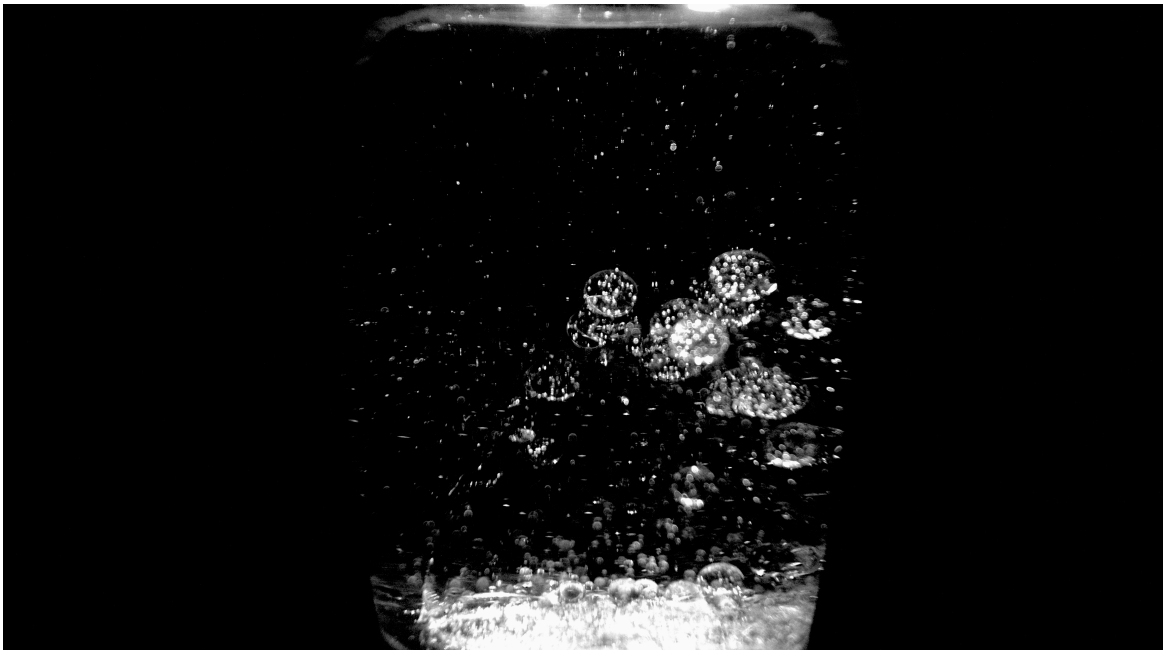

Dawood Ahmad // Team Third Report

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MCEN 4151 - 001

Collaborators: Faisal, Meg, Audrey, Sam

Introduction

The intent for this experiment was to focus more on producing a beautiful shot using a fairly simple apparatus. By using a simple test setup we were able to recreate the experiment multiple times with ease. Our experiment is driving oil into a cup of water. When the oil drips fall in the water they form a spherical shape due to the difference in densities between oil and water. Also, using the curvature of the glass the bubbles were magnified in size.

Setup

For this experiment, The setup required a bottle filled with vegetable oil, a wine glass filled with water and a light source placed under the glass. The wine glass was about 4.5 inches in height. The water used was regular tap water. For the light source, we used two iPhones placed under the glass with the flashlight turned on. Once the setup was ready, we squeezed the oil bottle to generate a stream of oil that was aimed at the water. The result were oil bubbles in the glass of water. These oil bubbles eventually settled at the surface and the glass was refilled with water for another shot.

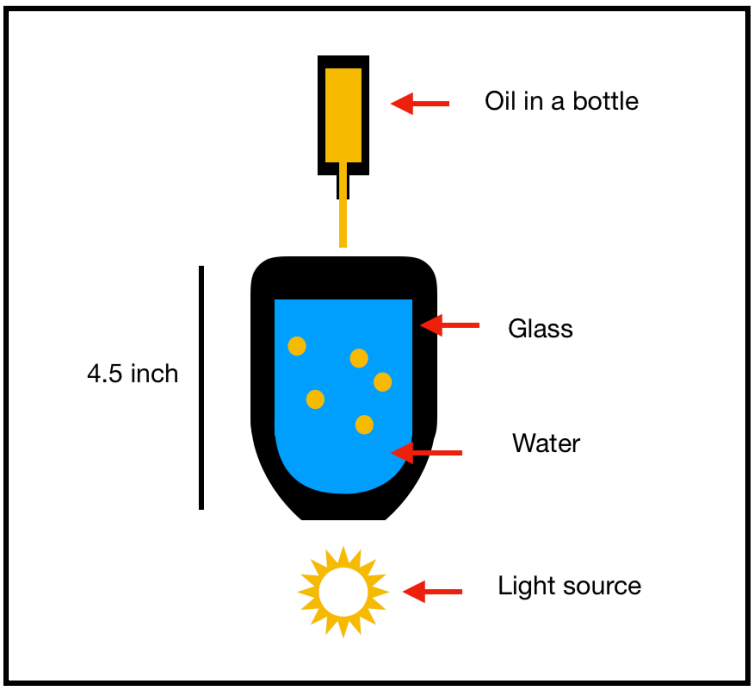

Figure 1. Depicts the setup of the experiment.

Flow Science

The experiment shows the interaction of two fluids with different densities. The vegetable oil has a density of 0.92 g/cm^3 . The tap water has a density of 1 g/cm^3. Due to the water having a higher density, the oil bubbles rise to the surface at the end of each experiment. To find out how fast they rise up to the surface we can use the following equation [1].

$$v = \sqrt{\frac{8rg\left(\rho_l - \rho_g\right)}{3\rho_l C_d}} \qquad (1)$$

Assuming the radius of the bubble is uniform and is 0.009m, and the coefficient of drag is 1.8 we can solve for the velocity. Using the previous assumptions we get 0.1 m/s for the velocity.

Camera settings

The camera used was a Sony ILCE-7RM2 with an FE 16-35 mm lens. Aperture was F/4.0, exposure was 1/4000, ISO was 102400, focal length was 24 mm, and the resolution was 8000x5320.

Edited image

Figure 2. comparison for before and after edited images. edited image is on the right.

Using darktable, I first cropped the image to the desired shape. The image was then rotated 180 degrees. The cropping and orientation alone gave the image a nice effect. Next I adjusted the black level correction until the s edges of the glass were not visible anymore. Finally, I adjusted

the contrast to give more definition to the bubbles. Figure2. Shows the edited image compared to the original one.

Conclusion

In conclusion the simplicity of the experiment setup allowed us to focus on getting the perfect shot and focus more on post processing and image editing. The image shows clear bubbles and the scientific intent was realized. Personally, what I like about this the image is the size of the bubbles. Compared to my teammates, this picture shows a more defined formation of bubbles. One thing that we could have done better was to use a high speed camera. This way, we can see what happens in slow motion. Also, We could have experimented with different glasses as the wine glass was giving a natural lensing effect.

Citations

[1] M.Y. Shi et al 2017 IOP Conf. Ser.: Mater. Sci. Eng. 231 012093. Retrieved from https://iopscience.iop.org/article/10.1088/1757-899X/231/1/012093/pdf