Get Wet

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The phenomenon that I captured for my first flow project was the relationship between vegetable oil and water. My initial idea was to image condensation on a piece of glass that rests on top of a cup of steaming water. As I started the set-up process, however, I quickly became uninspired. With some more thought, I decided to try pouring oil into water. This yielded interesting effects. The relationship between water and oil can be witnessed on an every basis through trying to wash greasy/oily pans and hands without soap. Water repels oil, so we need dish soap and hand soap to release the oil film when we are cleaning.

To capture this image, I used materials that I had on-hand in my apartment. I filled a wine glass halfway up with warm water and then proceeded to pour vegetable oil into the water. As displayed in the image, the oil initially sank to the bottom due to gravity and its flow downward, but then quickly sprang up to join the oil film at the top of the water. The oil floats because the density of oil is less than that of water, or, in other words, the oil is buoyant in the water.

Another phenomenon witnessed in this image is the hydrophobic interaction between the oil and water. A water molecule, or H_2O, has a polarity which means that one side of the molecule has a negative charge and the other end has a positive charge. Vegetable oil is made primarily of triglycerides. Triglycerides have long chains C-H bonds, which are nonpolar (there is no charge). The polar water molecules attract other polar molecules (negative (-) on one molecule attracts the positive (+) on another), hence water is attracted to itself. In the same way, nonpolar molecules are attracted to other nonpolar molecules, which is why the oil sticks together. Nonpolar molecules repel polar molecules. This leads to the congregation of oil and the inability of the two substances to mix into a homogenous solution.

The water I used was slightly above room temperature and came from Boulder County's tap. I poured the oil directly from the bottle, 2 inches above the wine glass. The wine glass is 4.25 inches tall with the bottom diameter being 2 inches, the top diameter being 2.5 inches, and the diameter around the center of the glass being 3.25 inches. The oil is Market Pantry brand and was poured at room temperature. The bottle had 16 ounces of oil at the initial time of the pouring. I used a basic warm-lighting desk lamp and put a piece of white cardboard partially blocking the glass from direct light. This gave the image a soft glow rather than a harsh light.

The camera I used to shoot this image is a Nikon D5200 DSLR on the manual setting. My shutter speed was 1/1000, aperture was f 5.6, and my ISO was 400. The shutter speed was abnormally quick so that I could capture the flow without motion blur. In order to get a good focus, I had my camera about 7 inches from the glass and zoomed in to the distance you see in the image. The focal length used was 24mm. The original image was very dark due to the fast shutter speed and low lighting. In Adobe Photoshop, I increased the brightness and contrast of the image. I used a mask to black out the areas around the glass so they would not be a distraction. I then cropped the photo into the same width/height.

Original photo

The image reveals the crisp line between the oil and the water. This proves that there is absolutely no mixing of the two fluids and demonstrated the hydrophobic characteristic of the oil very well. The gravity/flow downward and the buoyancy/flow upward of the oil is captured very well in this image. I fulfilled the intent I had with this set-up. If I was to redo this setup, I would take a video of the flow. This image captured movement well, but it might be more captivating if it was a slow-motion video.