IV 1 Report
Acrylic paintings

MCEN 4151: Flow Visualization

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09/27/2021

1. The purpose of the image

The purpose of the image is to get my feet wet by experiencing taking pictures of a fluid flow. In my case, the fluid flow I chose to experiment is acrylic paintings that are mixed, and the motivation behind choosing it was to observe the fluid mechanics of acrylic paintings when they are mixed. At my first attempt at mixing the flow, I applied a hairdryer to the mixed flow, but I noticed that it made the colors faded and less vibrant. At my second attempt, I tried putting water on the acrylic painting mixture, and it kind of ruined the flow pattern of the of them. So, I ended up mixing the acrylic paintings in a bowl with a hair comb. My main focus of this image is to observe the laminar flow of the acrylic paintings and how it behaves after applying water to it giving it a different viscosity.

2. Fluid Mechanics

To form a laminar flow of the acrylic paintings, I purchased the multi-surface acrylic paint since its viscosity is relatively low compared to other acrylic paintings such as the "Heavy Body Acrylic". Three painting colors were used: red, blue, and white, all of the flows acted as a laminar flow when poured into the glass bowl. The mixing process was easy since all of the acrylic paintings have low viscosities. Having low viscosities means that the flows are less resistant to fluid motion, so the mixing process was smooth. I used the Reynolds Number equation I was able to understand why laminar flow formed at last in my experiment:

$$Re = \frac{\rho * u * L}{\mu} = \frac{\left(2000\ \frac{kg}{m^3}\right) * \left(0\ \frac{m}{s}\right) * (0.0635\ m)}{(0.0000212\ \frac{Ns}{m^2})} = 0 \qquad [1]$$

Where:
Rho: density, u: flow speed, L: characteristic length and mu: absolute viscosity.

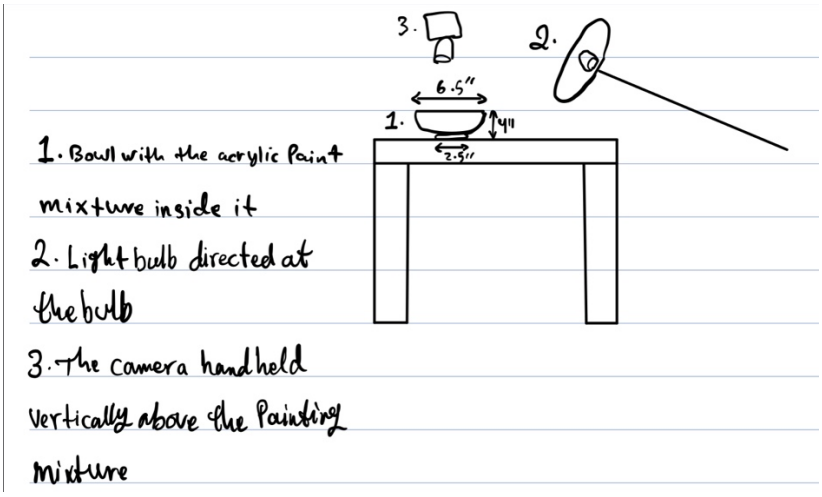
The flow speed is zero since the painting mixture was not moving when it was mixed. Since the Reynolds number is zero (less than 2000), the flow is laminar. Not to mention that the flow behaved as a laminar flow initially as well when the painting was poured in the bowl because the Reynolds Number at the moment was less than 2000 since the flow speed was so small.

3. Flow Visualization Technique

I used “Deco Art” multi-surface acrylic painting to capture the flow in this experiment. A glass salad bowl used to contain the acrylic painting. A small classic men’s hair comb is used to mix the acrylic painting and create the pattern in the final image. To avoid sunlight, this experiment has been conducted at night and indoors with a room temperature of roughly 23C. The lighting used in this experiment was a regular white bulb, to best minimize the light reflections on the acrylic painting flow the light bulb was directed upward with a tilted angle.

4. Photographic Technique

I used a Nikon D7100 DSLR camera with a lens of 18-105 mm to capture the flow. I handheld the camera about one foot away from the object with a vertical orientation to get an upper view of the flow. In addition, the image was shot with an 800 ISO, f/20 aperture, and a shutter speed of 1/13 seconds. Lightroom was used to perform post-processing edits to the picture, the contrast was increased to make the colors pop up, highlights were decreased to get most of the details out of the picture, and shadows were decreased using the tone curve. Besides, the image was cropped to be 1 x 1 to minimize the distraction in the image and make the viewer focus on the acrylic paintings flow and the variation of depth on the surface.



Sketch of the set up

Original image

Final image

5. Image Reveals

The image shows acrylic paintings mixed together forming a fluid mixture. What I like about the image is that is shows a dynamic composition of colors and sharp focus on the object. What I do not like is the light bulb reflections on the fluid flow. Fluid physics is shown clearly, the acrylic painting has a little high viscosity forming a laminar flow. One of things I would like to improve about this image is to diffuse the light bulb with a sheet or towel to minimize the reflections on the flow. However, I pretty much feel like I fulfilled my intent of this project and I am satisfied with the final result.

6. References

[1] *Reynolds number*. Engineering ToolBox. (n.d.). Retrieved September 27, 2021, from https://www.engineeringtoolbox.com/reynolds-number-d_237.html.