

Behavior of Lipid Nanoparticles in Aqueous Formulations: Measure of LNP Attraction and Repulsion

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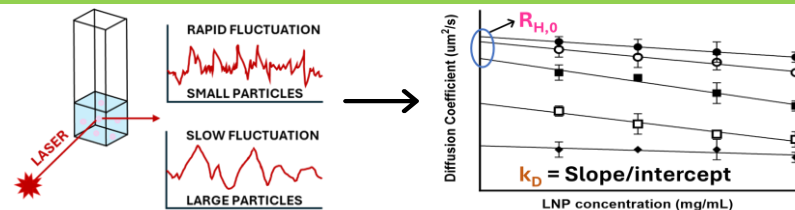
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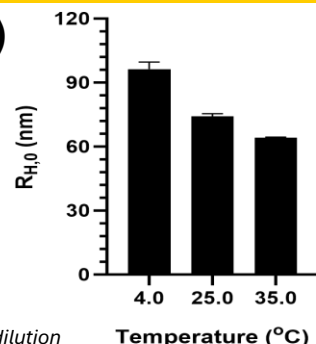
What Does Dynamic Light Scattering Measure?

Hydrodynamic Radius (R_H)

$$R_{H,0} = \frac{kT}{6\pi\eta D_0}$$

Hydrodynamic radius at infinite dilution ($R_{H,0}$) **excludes** interparticle interactions.

k = Boltzmann's constant, T = Absolute temperature,
 η = Bulk viscosity, D_0 = Diffusion coefficient at infinite dilution

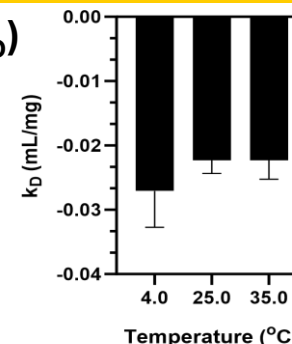


Attraction and Repulsion (k_D)

$$D = D_0 (1 + k_D c)$$

k_D values : **positive** (Repulsion);
negative (Attraction)

D = Diffusion coefficient, D_0 = Diffusion coefficient at infinite dilution, c = concentration

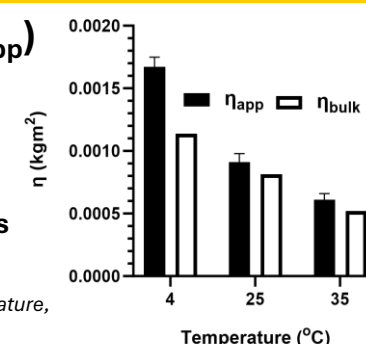


Apparent Viscosity (η_{app})

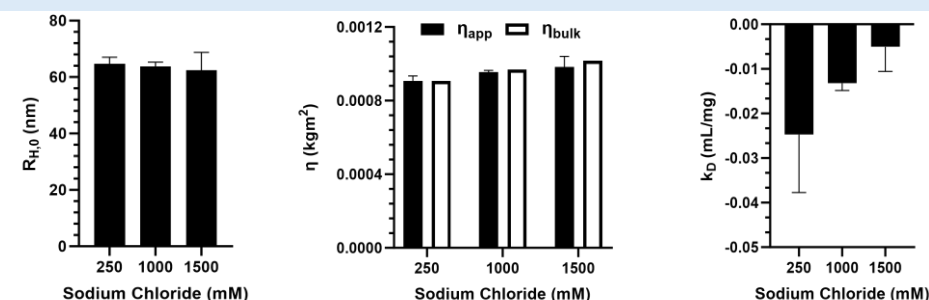
$$\eta_{app} = \frac{kT}{6\pi R_{H,0} D_0}$$

Viscosity experienced by LNP at LNP-water interface (η_{app}) **differs** from η_{bulk} .

k = Boltzmann's constant, T = Absolute temperature,
 $R_{H,0}$ = Hydrodynamic radius at infinite dilution



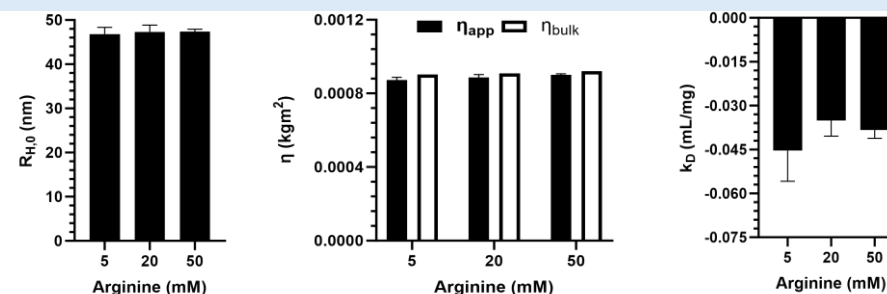
Sodium Chloride



Conclusions

- Sodium chloride and Arginine have **no measurable effects** on Lipid nanoparticles (LNP) behavior in solution.
- The apparent viscosity (η_{app}) **decreases** with **increasing temperature**.
- When a change in the $R_{H,0}$ of LNPs is **unlikely**, the apparent viscosity (η_{app}) could **change**.

Arginine



References

- Wright et al., *Anal.Chem.*, 2025 (doi.org/10.1021/acs.analchem.4c06089).
- Francis et al., *Int.J.Pharm.*, 2025 (Under Review).
- Francis et al., 2025 (Manuscript in progress).

