Honey Flow

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Image/Video 1

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I. Image Context

For the first image of the semester I was inspired by the initial survey we took coming into this course, particularly the question of what fluid flows do I think about most often. I use honey almost daily, whether it is in my coffee, tea, or oatmeal. Everytime I pour it I intently watch how slow and thick the fluid flows, as well as how it is so naturally golden. I decided to try and capture this viscous flow and highlight how the fluid can glow. I also only buy local organic honey, so I had the opportunity to capture the bubbles that get trapped in organic packaging processes.

The original idea was to pull honey from the jar and show the thick string from the pot to the spoon. I attempted this several times before deciding the honest was pulling too thin to show the bubbles and the viscosity I wanted to capture. An example of this is shown in Figure 1. At that point I had made a huge mess with a ton of honey fallen onto a plate. As I poured the honey from the plate back into the jar, I found exactly the phenomenon I was looking for. I instantly started taking pictures. The plate honey pour image, without editing, is shown in Figure 2.

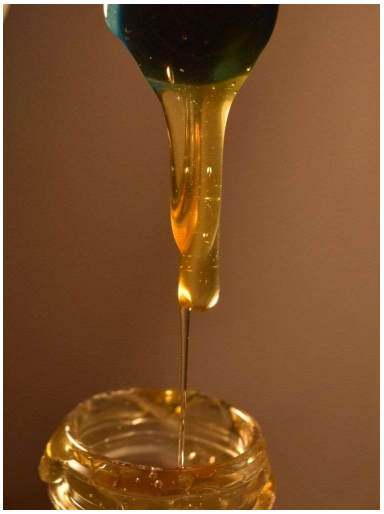

Figure 1. Raw image of first attempt at honey pull.

Figure 2. Raw image of honey pour from plate.

II. Fluid Dynamics

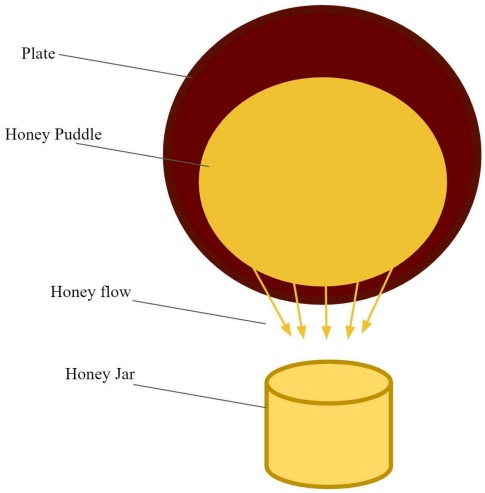

Figure 3. Flow apparatus of the honey pour.

The flow apparatus used for this image is shown in Figure 3. Essentially, I had a puddle of honey on a concave plate that I was pouring back into the jar. The flow followed the curvature of the plate, causing it to come together in a clump before leaving the rim. The plate has an 11 inch diameter, and the flow came down to a conical channel that was about 4 inches wide at is largest point and 1 inch wide at its smallest.

The flow itself moved slowly. This can be attributed to the fluids viscosity that contributes to it's Reynolds number. The sole force acting on the honey was gravity, so it's flow was completely determined by its own properties. The equation for the Reynolds number is seen in Equation 1, where U is velocity, D is diameter, and ν is kinematic viscosity.

$$Re = \frac{UD}{\nu} \qquad \text{Eq. 1}$$

Viscosity is affected by the temperature of the fluid. In this setup, everything was held at room temperature. Therefore the viscosity of the honey was 5755.1 mm^2/s [1]. To estimate the velocity of the honey, I compared how far the honey moved in two different frames and put their difference over the time apart the frames were taken. Figure 4 shows the frames I compared.

Figure 4. Two comparison frames to determine velocity of the honey.

