

Get Wet Project

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Introduction

The objective of this 'Get Wet' project is to explore and capture the physics of fluid flow. The image shows the interaction of ordinary essentials found in most bathrooms all across the nation, lotion and mouthwash. Often, everyone is in a rush to get in and out of the bathroom that they probably do not think about the interaction between the different types of products that has entered the sink. The image demonstrates the dynamics of lotion poured into a still solution of 40% mouthwash and 60% water.

Setup/Experiment

To setup the shoot, a solution of 40% mouthwash (Scope) and 60% water was contained in a glass cylinder, 4.5" diameter by 11" height, placed on top of a stool with a white backdrop, Figure 1. The camera was placed approximately 8" away from the center of the cylinder on a tripod. To enhance the lighting, a florescent tube was placed directly above the cylinder.

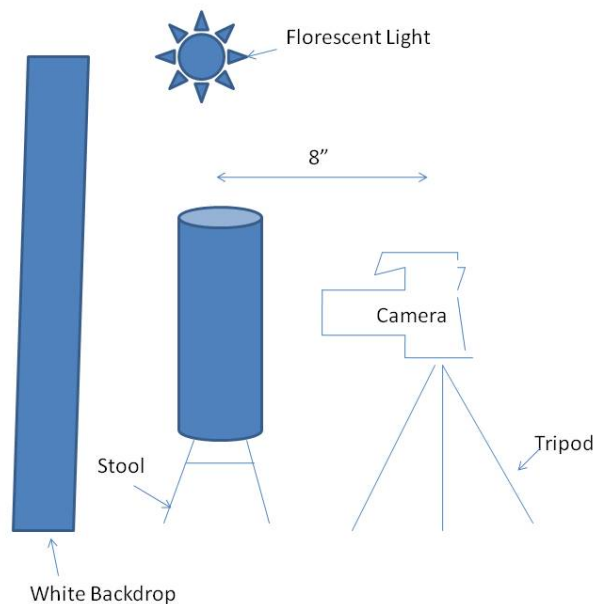


Figure 1: Photo Shoot Setup

The objective of this image is to introduce the lotion as slowly as possible to prevent turbulence in the solution and in the flow of the lotion itself. The specific gravity of the lotion ranging from 1.00 to 1.03 as indicated from the material safety data sheet (MSDS) and the mouthwash water solution's specific gravity is approximately 1 because the majority the solution is water. This

indicates that the lotion should sink when introduced to the solution. Outside of the comparing just the basic densities of the materials, we also would like to analyze the Reynolds number. This setup tried to prevent the lotion from entering the solution turbulently by placing opening of the lotion as close to the surface of the solution as possible without physical contact. The velocity of the lotion in the solution is determined by taking two consecutive photos with a known time interval and comparing the displacement which is approx. 2cm/s. Since the lotion is primarily composed of water and glycerin the dynamic viscosity is approx. $1 \text{ N}\cdot\text{sec}/\text{m}^2$. The characteristic length of the flow should be the diameter of lotion the enters the fluid which is approx. 5mm. With these approximations, the Reynolds number that is associated with this flow is approx. 103 which are below the laminar to turbulent transition threshold. This observed in the image.

Visualization Technique

The lotion used was Olay Complete Defense Daily UV Moisturizer SPF 30 and the mouthwash used was Scope Original Mint. Both of these products are made and distributed by Procter and Gamble Company and can be found at Target and other major retail stores nationwide. Once again, the solution used was 40% mouthwash and 60% water. There was no flash used when taking this picture because of the possible glare from the glass cylinder therefore a florescent light was used instead.

Photographic Technique

The image was taken using a 12.2 mega pixel Canon Rebel XSi digital single-lens reflex (DSLR) camera. An 18-55mm image stabilizing lens with was mounted on camera. The distance that the object was away from the lens is approx. 3" from the center of the cylinder and the focal length of the lens was 21mm. The size of the original is 4272 x 2848 pixels and final image is 4194 x 2628 pixels; the original image was shot in RAW format and converted to a TIFF for the final image. The aperture, shutter speed, and ISO setting was F3.5, 1/50 Sec., and 200, respectively. Minor Photoshop processing was done to the image, used curves and cropped the image.

Conclusion

Personally, I like the image because I like the color contrast between the mouthwash and the lotion. The part of the image I dislike is some of the smaller particles of the lotion floating around in the solution; it makes it look like the solution was dirty or there was dust on the lens. I also didn't like how everything was not in focus. I considered adjusting the aperture but the

consequence of that would be motion blur from having to adjust the shutter speed to match the aperture. One thing I do not understand about this picture is the tendency of the lotion to semi curl. The buoyancy force can cause the net force of different sections of the lotion to be different depending on how much solution it has displaced but I cannot visualize it causing those curls.

References

MSDS http://www.pg.com/company/our_commitment/msds/beauty_care.shtml#10

Smits, Alexander. A Physical Introduction to Fluid Mechanics. John Wiley and Sons, 2000.