

For this experiment we tried to visualize flows by adding all purpose liquid dye to a bottle of LaCroix sparkling water and filming it. My prediction for this was when you put dye in the sparkling water there will be many different flow patterns formed. After watching the GetWet assignment I thought if I put dye in the sparkling water I would see similar results to what my class mate Jonathan Pizarro had in his picture. He had nice flow formations going through out his image of dye in water. Which is what I predicted for mine but since my water was sparkling I thought it may give it a little more. When I did this experiment I noticed that it created different flows than what I had predicted. It would travel down the water in lines and little clusters and then spread out. This allowed me to use it as one of my points for this project. It allowed me to compare my hypothesis with what actually happened. So we wanted to see how the dye would move through out the sparkling water and try to figure out what was happening that caused the dye to do such movements.



This image taken by Jonathan Pizarro GetWet 2026 can be used to see what you may expect dyes to look like. It is used as inspiration for this experiment and does not show our experiment.

We had one glass filled with LaCroix, Liquid Dye All Purpose and our phone. An iPhone 17 Pro max to film our experiment. There was about 12 fl oz of LaCroix sparkling water in our glass. We used the glass to help us see where our dye would go in the water. You should have your picture of the glass and how much water you have along with where you will place the dye and camera.

Figure 2 depicts our experimental setup for viewing the spread of liquid dye through LaCroix sparkling water.

As you can see from the video there is a lot of darker dye coming down from the top of the liquid. It travels down in lines and uneven mounds. There are multiple reasons that can cause this phenomenon. The surrounding liquid can advect the dye as well as the dye diffusing. If the density of the dye is higher than the liquid it will begin to fall due to gravity. Density could be playing a role but we are unsure how much denser the dye was compared to the LaCroix. Due to the characteristics of the dye we think it's safe to assume that it was more dense and fell down.

Bubbles from carbonation could have been another contributing factor. When the can is opened CO₂ can begin to come out of the water. These bubbles can collect on the glass and expand until they break free and float to the top of the water. When bubbles travel up they displace water which can create small currents(Liger-Belair et al., 2015). We can't assume all the dye that traveled down was because of the bubbles. The amount of dye put in could have caused some of this to travel down or even the motion from when the dye first went into the water. There were many factors at play during this experiment.

The Reynolds number can be thought of as comparing the inertia forces in a system with it's viscous forces.

$$Re = \frac{\rho U L}{\mu}$$

(ρ) is the density of surrounding fluid kg/m³, (U) is a characteristic speed with respect to surrounding fluid in m/s. L is a characteristic length in meters and (μ) is dynamic viscosity Pa-s (Moebs et al., 2016). We know that if our liquid was not moving there would be no Reynolds number associated with the system, meaning the Reynolds number of the body would be 0. However since we see our dye falling down we know that there is some type of movement.

We can take an approximate value of Reynolds Number for our system of dye falling. Using a rough characteristic length for one of the dye clusters of (1.5×10^{-3} , {m}) and falling at a rate of (3.0×10^{-3} {m/s}). The density of the liquid surrounding our dye would be close to (1000 kg/m^3) and using a dynamic viscosity of (1.0×10^{-3}) gives us

$$\text{Re} = (1000)(0.003)(0.0015)/0.001 \\ = 4.5$$

This number is only an estimated value since we did not find any information on the clump size or velocity from our video. We know that there is viscous effects at play when the Reynold's Number is close to 4.5. This may not represent all areas within the glass (Moebs et al, 2016).

Using a dye we were able to visualize what was happening within the sparkling water. There were also bubbles that could be seen. The video was recorded with an iPhone 17 Pro Max. It was shot in 4K at 60fps with a 1x camera. Our video can be found here <https://youtu.be/rQcSdUQCouQ>. The distance from camera to glass, length of time it was exposed for, type of light used and how it was edited should be documented. We can also note the type of dye and how many drops were used.

As you can see from our video the dye traveled down in small streams and clumps. I expected to see something similar to the picture taken by Jonathan Pizarro where the dye would swirl around. Maybe because of our dye or the way it entered the water. There are many variables that could have played a factor in this. Since we didn't isolate each variable we are unable to say for sure. Our experiment was successful because we were able to show how we could use visualization to better understand a phenomena. By controlling how many drops of dye are placed into the cup we could test more. Also temperature of liquid and how long the soda has been opened could help as well. Finding how fast the dye is traveling could give us a more accurate velocity and Reynold's number.

References:

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