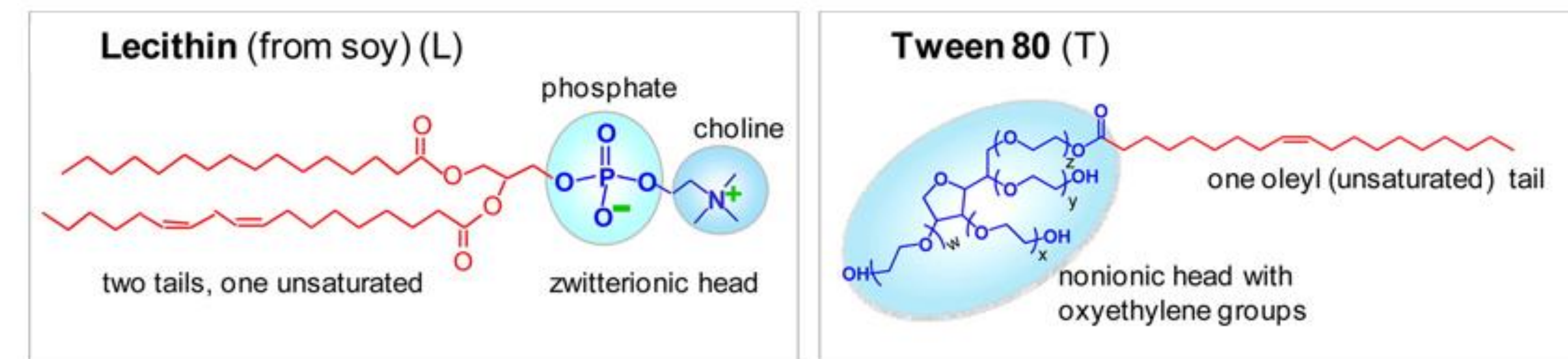


Abstract

A combination of two amphiphiles: lecithin (L), a phospholipid extracted from soybeans, and Tween 80 (T), a surfactant used in many food products to produce an effective oil spill dispersant.



