

Bryan Wong

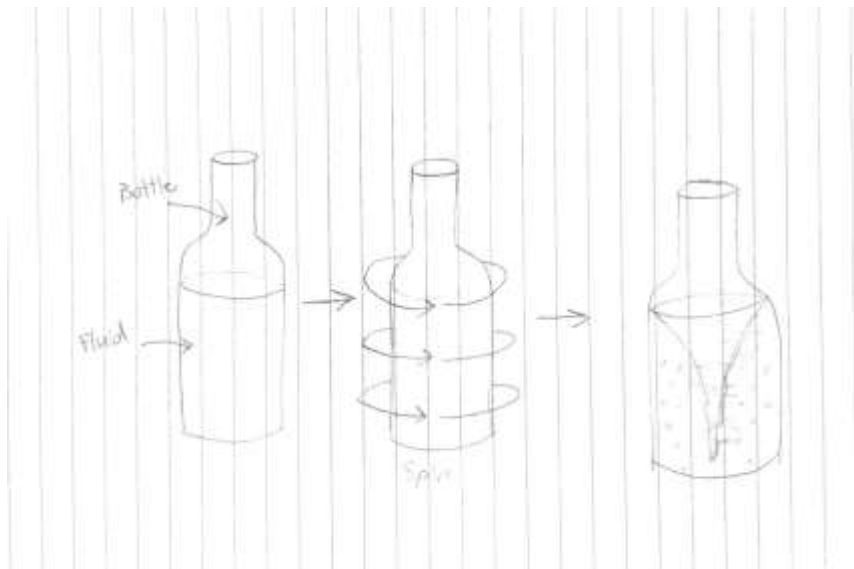
Image-Video 1 Report

Flow Visualization 2020

September 28, 2020

This video was taken in fulfillment of the Image-Video 1 assignment for the Flow Visualization 2020 course at the University of Colorado Boulder. I took this video to explore the effect of centripetal motion on a fluid inside a cylindrical container. I wanted to be able to visualize the analyze the fluid as centripetal forces were applied to it.

For my experiment I used a glass bottle that is approximately 12 inches in height and 3 inches in diameter at the base. The neck of the bottle remains at approximately 1 inch in diameter. The fluid within the bottle rests about 2 inches from the top of the bottle. To perform the experiment, I took the bottle when the fluid was at rest and spun it in a rotational manner about the centerline of the bottle. This created some centripetal force within the bottle and acted on the fluid. The fluid then was pushed to the outer edges inside the bottle and created a vortex in the center. The spinning also creates a dynamic pressure gradient that is lowest in the core and increases as you move closer to edge of the bottle. This pressure created from the centripetal force is ultimately what cause the vortex to form. Over time, as the fluid loses speed and slows down, the vortex formed shrinks until it vanishes due to the normalization of the pressure within the bottle.



*Figure 1: Sketch of experimental steps.*

To visualize the fluid phenomenon demonstrated in this experiment, I used a phone flashlight and place it under the bottle. The flashlight helped illuminate the bubbles formed

when the bottle was spun. The bubbles spun around the vortex that had formed and helped visualize the shape of the vortex and the speed the fluid was spinning at.

When created the video for this assignment, I used a Nikon D810 DSLR camera with a 70mm-200mm zoom lens. This allowed me to capture a wider view of the bottle as well as a close-up view. I recorded the video in 60 frames per second so that I could slow down the footage in post-production. I filmed the video on a tripod that was positioned about three feet from the bottle so that I would be able to focus correctly at a wide angle and a zoomed in angle. Since there was very minimal lighting for the experiment, I decided to use the lowest aperture possible to allow as much light to be absorbed into the sensor of the camera. I also used an ISO around 1000 to be able to get proper exposure. For shutter speed, I went with 1/60 since the video was set to record at 60 frames per second. For post-production, I used Adobe Premiere Pro but only made minor adjustments like cropping the video.

I think the final video did a good job at displaying the effects of centripetal force on a fluid. It clearly recorded the shape of the vortex as well as how fast it was spinning. I liked how mesmerizing the vortex was. I don't, however, like how noisy the video was due to the lack of lighting in the experiment. Overall, I feel that the video fulfills my intent but in future iterations, I would like to explore the phenomenon with different shapes of containers and different fluid viscosities.

*References:*

Wikipedia contributors. (2020, September 23). Vortex. In *Wikipedia, The Free Encyclopedia*.

Retrieved 01:09, September 29, 2020,

from <https://en.wikipedia.org/w/index.php?title=Vortex&oldid=979895994>