Comparison of the Rotational Behavior of Coffee Creamer in Two Different Liquid Media

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How Does Rotation Affect Dispersion Patterns of a Fluid Within a Fluid?

Introduction

- The purpose of this research was to explore dispersion patterns of a solute when combined with a rotating solvent
- The dispersion patterns of the creamer were observed after being both added directly to the rotating water and when having to first traverse a layer of vegetable oil

Method

- To facilitate this exploration a beaker of fresh water was mounted to a Pasco ME-8951 rotating platform which was connected to an adjustable power supply
- The power supply was systemically adjusted and the dispersion patterns of the coffee creamer was observed at 2, 4, and 6 volts.
- A color indicator was used to help visually dissociate the solute and solvent.

Results

At 2 volts a swirl of creamer was observed along the vertical axis through the center of gravity of the fresh water and a thin layer diffused radially at the bottom of the beaker. At 4 volts the solute formed bands radiating outward from the vertical centerline axis. At 6 volts a swirl was, again, observed at the vertical axis with a degree of diffusion towards the bottom of the beaker.

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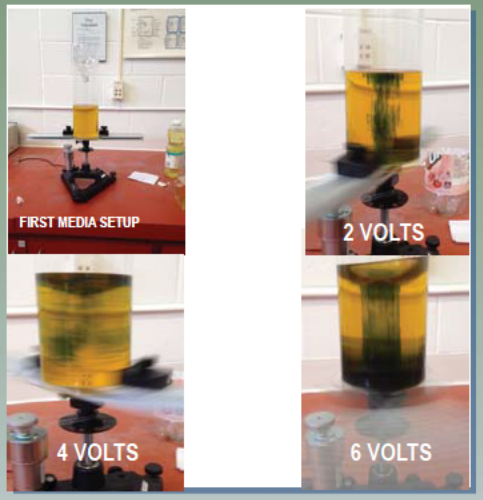

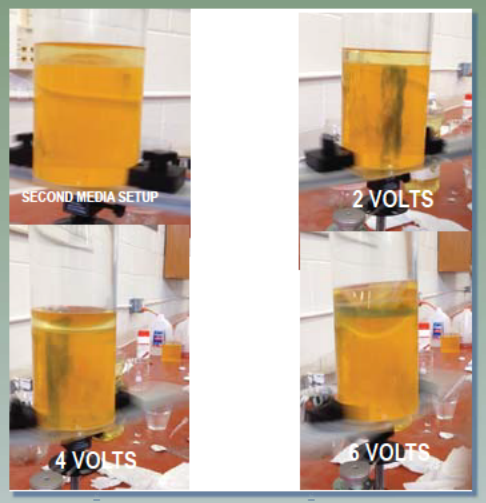

PASCO ME 8951 Rotating Element

Discussion

The pattern at 6 volts was much more distinctive than what was observed at 2 volts. It is possible that the unusual patterns observed at 4 volts were due to experimenter error. One speculative cause would be to have not added the creamer near the vertical axis of the fresh water. After direct applications of the creamer was observed and documented a layer of vegetable oil was added to the water. The layer was approximately half an inch thick. Again, the power supply was systemically adjusted so that the dispersion of the creamer was observed through the vegetable oil layer and into the fresh water at 2, 4, and 6 volts. Upon adjusting the power it was observed that the vegetable oil layer became unstable and bowed upward. Adding the solute when the layer was in this state resulted in a very quick yet radial dispersion. Upon noticing this pattern the decision was made to allow the layer to settle before adding the creamer. For each voltage level the general pattern of dispersion of the creamer was the same. After the application the creamer would remain as a sphere while slowly crossing the vegetable oil layer. Once the creamer began entering the fresh water swirls began to appear near the vertical centerline. However, while these swirls became more distinctive as the voltage was increased, they were never as distinct as observed during direct application.

Conclusion

- First media produced better results at higher voltage
- Second media became unstable at higher voltage

References

1. SPINLab Fluid Dynamics Educational Film Project. (n.d.). Retrieved February 14, 2015, from http://planets.ucla.edu/featured/spinlab-geoscience-educational-film-project/