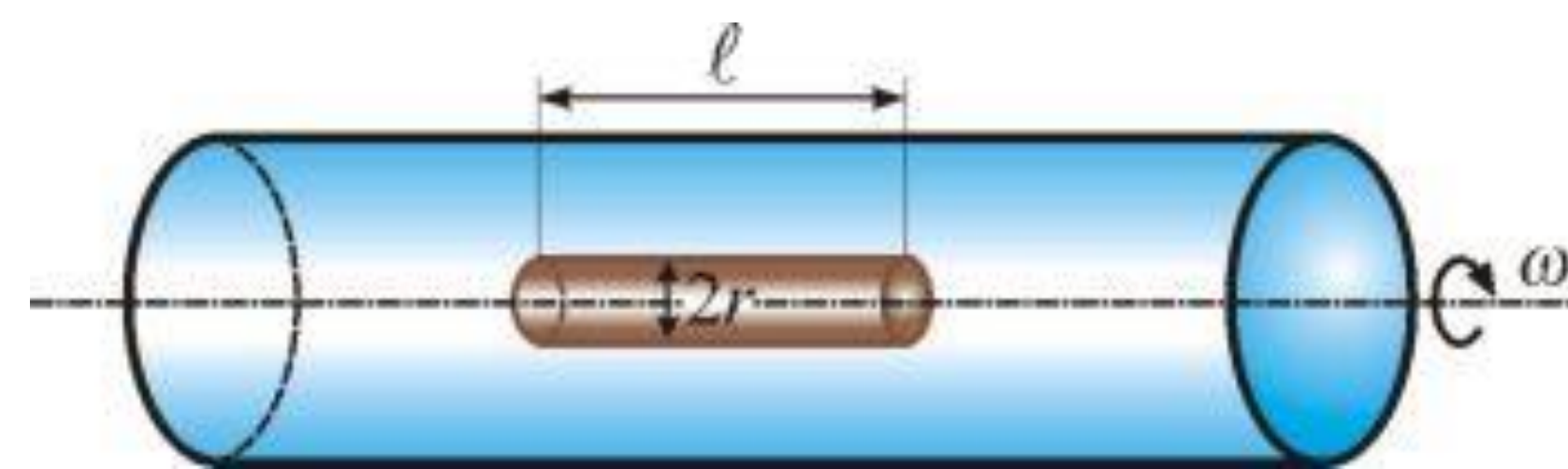
L-α-phosphatidylcholine

Polysorbate 80

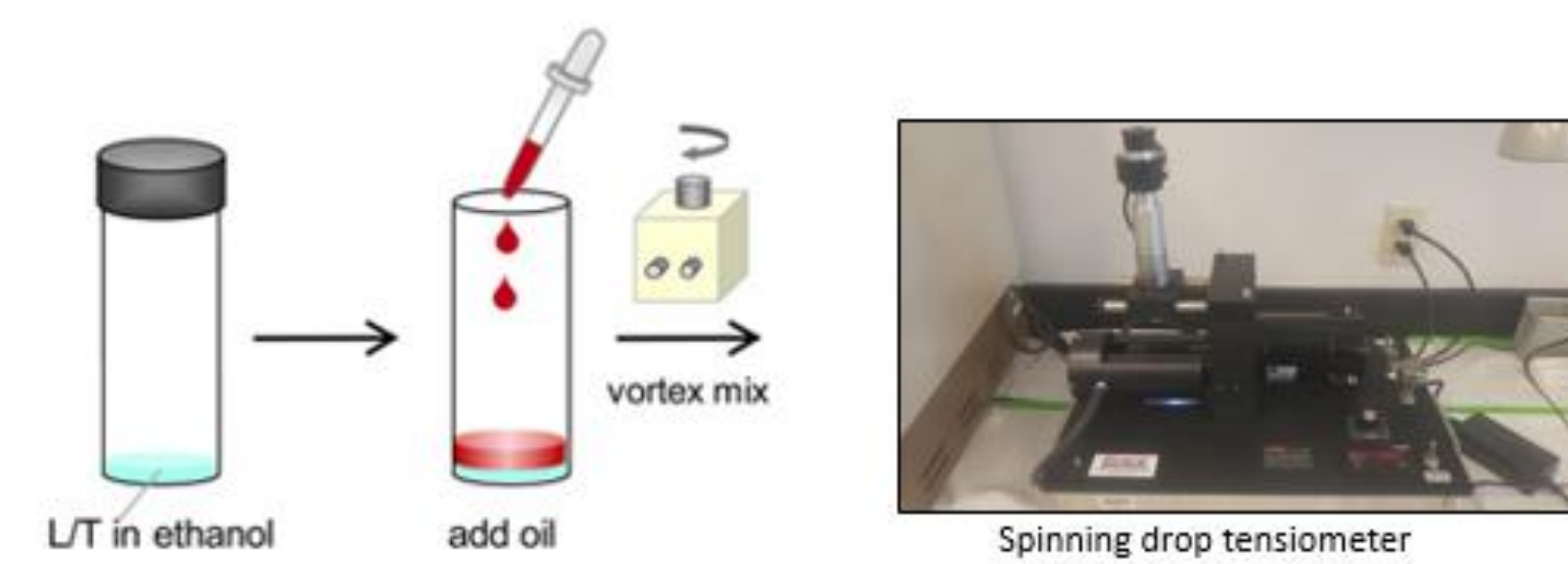
Interfacial Tension

The spinning drop method is used in measuring ultra-low interfacial tensions. A drop of less dense liquid is injected into a capillary tube containing the denser fluid. The tube is spun on its axis until the suspended drop is elongated into a cylindrical shape. When the drop length is much greater than the radius (**infinite length limiting equation**), the interfacial tension can be calculated using the expression below;

