MCEN 4151: Flow Visualization

Section 001

Image-Video 03 Report

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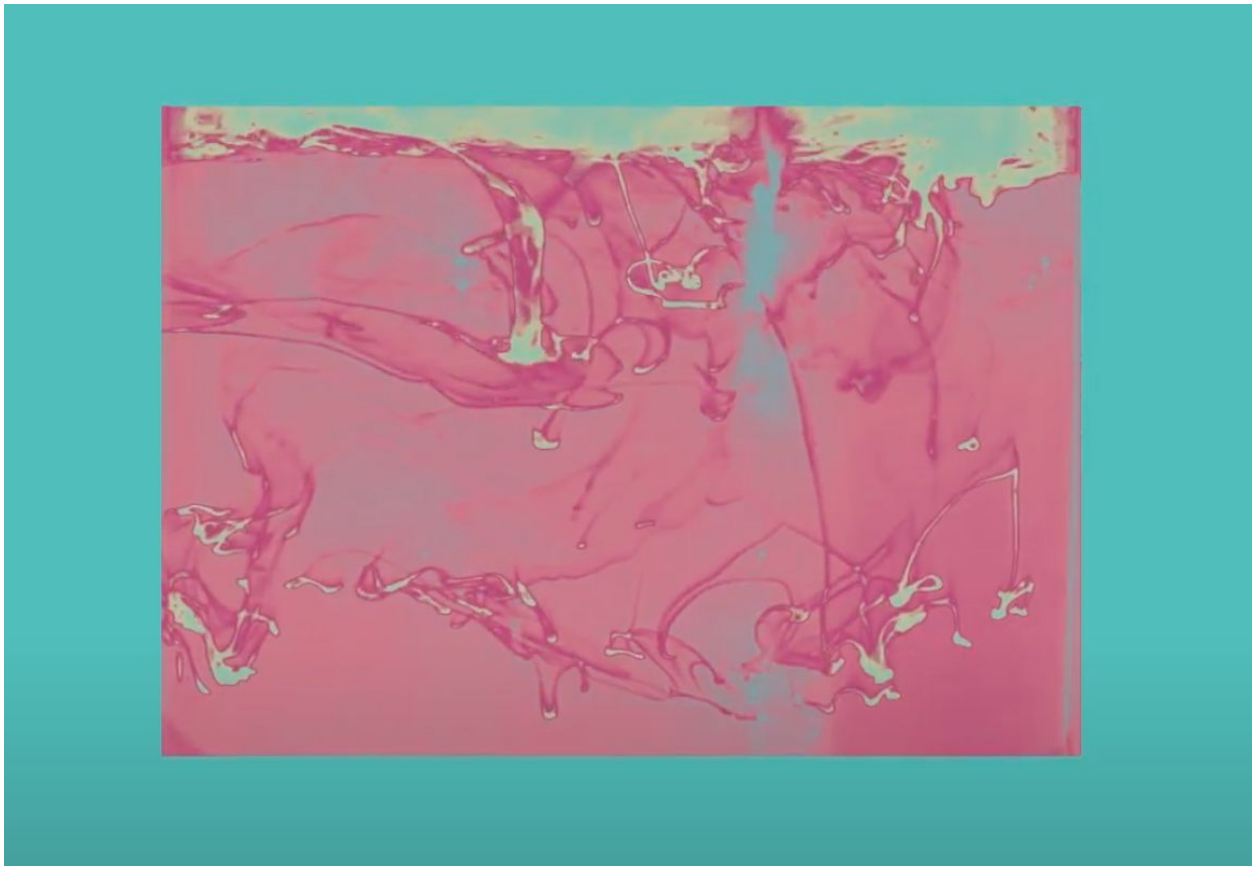

Link to video: https://youtu.be/BlN5wUt4Qfs

The image-video two assignment allowed us to dive into the flow-visualization world and experiment capturing different phenomena. The experiment being run is a mixture of super viscous fluid mixed water and food coloring.

