

Get Wet Report

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MCEN 5151: Flow Visualization

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Context and Purpose

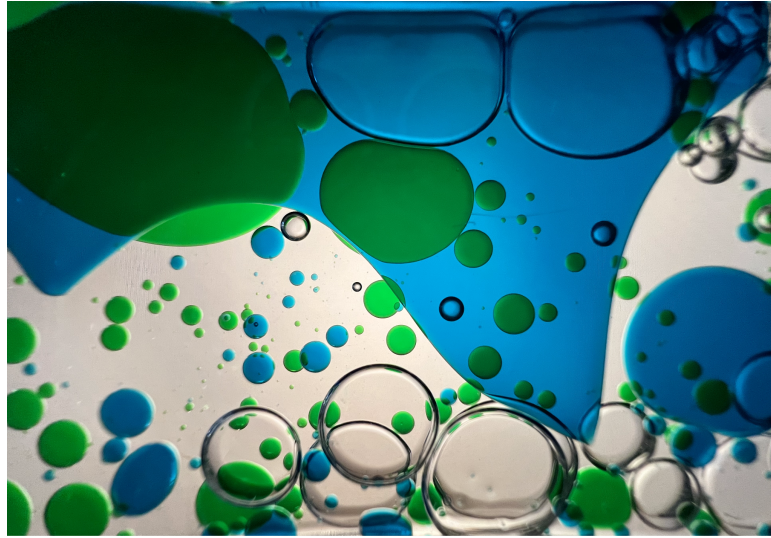


Figure 1: Final image of the custom liquid motion bubbler

The aim of this project was to demonstrate liquid motion flow for the ‘Get Wet’ assignment in MCEN 5151, Flow Visualization. An interesting mechanism that demonstrates flow between different liquids is a motion bubbler, a device that contains mineral oil, water, and dye. When shaken or disturbed, each individual liquid separates and creates unique bubble formations. This phenomenon was captured as shown above as part of the ‘Get Wet’ assignment.

Flow Apparatus

Mixture 1: Blue
Mixture 2: Green
Mixture 3: No Coloring

Figure 2: A section view of the layers in a liquid motion bubbler

A liquid motion bubbler is composed of 3 main ingredients: mineral oil, water, and dye. When water and mineral oil are mixed, the differences in density and viscosity cause the mineral oil to stay suspended as bubbles, traveling slowly through the water. This lends itself incredibly

well to visualizing flow. To help with this food dye is added to the mineral oil to help accentuate the shape and flow of the oil.

To add depth and color to the photo, multiple layers of the oil-water mixture were placed next to each other. Figure 2 contains a cross-section of the container used in this experiment, in which there were 3 separate narrow compartments containing a mixture of oil and water. Each of the 3 sections contained a different color of dyed mineral oil (green, blue, and transparent).

Visualization Techniques

The visualization technique used in this project was most prominently dye. This was mixed with the mineral oil to create the colored bubbles shown in figure 1. The mineral oil was Kroger USP Mineral Oil Lubricant, which mixed well with Wilton Candy Coloring. It is important to not that normal food coloring will not work since it is water-based, and therefore Candy Coloring is needed for this application. The dyed oil is then mixed with water in the compartments shown in figure 2. Once the apparatus is sealed, it can be shaken to create the effect shown in this experiment. With regard to photography, lighting was provided by placing the apparatus on top of a computer screen on full brightness to help capture the colored mineral oil bubbles. This was done in place of a light box to reduce the complexity and cost of the project.

Photographic Techniques

The setup of the photograph as described in the section above was done in order to reduce complexity, cost, and also to help visualize the flow occurring in the liquid motion bubbler.

Additional camera information is listed below:

- Camera: iPhone 13 Pro (via Lightroom)
- ISO: 130
- Focal Length: 14mm
- Exposure: f1.8
- Object-to-Lens Distance: 5.5cm
- Image Dimensions: 3875 x 2666px

Comments on Image

The image reveals the interactions between water and mineral oil, highlighting how their different densities act to form interesting flow patterns. The fluid physics behind this phenomena are shown fairly well in the image, as the interfaces between the two liquids can clearly be seen. With this in mind, it can be concluded that the project did fulfill its intent. However there are still several improvements that can be made, such as adding more layers and colors to make the image more interesting. The lighting and editing could also be improved as the color calibration skewed slightly too yellow. In the future, more layers and better lighting would make this project truly exceptional.