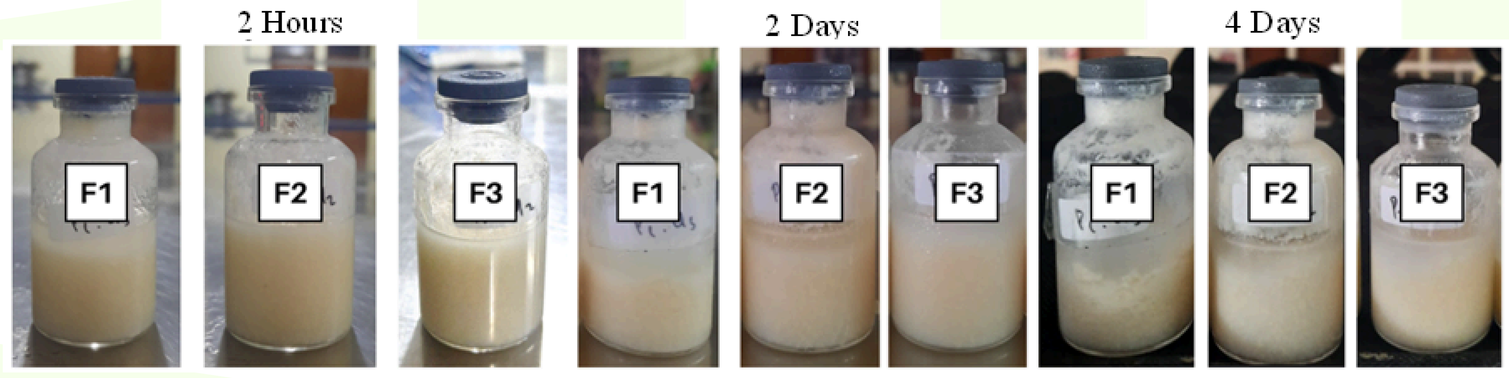


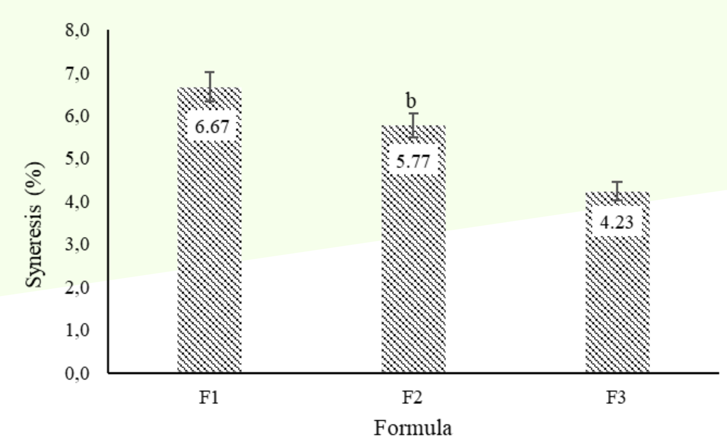
Figure 2. Physical stability appearance of glucosamine liposomes from day one to day four at 4 °C.
Note: Soy lecithin: cholesterol = F1 (40:60); F2 (50:50); F3 (60:40).

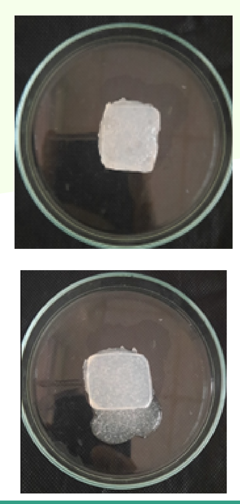
Table 2 Characterization of Glucosamine Liposomes

Formula	pH	EE (%)	Particle Size (nm)	Polydispersity index	Zeta potential
F1 (40:60)	5.32±0.15^a	98.60±0.74^a	649.9±142.93^a	1.9±0.20^a	-1.6±5.69^a
F2 (50:50)	5.74±0.13^b	98.25±1.27^a	598.9±32.31^a	2.2±0.29^a	1.1±5.20^a
F3 (60:40)	5.81±0.04^b	98.61±0.62^a	539.3±52.35^a	1.6±0.69^a	-3.7±0.30^a

Notes: Values followed by different superscript letters indicate significant differences ($p<0.05$).

Figure 3. Optical images of glucosamine liposome samples
Note: Soy lecithin: cholesterol = F1 (40:60); F2 (50:50); F3 (60:40), observed using an optical microscope at 400× magnification.





Formula 3 (lecithin:cholesterol 60:40) showed the best stability, highest entrapment efficiency, and favorable physicochemical and nutritional properties, making it the strongest candidate for an effective glucosamine delivery system.

CONCLUSION

This study demonstrated that GlcN-HCl derived from shrimp shell waste can be efficiently encapsulated into a stable alginate-based liposomal gel with favorable physicochemical, structural, and nutritional properties, indicating strong potential as an innovative functional food delivery system for the elderly.

FUTURE WORK / REFERENCES

Further optimization of the formulation, coating materials, advanced characterization, and performance testing is needed to enhance the stability of the glucosamine liposomal gel.

Rasheed MS, Ansari SF, Shahzadi I. 2022. Formulation, characterization of glucosamine loaded transfersomes and in vivo evaluation using papain induced arthritis model. Sci. Rep. 12(1):1–13. doi:10.1038/s41598-022- 23103-1.

WHO. World Health Organization. 2024 [cited 2025 Jun 26]. Ageing and Health. Available from: https://www.who.int/news-room/fact-sheets/detail/ageing- and-health