Image Report

Meg Ivy
Team First
10/14/19
ARTF 5200-001
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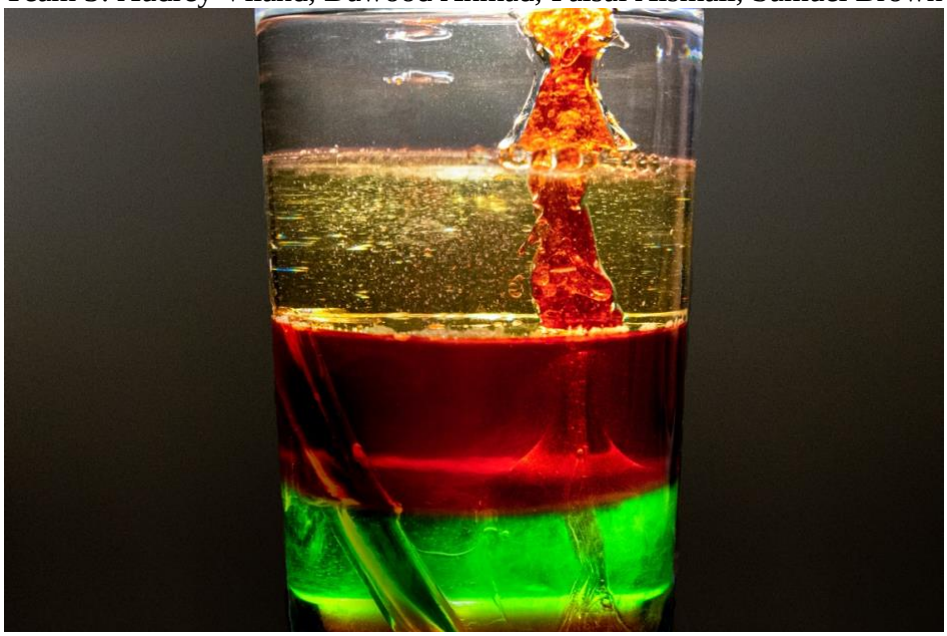

Background

This image is the first photo taken with the aid of teammates. The purpose of this image was to photograph a more complex flow phenomena as a team that would be difficult to accomplish alone. The intent behind this image was to capture air bubbles rising through multiple liquids of various densities. The goal was to capture how the air would migrate from higher to lower density fluids and if its migration would affect the fluids as it passed through. The assembly was completed by equivalent assistance from each teammate, and the process of blowing air into the apparatus as well as the apparatus and photo setup drawings were done by Audrey Viland.

Flow Apparatus

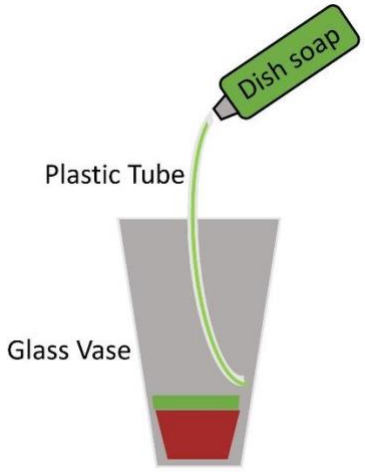

Figure 1: Apparatus Setup Technique

Setup of the apparatus consisted of equally layering five liquids into a 12'' tall glass vase beginning with the densest liquid. After the initial layer was added, a plastic tube was used to add the next densest liquid in an attempt to decrease mixing between liquids. This process was repeated for the rest of the liquids in an order decreasing density with the least dense liquid as the top layer (Figure 1). The order of the liquids in an order of decreasing density included: pancake syrup, dish soap, red-dyed water, vegetable oil, isopropyl alcohol. Once setup was complete and each layer was settled, a plastic tube was placed into the liquids with one end at the bottom. From the top end, air was blown into the tube and the movement of the air bubbles forcing their way to the top through each liquid was photographed.

