

Agitation of Oil and Water

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Photo/Video Assignment #3

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Introduction:

For the third photo/video assignment, I recorded the mixing effects of oil and water when agitated with a stirring rod. I used simple vegetable oil and tap water as my ingredients, with a wooden rod to incite motion. What I found most interesting about this fluid flow was the formation of oil spheres during the experiment. As the spinning oil-water mixture slowed, the oil formed spheres due to its hydrophobic nature. These orbs merged together one by one until the mixture stopped spinning and the fluids were able to fully separate. Overall, this flow was visually appealing, especially when viewed up close.

Science of the flow:

One of the main contributors to this type of fluid flow is surface tension. Since oil is hydrophobic, as it is spinning through the water it does not mix with the water. Rather, it forms tiny spheres. This is due to the surface tension of the oil [1]. Surface tension is a driving force that minimizes surface area in fluids. It is governed by this equation:

$$\gamma = \frac{F}{L} [2]$$

In this equation, F is the force exerted parallel to the surface of a liquid and L is the length of the line over which that force acts [2]. For the oil in water experiment, the oil orbs are caused by this surface tension, and the forces exerted would look like this:



Figure 1 - Forces on a sphere of oil in water [2]

Experimental setup:

This video was taken with indoors with artificial lighting using a warm bulb. The fluids were contained in a large glass jar, which allowed for a clear visualization of the flow. In addition, the experiment was lit from below using a lightbulb, which shown through the bottom of the jar. This lighting setup provided great contrast between the water, oil, and backdrop. The video was taken on an iPhone 12 Pro Max, initially using the “wide” $f/1.6$ aperture, which captured the image shown here:



Figure 2 - Image using $f/1.6$ aperture

Then, to get a clearer image of the forming spheres of oil, I captured the flow again using the “telephoto” $f/2.2$ aperture of the iPhone. This resulted in an emphasis on the flow, as shown here:



Figure 3 -Image using the $f/2.2$ aperture

Conclusion:

In this experiment, I captured the flow of agitated oil in water using a video. The video was taken on an iPhone 12 Pro Max, using two different lenses to emphasize the nature of the flow. The most interesting aspect of this visualization is the formation of oil spheres as the spinning oil-water mixture began to slow. This video was lit by a bulb placed below the fluid container, which created great contrast between the flow and the background. I was happy with how this video turned out, as it clearly depicts the fluid flow and is simultaneously visually appealing.

Bibliography

- [1] "UCSB ScienceLine," University of California Santa Barbara, 17 10 2005. [Online]. Available: <http://scienceline.ucsb.edu/getkey.php?key=997>. [Accessed 03 12 2021].
- [2] Haber, "University of California Santa Cruz".