# MCEN 4228: Flow Visualization
# Group Assignment 3
# May 3, 2010

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The purpose of this video was for the third group assignment and the final assignment in the course. There was collaboration with other members of my team as to what we wanted to do for the final assignment, but due our individual circumstances we decided to work on the assignment independently. This video is the combination of two effects. The first being the vortex formed when water is rotating in a cylindrical container and the second effect is the reaction between effervescent tablets and water.

The apparatus used for this image a black sheet as a backdrop, a large pitcher of water, a wooden spoon used to stir the water to get it rotating, and the effervescent tablet. The water was stirred with the spoon as fast as I could, probably around 150-200 revolutions per minute. The vortex is formed due to the centrifugal force of the water rotating. The sides of the pitcher are constantly changing the direction of the velocity vector of the water. This forces the water towards the outside of the pitcher. The less dense air also forms a rotating body of particles which makes up the tornado like structure in the middle of the rotating water. As frictional forces slow down the rotation of the water, the centrifugal forces become smaller and the vortex eventually disappears.

After that angular velocity was reached I stopped stirring, dropped in the effervescent tablet, and turned on the camera. The effervescent tablet, which was simply a generic alka-seltzer, started sinking to the bottom of the pitcher while rotating with the water. At this time the alka-seltzer also started reacting with the water producing the fizzy bubbles. This is due to the reaction of the citric acid and the sodium bicarbonate, and acid and a base, being allow to react with each other.

The reason that the alka-seltzer tablet eventually rose to the top of the pitcher is due to buoyancy effects. Initially the tablet is more dense than the water so it sinks, but as the chemical reaction between the citric acid and the sodium bicarbonate takes place the density changes and the tablet rises to the top of the container.

The image was taken in my home in Boulder, Colorado. The visualization technique used is fizzy bubble rising through a rotating body of water. All of the materials were common things that I had around the house and I didn't have to purchase any equipment. The pitcher was set in a window sill during the day to allow for natural lighting. Some of the sunlight was blocked by the black sheet in the background, but I felt the light was still sufficient to visualize the flow. A schematic of the setup can be seen in Figure 1.

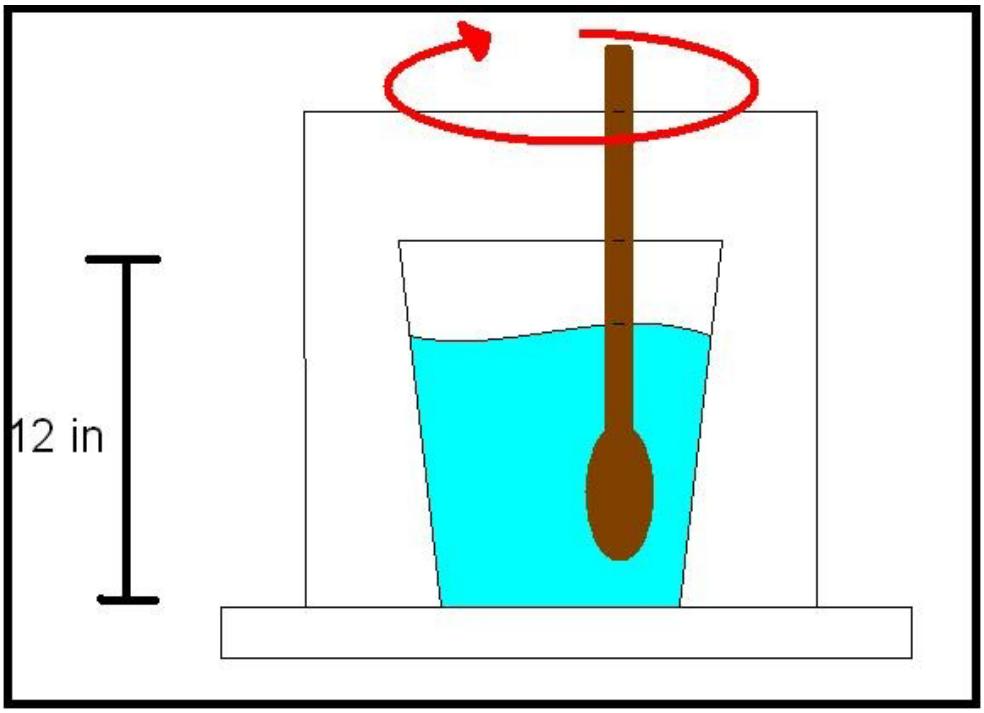


Figure 1

The camera used to capture the video was a Canon PowerShot SX120 IS. This is a 10.0 megapixel digital camera, and would be classified as a point and shoot camera. The field of view in the video is about 12 inches. The distance from the lens to the transparent wall of the pitcher was about 6 inches. The camera was shooting at the highest resolution it had, which was 640 x 480 pixels at 30 frames per second. The camera set to automatic settings and had an exposure value of +/- 0. After the video was taken it was imported into Window Movie Maker where it was rotated counter clockwise by 90 degrees, to allow for the picture to be seen from the correct perspective. Titles and credits were added as well as a fitting musical selection, being “You Spin Me Right Round” by Marilyn Manson.

I am very pleased with the way this video turned out. I think the phenomenon was very interesting to watch and I think that given the response of my classmates when they saw the video, they would agree with me. While some people may not appreciate the musical selection, as Marilyn Manson is a very controversial artist in a more unpopular genre of music to the general population, I believe his music enhances the video. If I were to do this video again I would use a higher resolution video camera on a tripod for better quality. I might also implore the use of food dye to see how that moved through the fluid. Also better lighting could have enhanced the video. Still, with what I had available I think the video turned out great and I am very happy with it.

# Work Cited

"Why does Alka- Seltzer fizz?" Retrieved May 1, 2010.
http://science.howstuffworks.com/question116.htm