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Flow Visualization F2007

Group Project #1

For our first group project, group alpha used the Hele-Hhaw cell to view different fluid phenomena. At first we had used the Hele-Shaw cell as intended, hoping to view viscous fingering produced by the Saffman-Taylor instability. We ended up removing the top plate and playing with different fluids on what would now be a light box.

The apparatus used was effectively a translucent white plexi-glass sheet over a high powered work light. Corn syrup was then poured onto the sheet and allowed to settle. A small drop of pure food coloring was introduced onto the edge of the corn syrup. The food coloring has a lower viscosity than the corn syrup and lowered the surface tension of the corn syrup introducing an instability that caused viscous fingering. This fingering was originally studied by Hele Shaw in the late 1800s.

The picture was originally taken with a backlight behind translucent acrylic. We used pure food coloring and store brand corn syrup for this picture. The field of view is approximately 3 inches with an object to lens distance of about 10 inches. Camera was a Nikon DSLR with a picture size of 3008x2000 pixels. The exposure specs were not available to me at the time, but we relatively used a 200-250 shutter speed with a low aperture number to get enough light into the shot. No flashes were used. The picture was post processed in Photoshop CS3 to invert the color.

The image shows a more discrete form of viscous fingering than we have previously seen. The thickness of the corn syrup allowed for the food coloring to move into the corn syrup rather than over it, creating a nice shading effect. I feel this picture shows the need of the food coloring to disperse across the surface to try and become stable. Next time, I would like to see more of our pictures have clarity; Clarity is key at small sizes. The Hele-Shaw cell didn't work for us, so next time I use the apparatus I would like to have it operational. If I were to pursue this phenomenon further, I would try introducing the less viscous material at different velocities to see the differences in the fingering patterns.