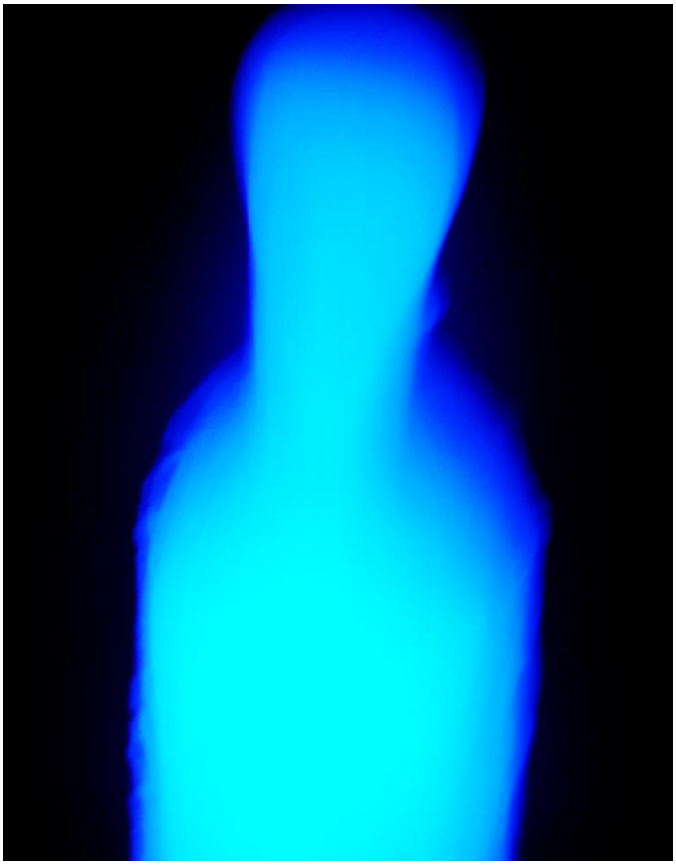
Get Wet Assignment



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Introduction

Described below in this report is the flow phenomena, visualization, and photography techniques used for the get wet assignment. The image captured for this assignment is a geyser produced by dropping a Mentos into a bottle of tonic water. The geyser was exposed to a black light to acquire the florescent effect from the quinine in the tonic water. The intent was to have a detailed image of the mushroom like shape of the apex of the geyser. Initially the desired image was difficult to create due to lack of force from the geyser. The final image was created with more Mentos, which increases the rate of reaction and the geyser's velocity.

Experimental Setup

This experiment had a relatively simple setup, although it took some fine tuning to create the intended results. Black curtains were draped in a shower and covered all surfaces in the photograph. Black lights were placed directly in front of the photographer and pointed towards the center of the shower. A glass window pane was placed over the lights to protect them from any liquid that might land on them. The bottle of tonic water was placed in the center of the shower with all labels and the cap removed. The camera was on a short, about 2 feet, tripod and aimed so that about the bottle and 12 inches above it was in focus. The Mentos were then dropped into the bottle and the instantaneous reaction was photographed using the burst mode to ensure that the desired image was captured. Figure 1 below illustrates this setup.

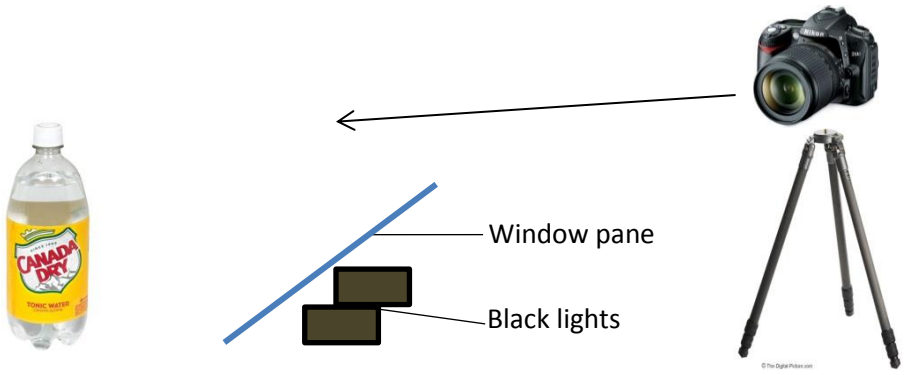

Figure 1: Experimental Setup

Flow Physics

Contrary to popular belief, when Mentos are dropped into carbonated substances a physical, not chemical, reaction occurs. The rough surface of the Mentos gives the dissolved carbon dioxide in tonic water, and other carbonated drinks, little nooks and crannies to escape the surface tension of the water. This process is called nucleation.[1] As more and more carbon dioxide escapes the water's surface tension, a large spike of pressure is experienced within the

bottle. By using Bernoulli's equation we can calculate the pressure within the bottle. This calculation is shown below with an estimated geyser height of 5 inches.

