Get Wet Report

FILM 4151-Flow Visualization

Athena Ross

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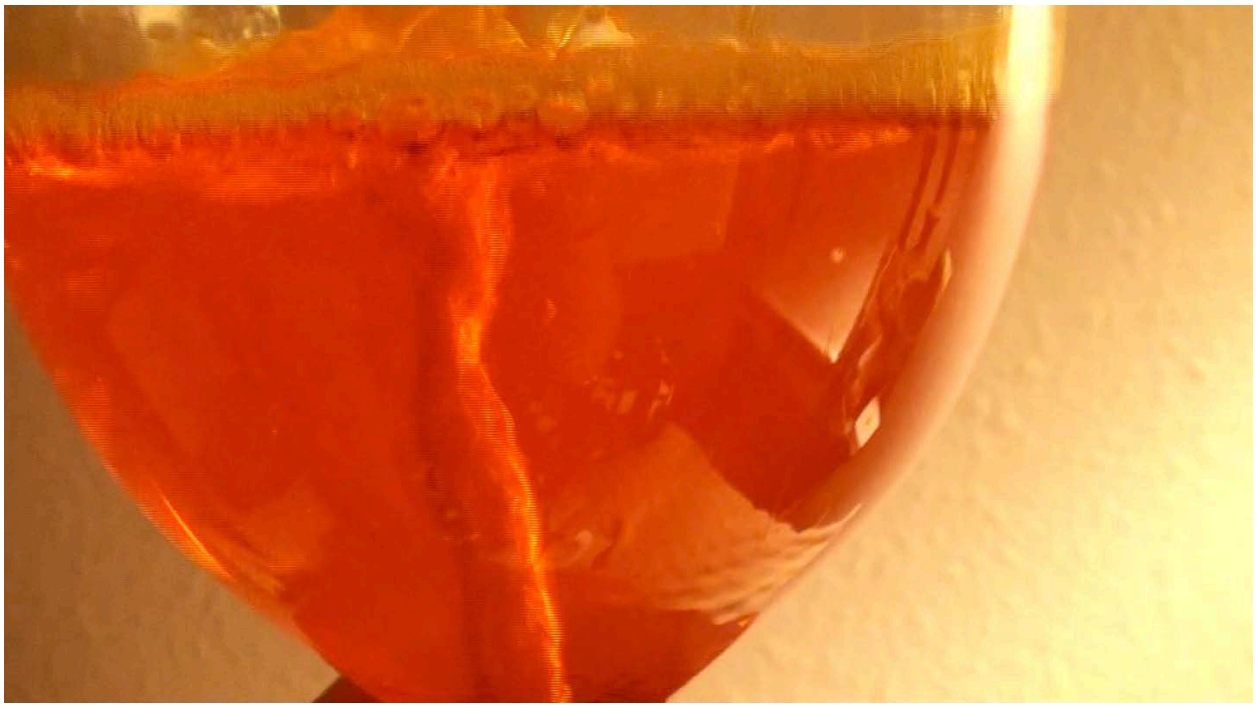

I. Background

The image displayed above is a still from my submission for the “Get Wet” assignment. This is the first assignment in FILM 4151, Flow Visualization. The instructions were to capture some sort of physical flow as it was occurring. The phenomena I chose to photograph was a vortex. For this project I decided to capture a vortex as it flowed from one two liter bottle into a second two liter bottle. In order to emphasize the vortex the water inside the bottles was dyed orange. It took a lot of practice shaking the bottle in order to achieve an aesthetically pleasing and clearly visible vortex.