$$\gamma = \frac{\Delta\rho\omega^2r^3}{4}$$

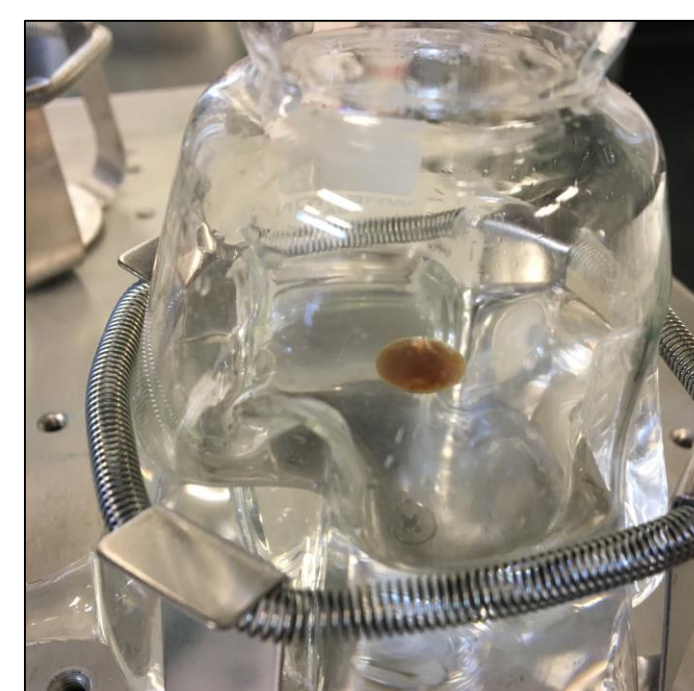


Where γ is the interfacial tension, $\Delta\rho$ is the difference in density between the droplet and saline water, ω is the angular velocity and r is the droplet radius (**Measured using the spinning drop tensiometer**).



Methods: Dispersant Efficiency

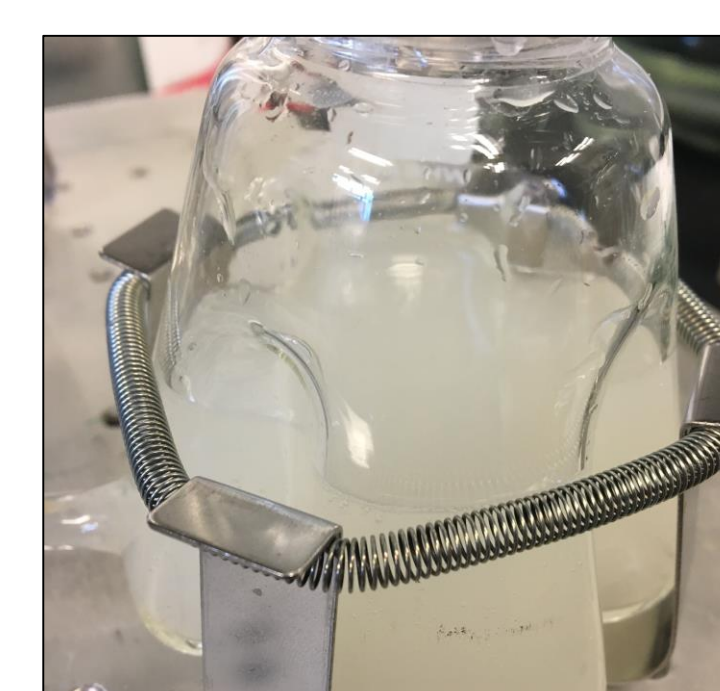
Baffled Flask Test is a 3-part procedure to measure the amount of oil effectively dispersed in water by a given dispersant. The first part consists of oil being dispersed in a saline water sample. The second involves a liquid-liquid extraction of the oil by using dichloromethane. Lastly, absorbance of this extraction sample is measured via ultraviolet spectroscopy.