When the air bubble was blown into the tube, it exited the tube at the bottom of the densest layer, the syrup. Since air is less dense than each liquid used, it was pushed to the surface of the top layer as a result of buoyancy force. The movement of the air bubble is also opposed by drag force. The drag force varies with each layer as a result of density. In more dense fluids, the drag force is higher, so the velocity of the air bubble is lower compared to its velocity in less dense fluids. In addition, as the air bubble was pushed to the surface, it pulled a trail of the pancake syrup with it, which can be seen in the dish soap and water layers of the image.

Visualization Technique

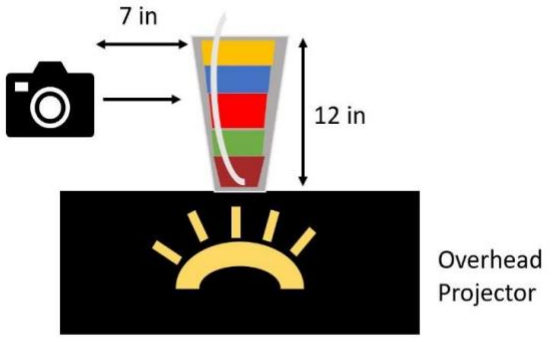

Figure 2: Photo Setup

A glass vase was used to hold the liquids because it is clear, so the flow could be visualized from the side, instead of from the top of the liquids. The liquids used were pancake syrup, dish soap, water with red dye, vegetable oil, and isopropyl alcohol. The photo was taken at night in a classroom to decrease outside lights from creating a glare on the vase. In addition, no camera flash was used, but the vase holding the fluids was placed on an overhead projector to light the vase from the bottom without creating glare on the sides of the glass (Figure 2).

Photographic Technique

Figure 3: Original, Unedited Image

The image was taken on a Nikon D3300 camera with an 18.0-55.0mm f/3.5-5.6 lens. This lens was used because it has wider apertures and shorter focal lengths that takes better photos from a shorter distance. The photo was taken from 7 in, distance to lens, to incorporate the entire vase and the flow observed inside the vase. The shutter speed was 1/1000 sec, which was very fast because it allowed for the capture of the fast-moving bubbles without motion blur. The aperture was f/3.8, which was a wider setting that allowed more light to hit the sensor of the camera. The ISO was 800 which was fairly high because, even with the bright projector light, the fluids were fairly dark, and the camera needed to be more sensitive to light so that the image was clear and well-lit. Before image processing, the original image was 6000 x 4000 pixels (Figure 3). The image was edited on Adobe Photoshop and Lightroom CC. The first edit performed was to remove the distracting background. This was done in photoshop using the magic wand tool to select the background on the left side of the vase above the projector and save it as an image. Next, the entire background on the left side of the vase was selected and cleared with the magic wand and replaced using the saved background selection. This step was repeated on the right side using the same background as on the left side.

The remainder of processing was completed in Lightroom CC image was then cropped to remove the top of the vase and most of the bottom syrup layer to the edge of the glare. This was to focus on the flow and remove any obvious distractions. The remaining glare was selected with the brush tool and the tone and temperature was adjusted to match the syrup color. The shadows of the glare were also increased to darken the glare. Next the trail of liquids pulled from the bubble were selected and the contrast, and exposure were increased to sharpen and enhance them. The tube was then selected with the brush tool and the contrast and exposure were decreased to draw attention away from it. Finally, exposure, contrast, and shadows were increased slightly for the whole photo, and highlights were decreased. The tone of the image was made very slightly less yellow.

Image Analysis

In conclusion, the intent was fulfilled, and the image reveals how air flow can be affected in liquids of varying densities. I really like how crisp the image is, especially where the flow is occurring. The fluid physics are well shown, and processing of the image did not affect the appearance of the physics. I dislike some of the glare that remains on the edges of the glass. I would like to improve how close the image was taken to the apparatus. As a result, I would further develop this idea by attempting to take closer photos of the flow occurring. Finally, I only have questions that involve a description of the more complex fluid dynamics occurring in the

image. Since I have not taken fluid dynamics, I do not have the in-depth knowledge needed to describe every phenomenon occurring in the image, and I would like to learn about them.