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MCEN 4151, Flow Visualization

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Get Wet Report: Honey Droplets Image

Figure 1: Get Wet Image

Introduction:

The purpose of this image assignment is to immerse oneself in the world of photography, flow visualization and picture editing. To this end, the photographer has chosen to capture the flow of a fluid down strands of hair. Initially, this picture intended to capture the flow of water down the real hair of a person. The camera available was not able to capture such quick flows, however, and so the fluid had to be changed so that the flow could descend slower and be able to be captured appropriately. The strands of hair were also isolated in the final image in order to avoid messiness and to provide stillness for the image to be captured.

Flow Description:

The main fluid properties responsible for the image shown here are viscosity, defined with the symbol μ, and gravity, defined by the letter g. In this case, since the strands are laid out vertically, gravity is the driving force that causes the fluid to accelerate downwards; and viscosity ensures that the fluid does not accelerate too quickly and allows the camera to capture the flow. The interesting thing about honey as a fluid in this experiment is that it is viscous enough to suspend the honey droplets in the hair for a very long time. The viscosity of honey is about 10 Pa-s, according to vp scientific (http://www.vp-scientific.com/Viscosity_Tables.htm), compared to water's .01 Pa-s. The Reynolds number for this fluid is extremely small (Re>>1) due to the high viscosity, small diameter of the droplets (about 6mm) and near-zero velocity of the droplets. The diagram below shows how the phenomenon occurs.

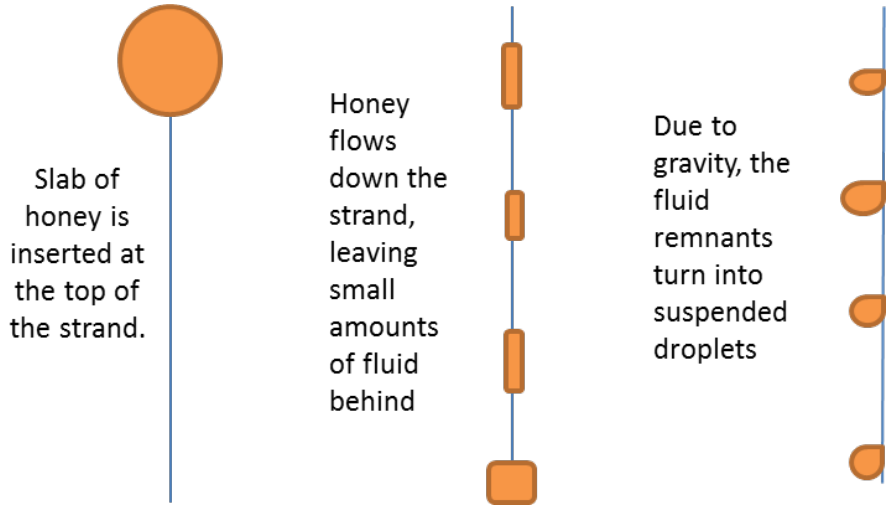

Figure 2: Fluid Phenomenon Explanation

Flow Visualization Technique:

The image was captured using the lighting from a regular dormitory room. The honey was at room temperature at the time of image capture. Three strands of hair were chosen for aesthetic effects, and a dark-brown background was chosen as opposed to white in order to provide better contrast to the clear brown honey droplets. The spot for the image was chosen because of the different levels of lighting provided aesthetic effects to the image. The mechanics of the setup consisted of hanging the strands of hair off of an extrusion in the wall by using tape to secure the hair. If there is no extrusion on the walls, a pencil or similar object can be taped to the wall to provide the same effect.

Photographic Technique:

The image was taken with an Olympus camera, series XXXXX. Manual mode was used with settings F7.1, shutter speed 1/3s, ISO 400, and zoom @45mm. The maximum possible zoom was chosen in order to provide the best detail for the droplets. Manual focus was also used, and the ISO, shutter speed and F-stop were chosen in combination for having provided the most aesthetically pleasing image. The original image was taken as an ORF (Olympus Raw File) and processed through Olympus Viewer 2. The color contrast curve was adjusted to an S-shaped curve, as learned through the Flow Visualization class during the basic picture editing lecture. Some cropping was done to eliminate the wall extrusions and the other distracting elements. The corner on the bottom right of the picture was not cropped due to aesthetic reasons, but this feature may be thought of as distracting as well.

Conclusions:

The image is aesthetically pleasing; the colors of the honey are warm and natural and are pleasing to the eye, although a better background could have been chosen to further bring out the contrast of these droplets. Furthermore, some of the droplets appear out of focus, but this could potentially be used to bring the viewer's attention towards the center of the picture. To develop this image further, more strands of hair would be used to give the image more suspended droplets and maybe provide a curtain effect. In general, this image was a very good learning experience to become immersed in the field of photography and fluid visualizations.