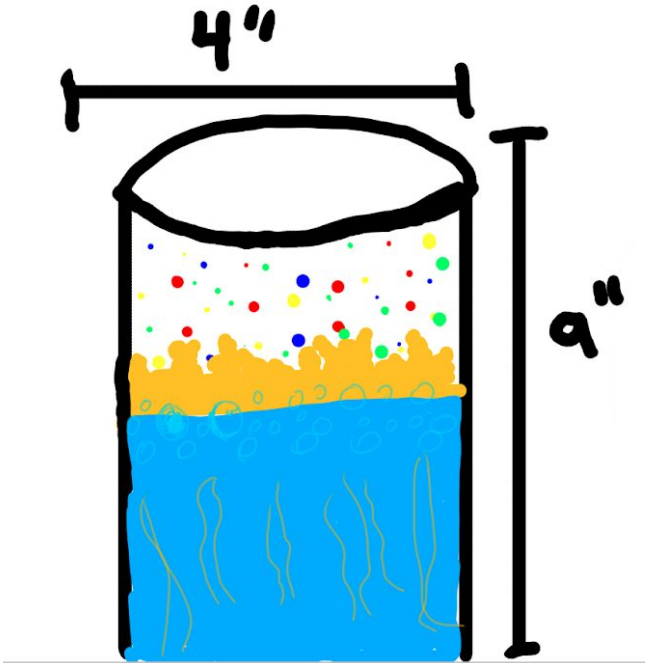

Figure 1: Fluid Apparatus sketch

The flow apparatus is a clear cylinder container that is a mixture of oil, water, and food colors. The experiment was that on a separate cup full of canola oil, I mixed multiple drops of food coloring creating a vortex for all the food dye to become small in structure. Once all the food dye in the cup of oil looked like a bunch of grains, I poured the mixture into a clear container full of water. All the dense fluid rose to the dope because of the buoyancy force (proportional to the density of each fluid). As the time went on, most of the food dye was dosvoling and losing its structure causing them to float back down throughout the container of water. Observing the video, I assumed that the food dye experienced laminar flow because of the small streamlines. This indicates a small Reynolds number, equation shown below.

$$Re = \frac{UD}{\upsilon}$$

Figure 2: Reynolds number Equation

The technique was very hassle free as preparation did not take a lot of time, to do this experiment at home, an individual would need a clear container, food coloring, oil, and water. To get the best lighting, I suggest having a white background with a lightsource hitting the container directly at an angle of 45 degrees with respect to the xy plane of the container. In my experiment, I used my iPhone 7 Plus built in light and then used the sunlight coming from the windows.

At first, the photo had a large field of view, I decided to crop it for aesthetic reasons. The distance from the object to the lens was very close, within inches. It was challenging to get a good focus at such a short distance but lowering the ISO to 400 and using manual focus helped. The image was captured using a canon camera, with a lens of width of 55m the original video had a size of 1080x1920 pixel. I used HitFilmExpress for all my video editing. I cut out the most interesting part of the experiment and applied a saturation effect with a pink hue to get the colors shown in the video. I then used the moving background feature of HitfilmExpress to get the video clip moving. The reason why is because I wanted to empathize with the idea of emulsion. The camera had a shutter speed of 1/80 with a f stop of f/2.2.

Figure 3: Unedited original photo

This video demonstrates emulsion and how a small Reynolds affects fluid flow. In the future I would like to play around with the FOV to characterise the emulsion taking place.

References

1. Underwood, C. (2019, October 08). Rainbow Rain Experiment. Retrieved November 13, 2020, from http://www.growingajeweledrose.com/2019/02/rainbow-rain-experiment.html
2. Britton, S. (2020, September 10). Rainbow Rain Science Experiment – STEM activity for kids. Retrieved November 23, 2020, from https://beyondtheplayroom.com/rainbow-rain-science-experiment/
3. Helmenstine, A., & Helmenstine, A. (2020, October 07). What Is an Emulsion? Definition and Examples. Retrieved November 26, 2020, from https://sciencenotes.org/what-is-an-emulsion-definition-and-examples/