MCEN 4151: Flow Visualization

Section 001

Image-Video 01

09/28/2020

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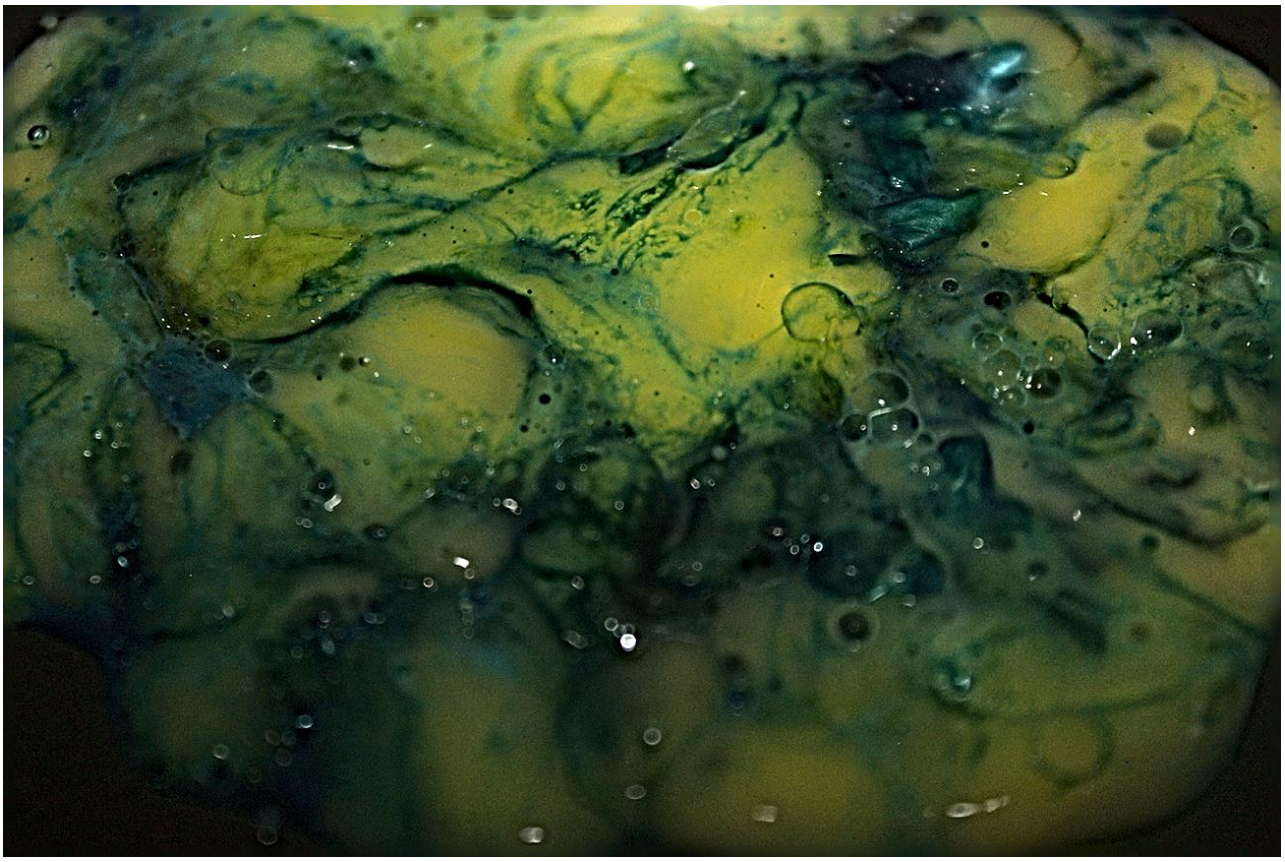

The Image-Video 01 assignment gave us our first glimpse on how to capture fluid physics with a camera. The intention behind the assignment was for us to create a fluids phenomenon and capture it using camera that allowed us to adjust the settings so that we could get a high-quality image. A fluid phenomenon that intrigued me was the mixing of different density fluids. Due to this, I decided to mix an egg yolk and canola oil alongside with some blue food coloring for another level of visual effect.

