Team Third Report

Fall 2019

MCEN 4151-001: Flow Visualization

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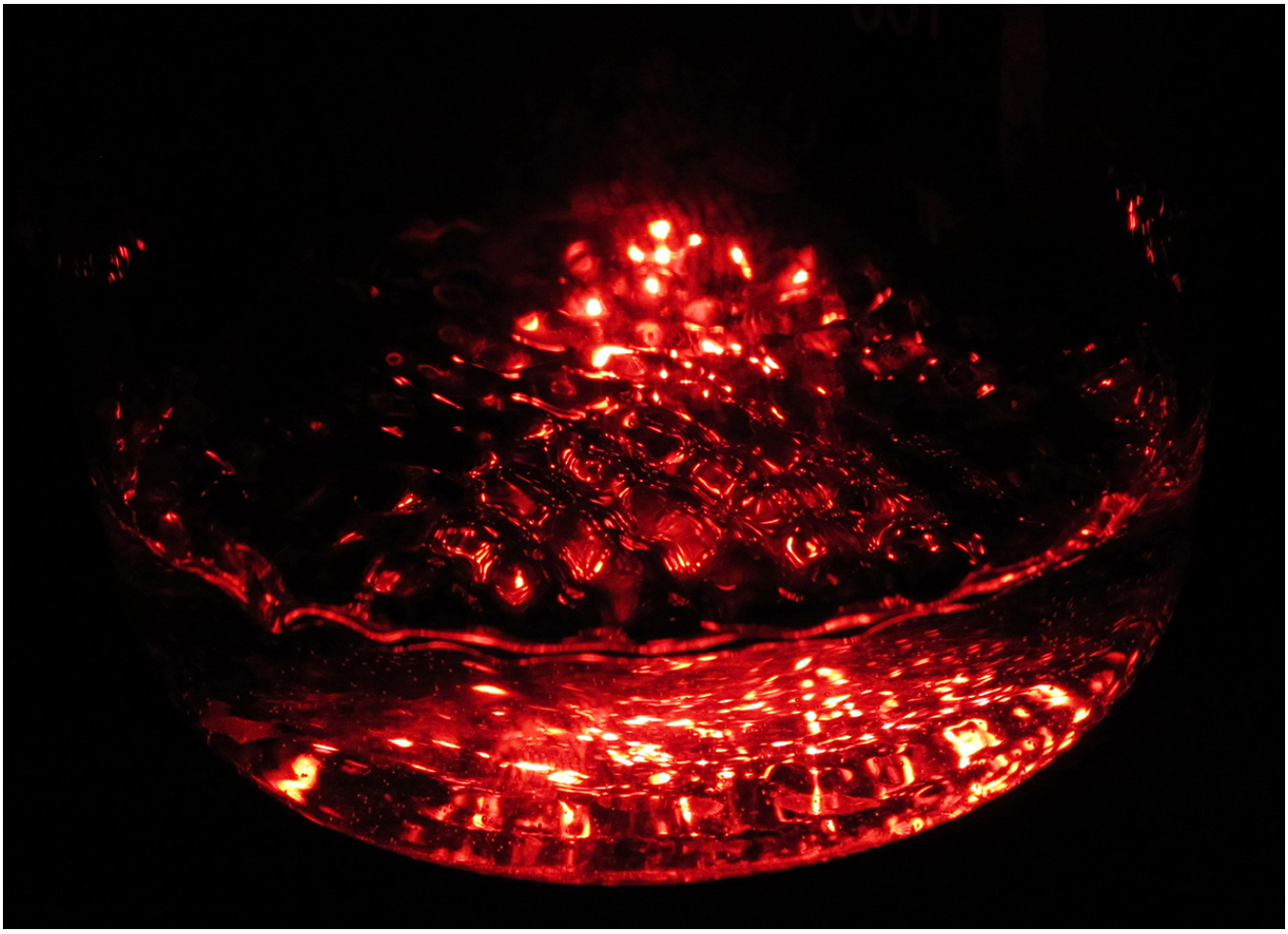

I. Introduction

This report explains our third experiment as a team for the Flow Visualization course. So, for this task, we wanted to visualize and capture the reaction on water if we send sound waves from the bottom of the glass. To accomplish this goal, with the help of my team members, we put a glass of water on top of a speaker which will send sound waves of some specific frequency.