Anadarko crude oil before adding dispersant



Anadarko crude oil after adding dispersant



Anadarko crude oil after 10 min shaking

Motivation

Oil spills are some of the most ecologically devastating man-made disasters possible. Dispersants are commonly employed for the remediation of oil slicks on water surfaces. An effective oil spill dispersant should have the capability to adequately reduce the interfacial tension at the oil–water interface. Reduction of the interfacial tension results in significantly greater surface area generation (smaller oil droplets) as inferred in the expression bellow.



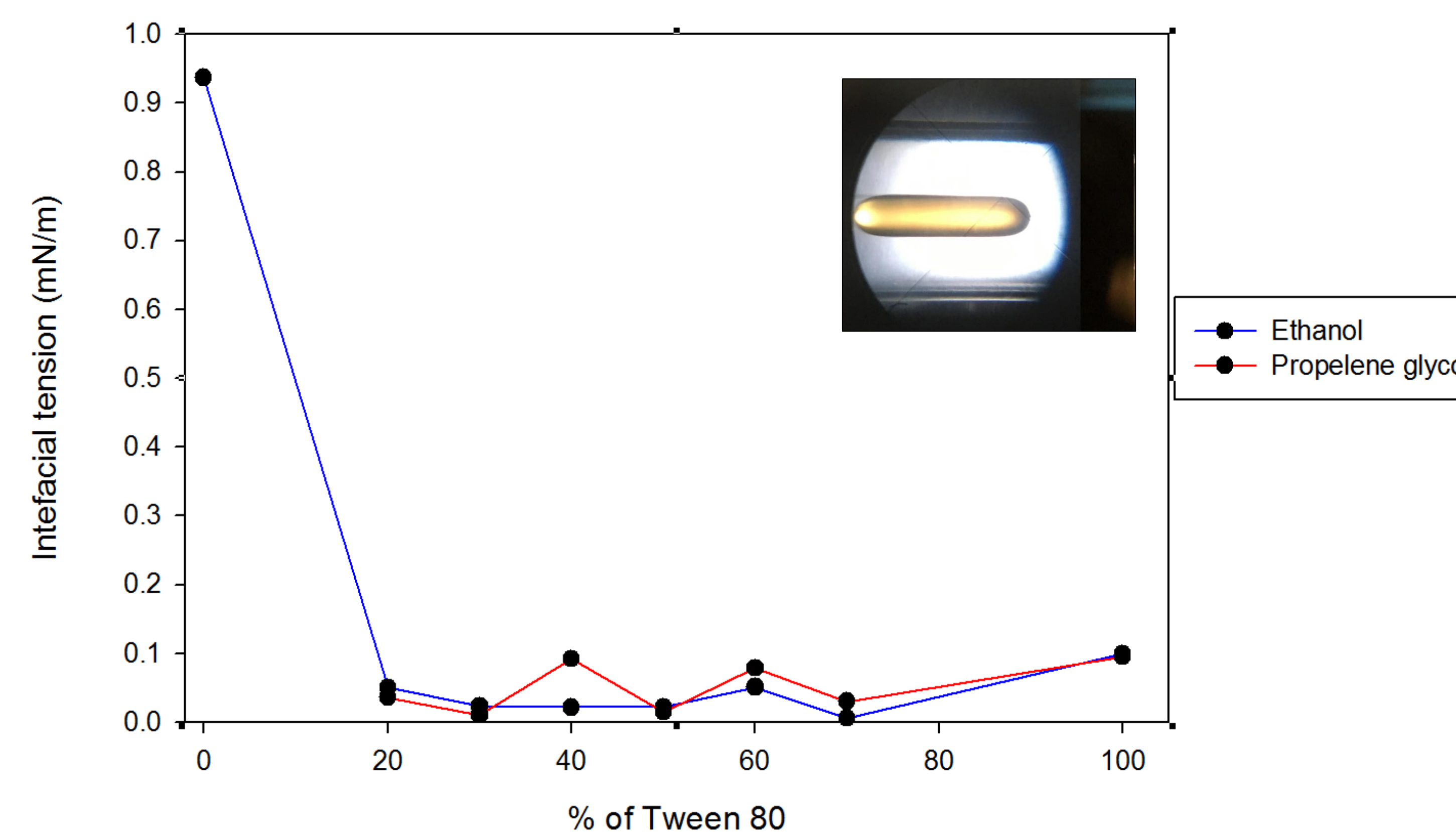
$$\Delta W = \gamma \Delta A$$

where ΔW is the change in energy, ΔA is the change in interfacial area and γ is the interfacial tension at the oil–water interface.