The basic fluid phenomenon that was captured in this picture was buoyancy force and density differences among three different fluids: egg yolk, canola oil, and the blue food coloring. When looking at all three fluids, the egg yolk is the one with the greatest density, then comes the food coloring and finally the oil. In order to show a different view of this effect, I decided to place the fluids in a bowl instead of a glass cup. Because the bowl had a greater radius, the fluids expanded outwards instead of filling up like it would in a cup. Throughout the experiment, the egg yolk acted as the "main" fluid in the experiment. I added the oil and food coloring as a mixture to see the outcome. The relationships below show how the food coloring interacted with the oil and how the oil interacted with the egg yolk.

$$\rho(egg) > \rho(food\ coloring) > \rho(oil)$$

$$F_b(oil) > mg \rightarrow \text{"float"}\ on\ yolk$$

$$F_b(food\ coloring) < mg \rightarrow \text{sink}\ into\ oil$$

When looking at the relationships, the oil ended up surrounding the yolk due to the container that I picked. At the same time that this was happening, the food coloring was sinking though the oil but also surrounding the yolk which resulted in the blueish swirls effects on the egg yolk.

The set up for this image was in a dark kitchen with no light source. There was blue food coloring, purchased from King Soopers, that was used on both the egg yolk and the oil before the two were mixed together. The mixture of the egg yolk and the canola oil, with both having blue food coloring, were placed in a black bowl to allow for a dark background. The picture was taken with the camera flash a minute or so after the initial mixture occurred. This allowed the oil to coat the egg yolk which resulted in the swirling effects seen in the picture.

The photograph was taken on a Canon EOS Rebel T6 camera. The camera lens was set up relatively close to the bowl aiming downwards to allow for greater magnification and detail in the swirls created by the food coloring. The settings were set as: focal length of 43mm, exposure time of 1/60sec, an ISO of 800, and f-stop of f/5. For the image processing, I ended up using Darktable to adjust the base curve in order to brighten up some of the dark areas within the image. I also went in to tweak the sharpness, in order to increase the details of the food coloring paths, and the haze, to add more contrast between the highlights and shadows.

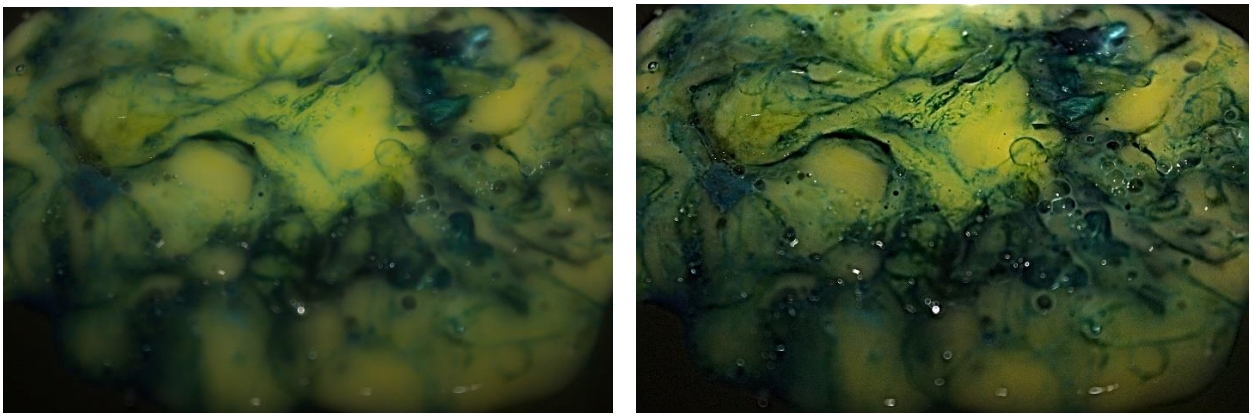

Figure. 1 Comparison bewteen the original image at 5,000 x 3,500-pixel (left) and the edited image at 1,300 x 900-pixel (right)

The final processed image revels how fluids of different density, in this case an egg yolk and canola oil, inteact with one another. Because of the desnisty differnece, we can see that the oil does not mix with the yolk but instead almost “wraps” around the yolk. I am really please on how I was able to capture the disticnt pathways that the food coloring took as a result of the oil. What I dislike is that the the picture as a whole is not focused evenly. The top to center of the picture is nicely focused but the bottom of the picture is a little out of focue. Due to this, I would like to improve the overall focuse of the final image by playing around more with the aperture and shutter speed of the camera. Overall I feel that my intent was fulfilled