II. Experiment Set Up & Camera Settings

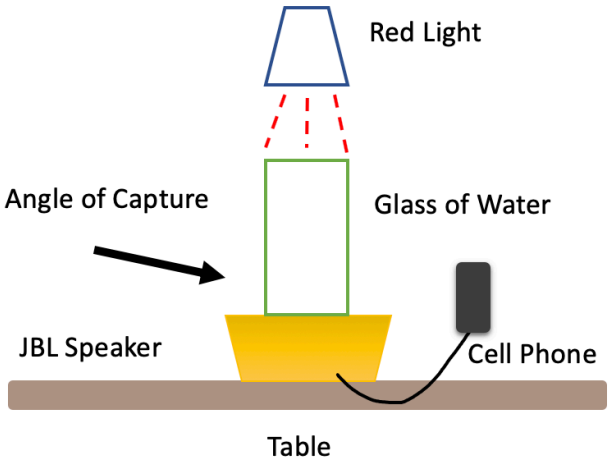

Figure 1. Side view of the experiment set up

We performed the experiment in a complete dark room where the only light was coming from the red flashlight on top of the glass as shown in Fig.1. In this experiment, we stationed a glass of water (1/4 full) over a speaker. The speaker is connected to an iPhone which is sending a sinusoidal wave of 110 Hz frequency using an app called “Audio Signal Generator”. The photo was taken with a Canon PowerShot SX530 HS. To capture the red colored patterns on the surface of water and the beautiful light reflections in the bottom of the glass, I used 1/2000 speed shutter and f/4.5 for aperture. As for the focus and ISO, I used manual macro focus with 800 ISO. Also, the distance from the glass was about 1 to 2 inches. The focal length was 7.528 mm, and the field of view is about 2x3 inches.

III. Flow Physics

The phenomenal that we captured is called Faraday instability. This phenomenal can be defined as the formation of unstable surface of liquid which is the patterns in our case due to the vibrations from the sinusoidal wave. Also, the patterns are called Faraday ripples. This technique is used to visualize the sound waves as water waves. Fluids have a critical frequency that needs to be exceed in order to form the Faraday ripples. Moreover, Faraday instability depends on the viscosity where the width and height of the ripples, frequency, and amplitude of waves vary based on the viscosity.

IV. Photo Editing

My picture dimensions are 4608×3456 pixels. Using Photoshop software, I cropped the slightly from the top and the side. Also, I increased the brightness as shown below in Fig.3. Finally, I deleted some unnecessary distracting elements which are some labels on the glass (if you notice in Fig.2, there is a number in the top middle of the picture), and reduced the dimensions to 1248×900 pixels

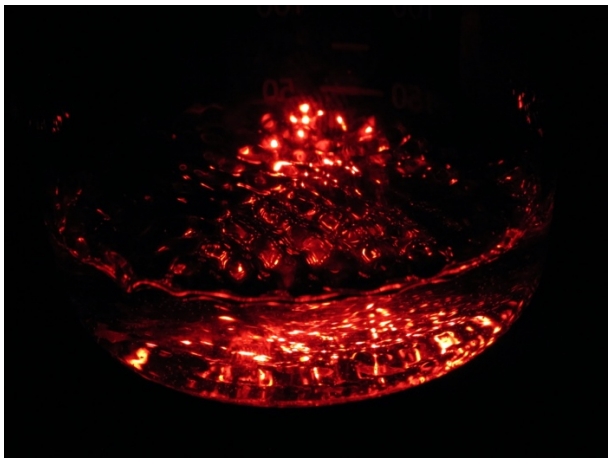

Figure 2. Photo before editing.

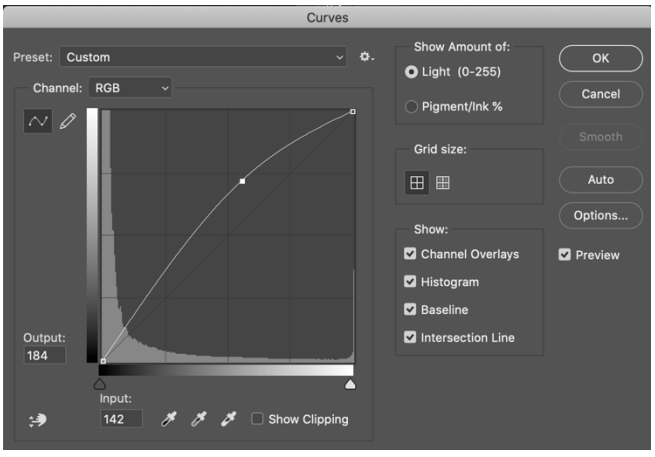

Figure 3. Brightness curve.

V. Conclusion

I am really glad about the photo I got. Although I was aiming to focus on the patterns resulted from the wave, but what I love the most about this picture is the light reflections in the bottom of the glass. Moreover, there are a lot of ways to improve this experiment such as, adding food coloring, trying it with different liquids, or maybe two liquids in the same time.

VI. References

1- Determinants of Faraday Wave-Patterns in Water Samples Oscillated Vertically at a Range of Frequencies from 50-200 Hz. (n.d.). Retrieved from https://www.waterjournal.org/volume-9/sheldrake

2- Slaughter, L. M. (n.d.). VISCOSITY DEPENDENCE OF FARADAY WAVE FORMATION THRESHOLDS. Retrieved from http://digitalcommons.calpoly.edu/cgi/viewcontent.cgi?article=1005&context=symposium.