Conclusions

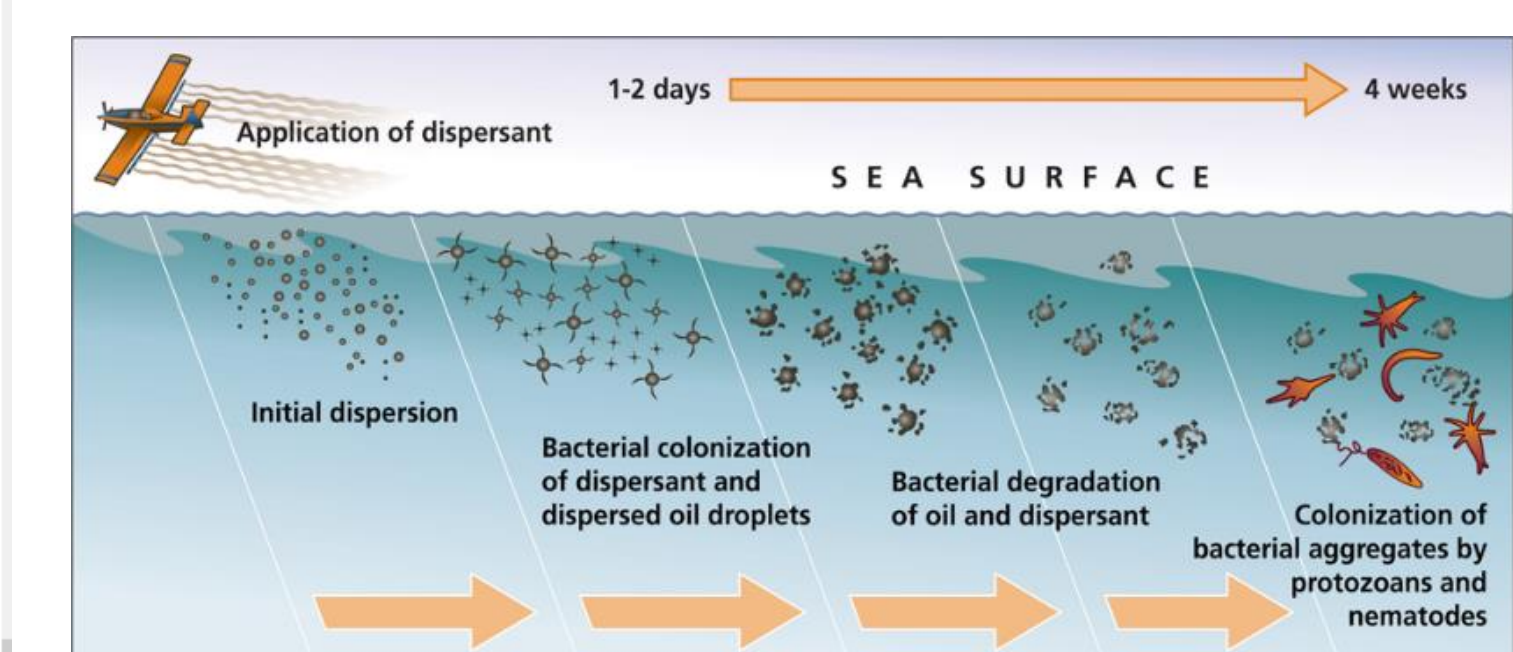
- A dispersant made by combining Lecithin and Tween 80 was prepared and its interfacial tension reduction capability was evaluated.
- The effectiveness of the dispersants in oil spill remediation was examined with the baffled flask test.
- The combination of Lecithin and Tween 80 resulted in a significant reduction in interfacial tension and high dispersion efficiency.
- Even though interfacial tension was reduced, there was no significant differences over 20/80 to 70/30 of L/T wt. %.
- Except for the 0 % tween 80 dispersion efficiency result, there was a clear correlation between the reduction in interfacial tension and a high dispersion efficiency.
- Interfacial tension measurements of Lecithin / Tween 80 dissolved in ethanol and propylene glycol showed a interfacial tension reduction capability.

