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Team First

MCEN 4151

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1. Introduction

The image above shows the stratified flow of water moving through oil. Colored water was put into a container and then topped with a layer of vegetable oil. To create the flow an effervescent antacid tablet was dropped through the layer of oil. When the antacid reached the water, the reaction released bubbles which dragged the water up through the oil. As the gas was released on the surface the water fell back down through the oil and began to settle back at the bottom. The cycle created the effect of a sort of “lava lamp” with sections rising and falling throughout the process. The yellow green liquid is the vegetable oil. The water was colored with blue food coloring and thus can be differentiated from the clear bubbles of gas which were released from the antacid tablet.

2. Set up

The set up for this experiment was relatively simple. A clear glass was used and filled with 1/3 water and 2/3 Harris Teeter brand vegetable oil. Then blue food coloring was dropped through the oil. The food coloring does not mix with the oil, so it falls through until it reaches the water (IMAGE 1) Then the water and food coloring was stirred to ensure an even color for the water. Then an Alka-Seltzer tablet was dropped through the oil and began to react when it reached the water. This reaction is possible because the Alka-Seltzer tablet contains sodium bicarbonate (a base) and citric acid (an acid). These two components are unable to react when in dry form, however, once they are dissolved in water, they react together and give off carbon dioxide bubbles.



[1] These bubbles then created a buoyant plume which dragged the water up through the oil. Some bubbles of water were trapped on the surfaces by the surface tension between the water and the oil while others were able to fall back down to the bottom after releasing the carbon dioxide. (IMAGE 2).

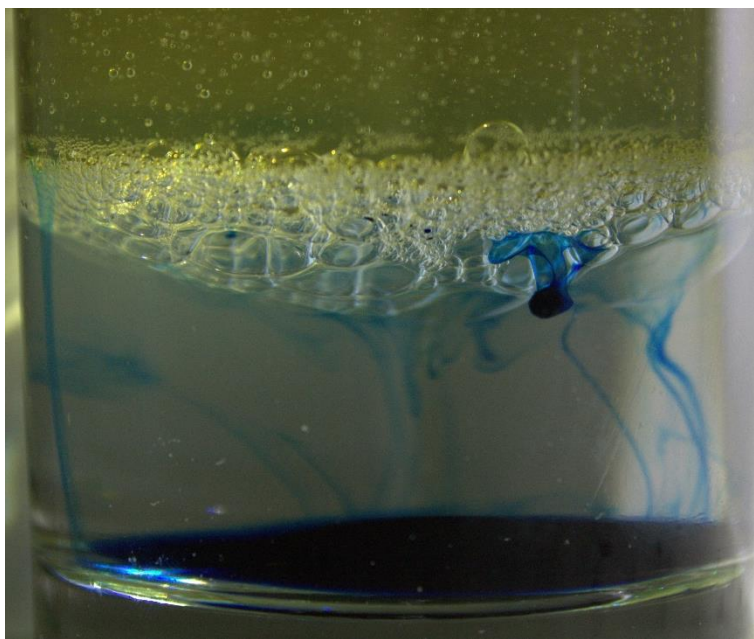


IMAGE 1



IMAGE 2(unedited)

