Get Wet Project Report
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Course Section: No clue, sorry
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This Get Wet experiment was designed to visualize the way in which a dense, colored viscous fluid introduced into water goes through the transition from smooth flow to more complex instability. I poured corn syrup mixed with green food coloring from a height of about one foot into a vase of water, with the aim of photographing how gravity and viscous forces work together to fold and distort the fluid. I wanted to produce an image that is not just visually appealing but also has a physically important structure. I tried several lighting and camera setups before settling on the one shown.

The setup was a clear glass vase filled with water, then a pouring of colored corn syrup into the water from a height of about 30 cm above the surface. A semi-transparent folder divider was placed halfway through the vase to reduce distracting reflections, increase the fluid contrast, and focus the camera. The LED bulb behind the vase provided a diffused warm background for the green syrup to stand out. As syrup enters, it initially flows in smoothly (laminar) under gravity. However, because syrup is much denser and more viscous than water, the fluid becomes unstable: the denser fluid is trying to move downwards through a lighter fluid. This is analogous to Rayleigh–Taylor instability in viscous fluids, where a denser fluid is accelerating into a lighter one. With increasing disturbances, the colored syrup begins to fold, curl, and form patterns rather than a single smooth column.

A closely related phenomenon is viscous fingering (or the Saffman-Taylor instability), which happens when fluids of different viscosities develop fingers or branching extensions at their interface. While classical viscous fingering is often studied in porous media or Hele-Shaw cells, the same overall principle of interface deformation by viscosity is involved here (see https://www.sciencedirect.com/science/article/pii/S2405844021017175).

To quantitatively estimate the flow regime, I estimated a characteristic velocity $U \approx 0.1$ m/s (from the speed of the syrup at entry), a characteristic diameter $D \approx 5$ mm (0.005 m, the width of the stream of syrup), and I used an approximate kinematic viscosity $\nu \approx 5 \times 10^{-3}$ m²/s (for the syrup mixture). Then:

$$Re = (U \times D) / \nu = (0.1 \times 0.005) / (5 \times 10^{-3}) \approx 0.1$$

The extremely small Reynolds number reaffirms viscous fluid dominance and the absence of turbulence in the flow. The instabilities created are due to the density contrast and viscosity contrast, not inertia.

I combined the corn syrup with some green food coloring until the dye color was noticeable but not black. The syrup was added slowly so that the stream did not splash or form too much turbulence. The folder divider in the back of the vase softened the LED light and reduced reflections or harsh glare. I positioned the LED light directly behind the vase, shining through the liquid, which provided a warm golden backlight that makes the green syrup visually pop. This provided me with pleasant contrast without unsightly shadows or reflections.

I recorded video of the entire process on a GoPro Hero 11 set away from the vase. From this video I extracted one frame showing a dramatic fold and structure that wasn't too Kaotic or busy. Earlier experiments with the camera under water or with overhead lighting were ruined by reflections, loss of focus, or background noise.

Camera distance: ~30 cm from vase

Lens: internal wide angle GoPro

Camera: Digital / GoPro Hero 11 Mini

Final image size: ~ 3840×2160 px (taken from video)

Exposure: auto mode (shutter ~1/60 s, aperture ?, ISO ?)

Image processing: cropped, AI unblur feature, brightness/contrast adjusted, minimal modification

The photo clearly depicts a progression of smooth entrance to folding, curling, and branching of the colored syrup in water. The flow demonstrates the effect of gravity acting more on the denser fluid and viscosity resisting deformation, creating characteristic folds. I like the visual contrast: the green is sharply defined against the golden background. The loops and curls are both scientifically interesting and aesthetically beautiful. There are, however, some issues. The GoPro's wide lens does distort the visual somewhat, and auto exposure under- or over-exposed areas periodically, with the same thing occurring for the auto color correction. Reflections from glass surfaces can still be seen in spots. In future studies, I would try to use a DSLR camera with a macro or telephoto lens, use higher frame-rate video to capture the initial growth of instability, and possibly alter fluid ratios or dyes for more clarity.

I believe this image meets my goal of merging visual art and fluid physics, and has sufficient documentation that another person could attempt a similar photo.