Results: Interfacial Tension



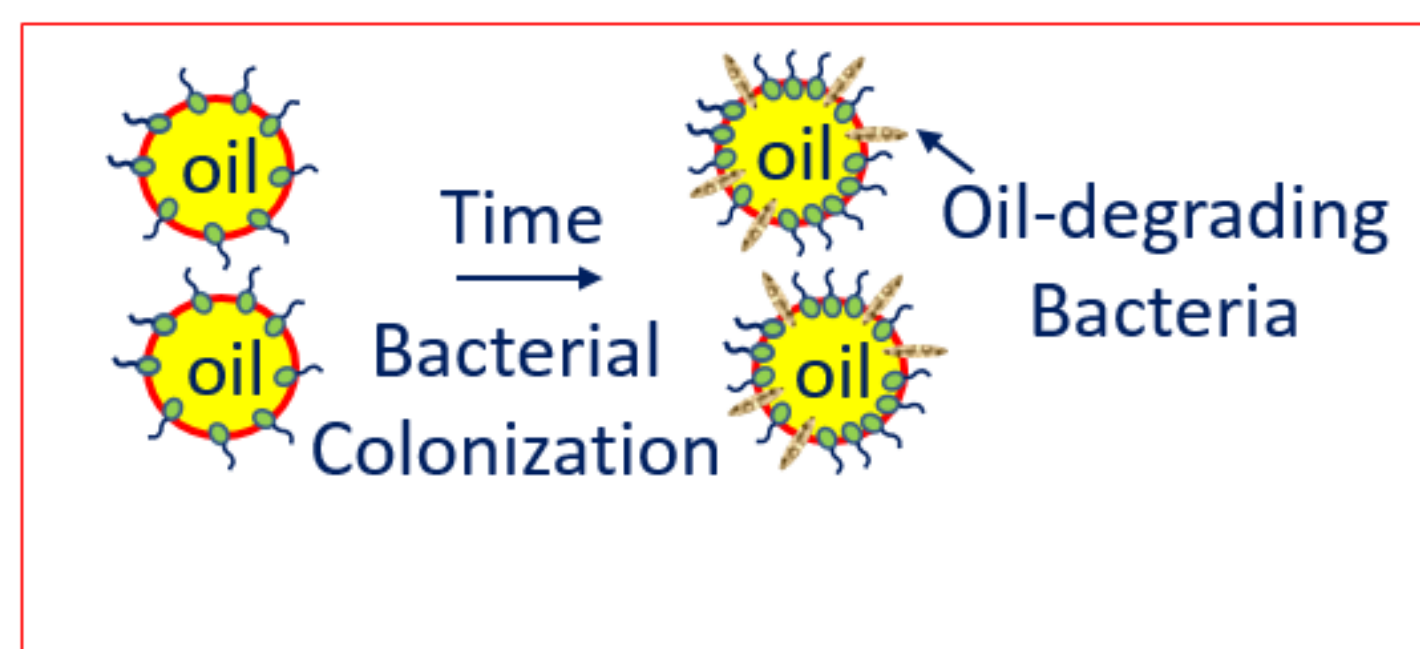
Future Work

- Oil spill dispersion and biodegradation.
- Evaluate the bacteria biodegradation of oil in the presence of Lecithin / Tween 80 dispersant.

