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Physics: Viscosity and Surface Tension of Fluids

Paper citation: Wei R, Chen J, Huizinga JD (2014). On the Relationship Between Viscosity and Surface Tension. J Emerging Investigators *33*: 1-5

Paper questions

In reading through the assigned paper, please answer the following questions:

1. What is the question being investigated by the researchers?

   The researchers wanted to learn if there was a correlation between surface tension of fluids and their viscosity.

2. How do the authors define surface tension? How do they define viscosity?

   The authors define surface tension as the property of liquids such that their surfaces behave like a thin, elastic film. This is caused by the isward pulling force exerted on the surface of the fluid. Viscosity is the resistance of a liquid substance to flow.

3. What was the authors' hypothesis?

   The authors hypothesized that there would be a positive correlation between surface tension and viscosity.

4. Describe the authors' experimental approach.

   The authors designed an apparatus to measure surface tension, and upon validating this apparatus, used various solutions of either agar or flour to create fluids of various viscosities. They then used their apparatus to measure the surface tension exhibited by these viscous fluids.

5. How did the authors validate their experimental set-up?

   The authors validated their set-up by testing the surface tension-measuring apparatus using water with dish detergent (which weakens hydrogen bonding between water molecules and decreases surface tension). The solution with dish detergent measured a lower average surface tension on the experimenters' apparatus.

6. How did the authors create fluids with different viscosities?

   The authors used various solutions of either agar or flour to create fluids of various viscosities.

7. What were the results of the authors' experiments, and what is their interpretation?

   The authors found that fluids with greater viscosity did not have greater surface tension. Their results suggest that viscosity and surface tension are not correlated (at least in these fluids).

8. How do the authors attempt to explain their surprising results?

   The authors explain their results by suggesting that intermolecular forces between water molecules do not change when water is mixed with starches or agar. Therefore, surface tension of the water should not change.

9. What are some shortcomings of this paper?

   The authors do not test fluids other than water, nor do they test any solutions were hydrogen bonding between water molecules could be affected.

10. Propose two follow-up experiments that could be performed given the data presented in this paper.

    It would be interesting to look at different fluids (such as solutions of with alcohols which might change intermolecular forces between water molecules) and test surface tension vs. viscosity. In addition, the authors suggest that they could conduct more replicates of their data.