$$P_{bottle} = \rho_{tw} g h_{geyser} = \left(0.0372 \frac{lbm}{in^3}\right) * \left(386 \frac{in}{s^2}\right) * (5\ in) = \boxed{71.8\ psi}$$

This calculation assumes a tonic water density of 0.0372 pound-mass per cubic inch and an acceleration of gravity of 386 inches per second squared. The pressure within the bottle causes the contents, gas and liquid, of the bottle to be forced out of the nozzle at a high velocity, thus creating the geyser.

Photography Technique

This image was captured using a Nikon D3200. The lens used was an AF-S Nikkor 18-70mm 1:3.5-4.5G. Due to the low light the Hi 1 sensitivity setting was used, which is equivalent to an ISO of 12800. A shutter speed of 1/1000 with an aperture of F/4 was used to acquire the details in the image. The camera was placed roughly 2 feet away from the subject with a field of view 30 by 24 inches. Manual focus used with a focal length of 18mm. The image taken had dimensions of 3008 by 2000 pixels. The open source photo editing program GIMP was used for all post processing of the image. The image was first cropped to better center the subject. Then the curves tool was used to apply a filter that deepened the black surrounding the subject and brightened the subject to better see the details of the geyser. A before and after can be seen in figure 2 below.

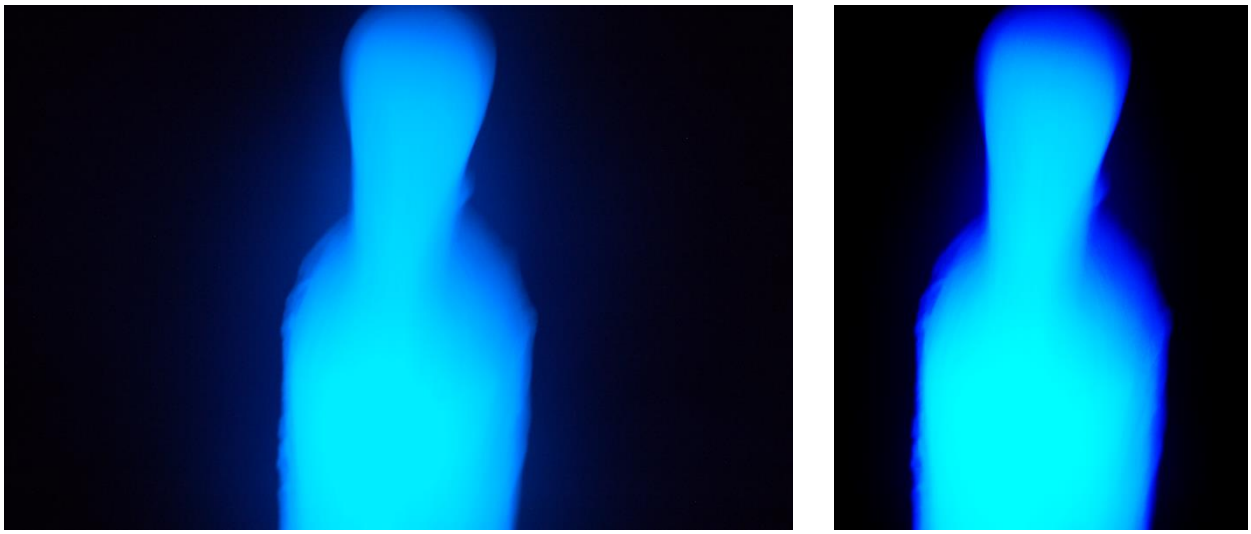

Figure 2: Before and After Post Processing

Conclusion

Overall, this image doesn't capture the details of the fluid phenomena that well. This works in an artistic sense though as it gives the photo a mysterious quality. The one thing that could be improved is the shape of the geyser. It was more desirable to have a greater spread of fluid at the apex. The darker blue lining around the fluid creates a pleasing aesthetic, and was a happy surprise discovered during image processing. To develop this further one could increase the quinine concentration or add another fluorescent substance to increase the glow of the fluid which would in turn increase the visibility of the flow.

Works Cited

[1] Senese, Fred. "Why Do Mentos Mints Foam When You Drop Them into Soda Pop?" *General Chemistry Online*. 15 Feb. 2010. Web. 19 Feb. 2012. <http://antoine.frostburg.edu/chem/senese/101/consumer/faq/mentos.shtml>.