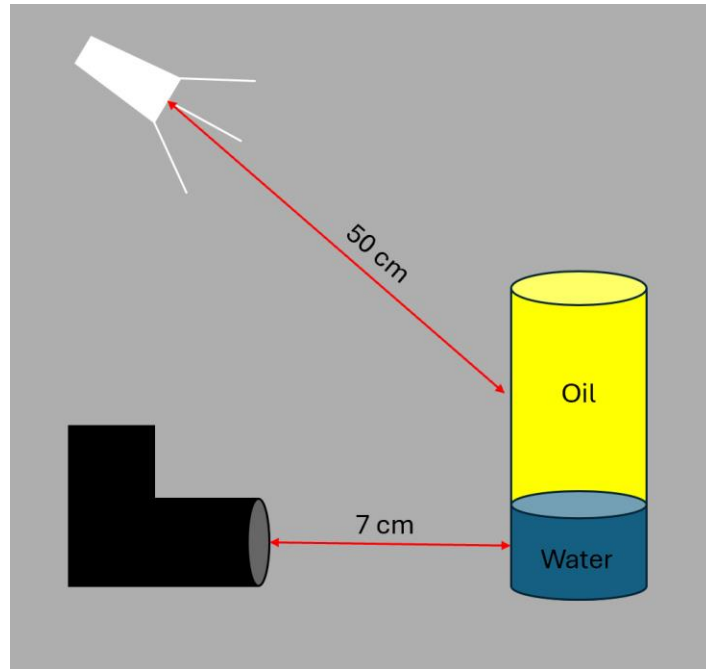
3. Visualization Technique

The experiment was conducted at room temperature using Harris Teeter Vegetable Oil, Color Right Blue food coloring and regular tap water. The container was filled with 1/3 tap water followed by 2/3 vegetable oil. The food coloring was dropped in and mixed with the water. Once the solution was settled and Alka-Seltzer tablet was dropped into the container and the results were photographed.

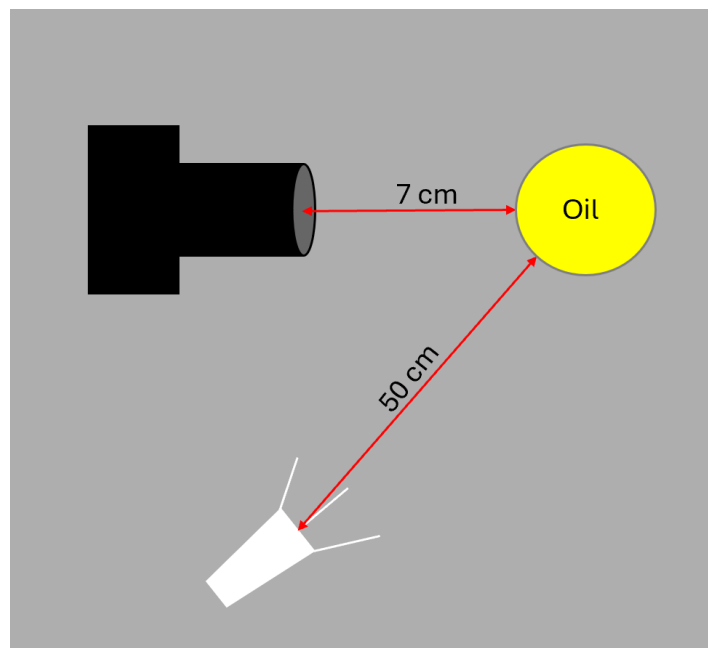
4. Photographic Technique

The camera (Canon Rebel T7) was held approximately 7 cm from the surface of the glass. A Petzl headlamp was held approximately 50cm from the glass 45 degrees to the right of the camera and 60 degrees up. The headlamp was an LED light emitting 350 Lumens [2]. The field of view of the camera was approximately 5 inches with the glass being about 3 inches in diameter. The aperture was f/5.6, exposure time was 1/50 sec

and ISO speed was 3200. The focal length was 49mm which gave the original photo dimensions of 6020x4015. The photo was edited using the program Darktable.



Side View



Top View

To edit the image, first extra space on each side was cropped out. Then the detail in the local contrast was increased to 204%. In the Filmic RGB setting, the contrast was increased to a value of 1.589. The Global Vibrance was maxed out and the Global

Saturation was increase 50% while the shadows were decrease to -30%. Finally the Global Brilliance was decrease to -5% and the highlights were decreased to -12.85% which resulted in the final image. To create the final image the photo was cropped and the the exposure was increased slightly. Then the white exposure was decreased while the black exposure was slightly increased. The global vibrance was increased and the contrast was maxed out. The global saturation was maxed out and the global brilliance was increased. Finally, the highlights were decreased until the final image was created. The final image dimensions were 2960x3515. The original and edited images are shown below.



Original



Edited

5. Conclusion

The experiment was an overall success. The stratified and asymmetric flow was visually appealing to watch and created interesting patterns and plumes. The difference in the densities of oil and water as well as oil being a hydrophobic fluid allowed the reaction to happen and still prevent mixing of the two liquids. If this experiment were to be repeated, it could be improved with a different light source that was less intense than the one used. As it was conducted the light used reflected off the edge of the glass which causes distraction in the image. It might be interesting to see how a black light might have shown the same flows while adding different colors and reducing overall glare.

6. References

[1] Alekha K. Dash, in [Pharmaceutics \(Second Edition\)](#), 2024

[2] "TIKKA Headlamp Specs." *PETZL*, www.petzl.com/US/en/Sport/Headlamps/TIKKA. Accessed 6 Oct. 2024.

7. Contributions

Catherine Parchinski: Setup and execution and report editing