II. Flow Apparatus

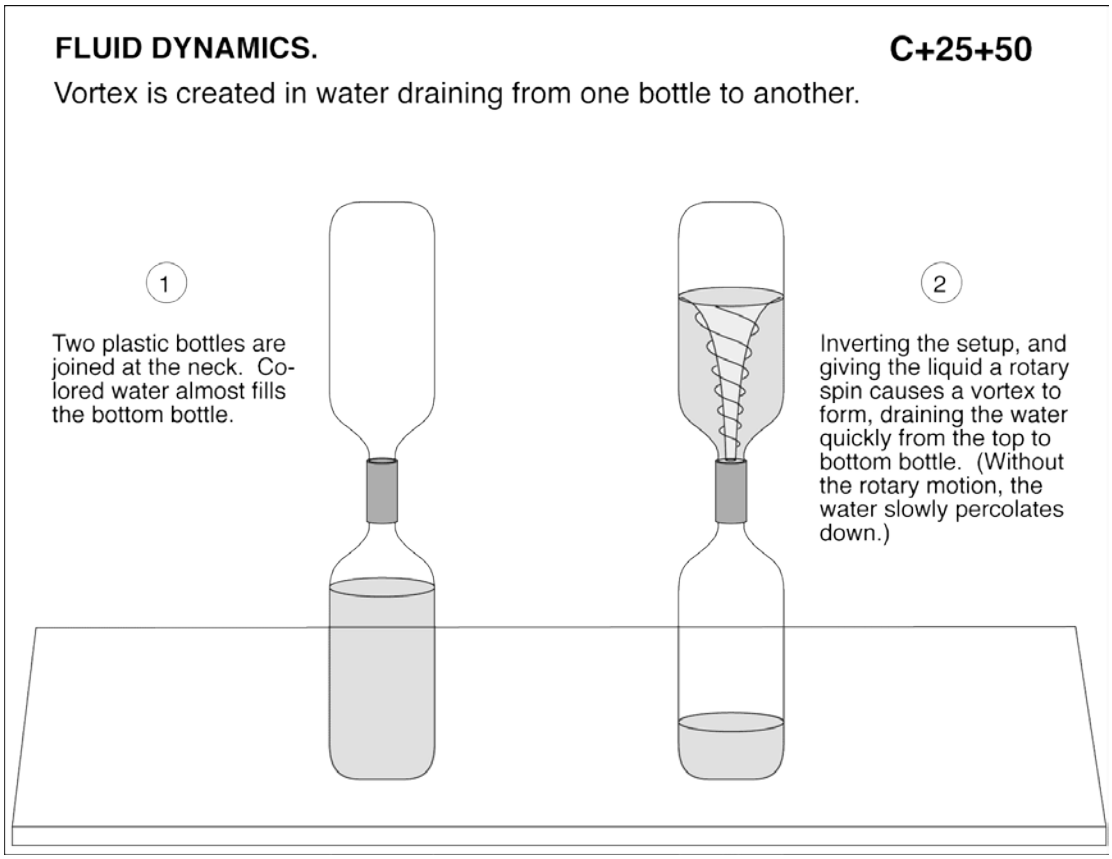

Figure 1

In order to create the vortex, I began by obtaining two empty two liter bottles. I removed the outer label so the vortex occurring inside would be visible. One of the bottles was filled two-thirds full with cold tap water then dyed with orange highlighter fluid. The bottles were taped together using electrical tape, with the bottle on the bottom being the one full of water to avoid any spillage. Once taped together the bottles were flipped so the bottle with the water was on top, and a vortex was

induced by lightly shaking the bottle in a circular pattern. (See Figure 1) Gripping the top of the upper bottle, I spun the bottle to the right to create a counter-clockwise vortex. If the bottle were to be spun in the other direction, then the vortex would switch directions as well. The force of my hand spinning the bottle induced the vortex. Gravity pulled the water down through the hole into the lower bottle. Centripetal forces pulled the water to the hole. It is these forces that cause the vortex to be larger on the top and smaller on the bottom. “The slope of the water is steeper because the centripetal forces are increasing as the water moves with higher speeds and in smaller circles” (Quote). Normally, if the water were to flow uninhibited, the air and water would take turns flowing through the hole into the opposing bottle. By spinning the bottle the air is allowed to move freely up through the center of the bottle and into the upper bottle while the water spirals down into the lower bottle.

III. Visualization Technique

The water achieved its’ orange color using orange highlighter fluid. Before the two bottles were taped together I cut open two large orange highlighters. The cores were removed and then tied to string. Dropping the cores in, but being sure the strings remained out of the bottle, I allowed the strings to soak in the water for approximately five minutes. Once they had finished soaking they were removed and I gently pressed on the cores, allowing the fluid to drain back into the bottle. After there was no more moisture to squeeze out of the highlighter cores I shook up the bottle to mix the fluid so the whole bottle would be orange.

The lighting used for this project was existing lights in the room. First was a standard ceiling light, which had a sheet difusing the light. Next was a lamp. This lamp had a shade, which created a more even flow of light and kept the light from being too harsh. The lamp was placed slightly behind and one to two feet away from the bottles.

IV. Photographic Technique

The camera used to record the flow was a Sony Handycam shooting 1080i at 29.95 frames per second. The camera was held approximately a foot and a half away from the subject because I was restricted by my ability to reach the bottle and hold the camera steady. I could not zoom in on the image because I would lose a portion of the vortex, and I wanted to make sure to capture the whole thing. As a result, the wall was visible in the right part of the image. Also, I did not want to risk the image being shaky as a result of zooming. I did not have a tripod handy so holding the camera while it was propped on my knee was the best option. The shutter speed was at 1/30th of a second, which is standard for video. Final Cut Pro was used to edit the video. I cut out the beginning and the very end where I begin the shaking process, and also

where the bottle is empty. Color correction was used to adjust the exposure and bring out the orange in the image.

V. Analysis

This image clearly demonstrates the occurrence of the vortex in the bottle. I was able to bring out the vortex through the use of orange highlighter fluid, and also give it an artistic quality which clear water doesn't have. My favorite part of the image is the splashing which occurred at the end. This happened by accident and added an interesting aspect to the overall video. If I were to do this experiment again I would use a camera with faster frame rates so I could get a clearer image, without the interlacing, and possibly show some of the splashing in slow motion. Overall, I think I fulfilled the purpose of this assignment nicely and showed a vortex in an artistic manner.

References:

[1] *Tornado in a bottle*. (n.d.). Retrieved from http://oceanservice.noaa.gov/education/for_fun/TornadoBottle.pdf

[2] *A water vortex in two bottles joined vertically* [Print]. Available from http://berkeleyphysicsdemos.net/node/268