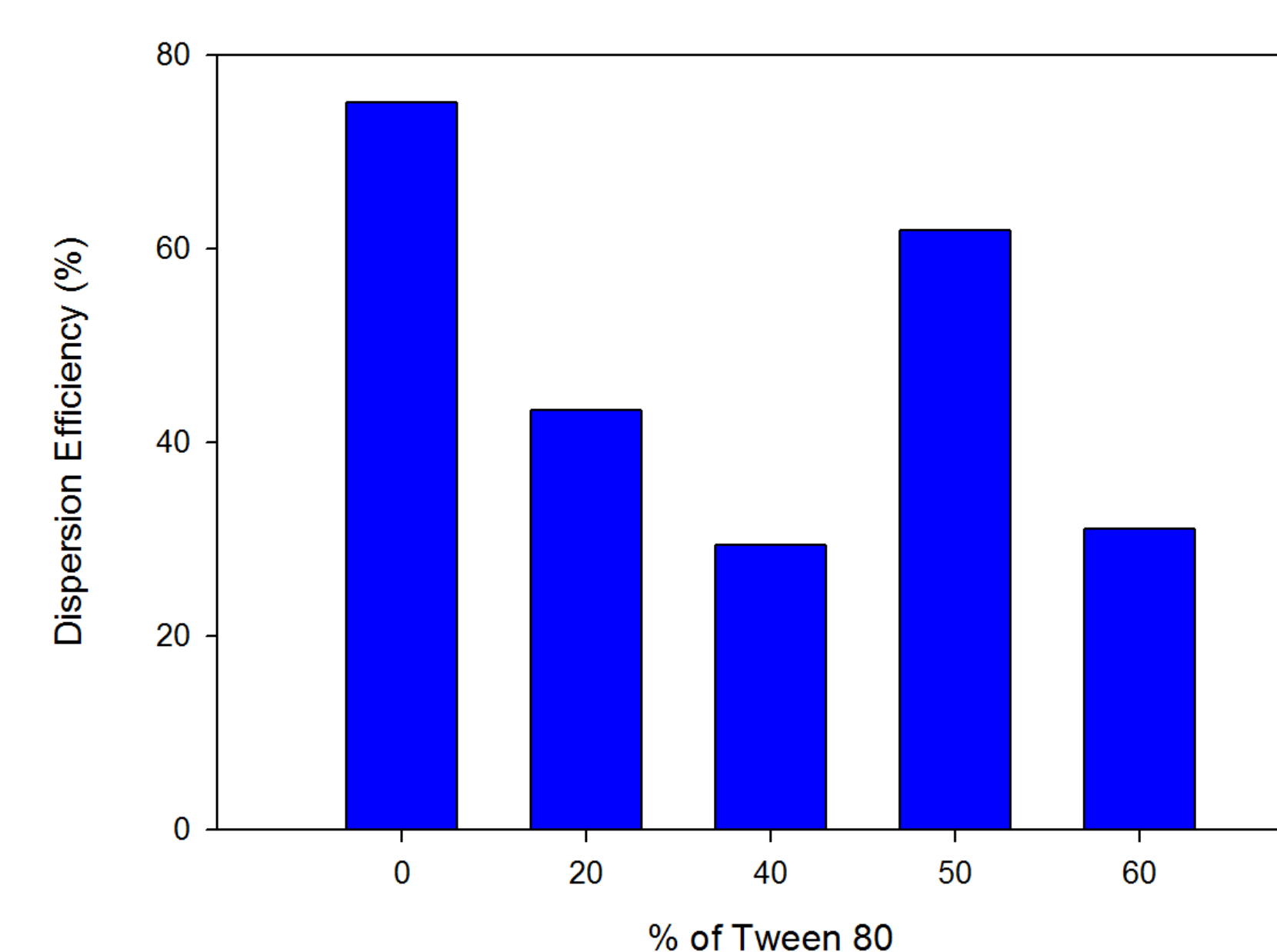


Dispersion by ocean waves and Biodegradation

Biodegradation of suspended oil droplets



Results: Dispersant Efficiency



References

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