These pictures were taken 1 second apart. Observing the bubble that is circled in red, it moves about 1/4th of an inch down. Therefore, I determined the velocity is 0.250 in/s or 6.35 mm/s. I estimated the diameter of the flow around where this bubble is to be about 1 ½ inches or 38.1 mm. Given all of these variables and plugging them into the Reynolds number equation, the Reynolds number is 0.042. Low Reynolds numbers yield laminar flow, creating "sheet-like" flow. When Reynolds numbers are low it means that we cannot ignore the viscous forces in a fluid [2]. This makes sense for a fluid as viscous as honey.

$$Re = \frac{(6.35\frac{mm}{s})(38.1\ mm)}{5755.1\frac{mm^2}{s}} = 0.042$$

III. Visualization Technique

To visualize the honey, I did not need to change much about its natural characteristics. The golden tone of the honey gave the effect I wanted out of the image in the first place. For the lighting, I placed my desk lamp behind the honey so the light was shining through it. My desk lamp has a warm white light bulb in it, so it helped contribute to the warm glow of the lighting. I changed the angle it was shining at a couple time. I ultimately chose the angle off of what made the honey glow the most and how the shadows in the bubbles made them look prominent.

IV. Photographic Technique

The field of view for my image was about 10 x 6.67 in. I chose this because it is a bit less than the width of the plate wide, and I wanted to capture as much of the thinning of the fluid as possible. My camera was held about 6 inches from the honey to get the proper focus. My camera lens focal length is 18-55mm and I use a Nikon digital camera D5500. The original photo was taken with the pixels 6000x4000. The camera was on ISO setting A 3000. The aperture was on F/ 4. The shutter speed was 1/60. Honestly, most of these settings were chosen purely out of experimentation with my camera, and what created the best image.

A comparison of the raw image and final is shown in Figure 5. I cropped the image to cut out unnecessary background noise. I also upped the contrast, saturation, and clarity of the image, while decreasing the exposure. All of these edits gave me the dramatic, warm, honey glow effect I was looking for.

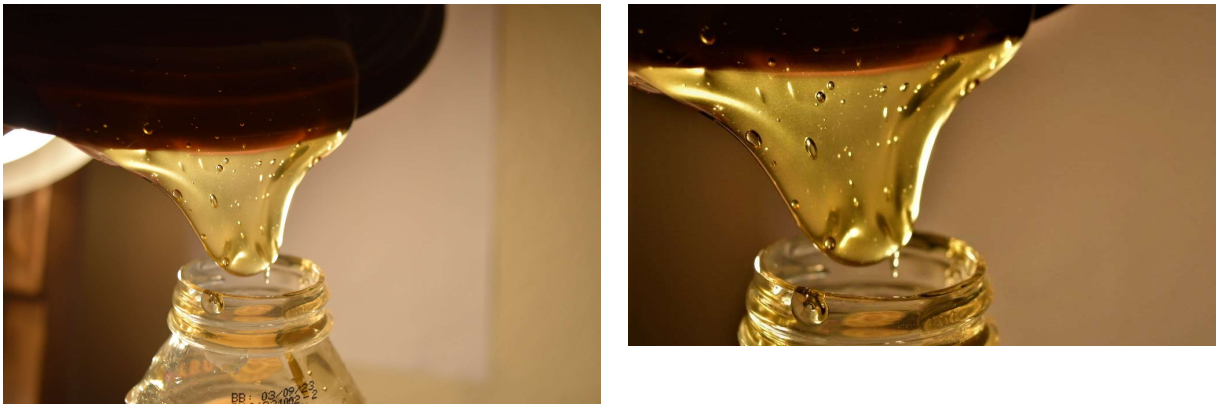

Figure 5. Left: Raw image. Right: Final edited image.

V. Image Overview

Overall, I am extremely satisfied with how this image turned out. The warm, golden glow of the image coupled with the reflections and thickness of the honey really satisfies my intent. The main thing that I would change about it is the glow that appeared next to the plate during post-processing. I also may have chosen a different plate to pour off of in the future, mainly to play with different color contrasts with the honey. I also would be interested to see how a different shaped pouring medium would affect the flow of the honey. My only question is whether or not the color of the plate and the jar take away or add to the picture. I could not decide if they were to distracting to include, or if they gave nice context to the image.

References

[1] *Viscosity of flower honey (blended) – viscosity table and viscosity chart :: Anton Paar Wiki*. Anton Paar. (n.d.). Retrieved September 26, 2021, from https://wiki.anton-paar.com/sg-en/flower-honey-blended/.

[2] NASA. (n.d.). *Reynolds number*. NASA. Retrieved September 26, 2021, from https://www.grc.nasa.gov/www/BGH/reynolds.html.