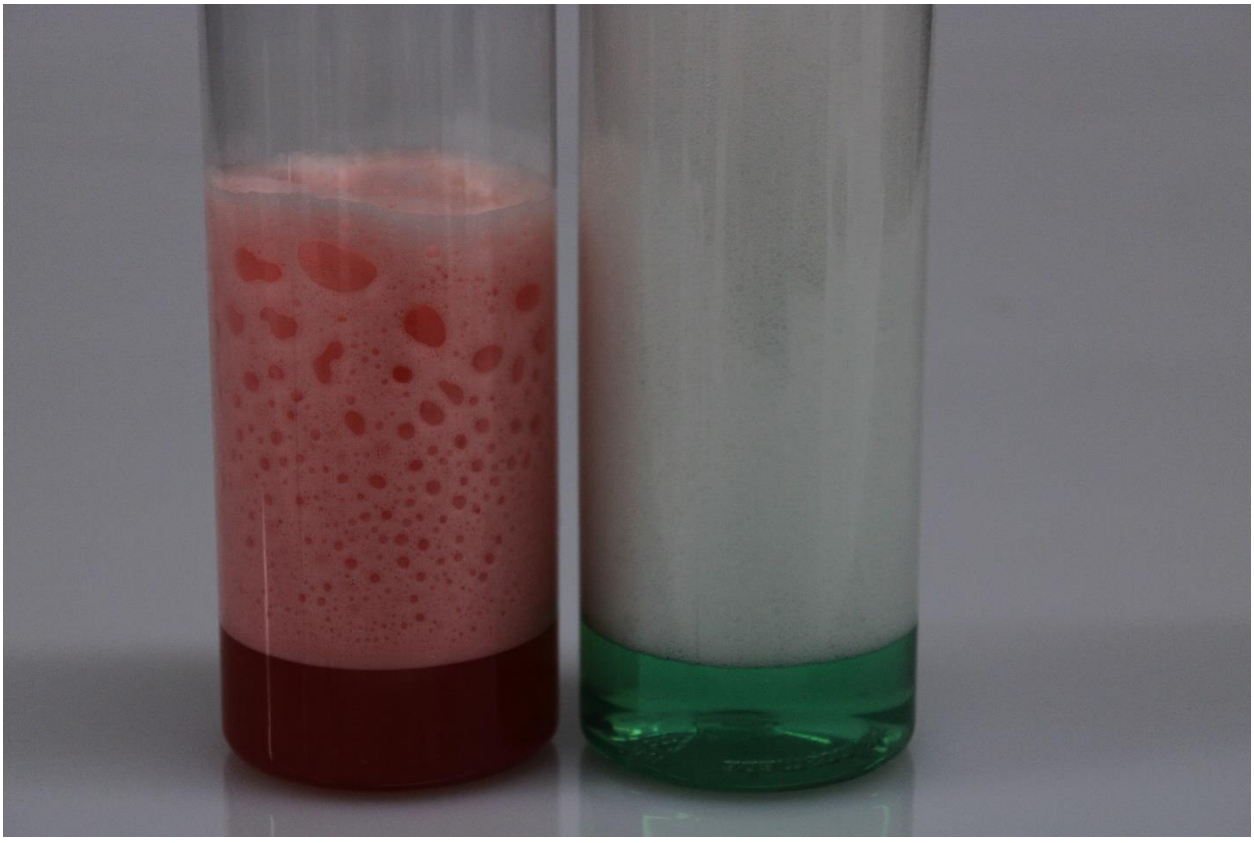
2020 Fall Image-Video 3

Hannah Moller

MCEN 4151-001

Assisted by Colton Oglesbee



I. Introduction

The purpose of this picture was to explore a concept in flow visualization of our choosing to understand more about fluid photography and its challenges. I choose to research the concept of the foam stability and instability. To create the photo and video that will later be analyzed in this report, I used the help of my friend and classmate Colton Oglesbee. I was fortunate enough to use be able to use the professional photography set up at Colton's workplace that included a black backdrop and lighting. Colton was also a huge help allowing me to use his phone to create a time lapse video since I do not have that capability. The following report shows the experimental set-up, the physics behind the phenomenon, and the techniques used to achieve the image.

II. Set-up and Materials

The materials used in this photograph was two 20 oz clear bottles, a third of a cup of water, and two different types of soaps. The ones used in this video and photo is Adam's Polishes Mega Foam (red) and Adam's polishes Strip Wash (green). The set up was in a dry room of a warehouse with no natural light and with the florescent overhead lights on. To hold the phone still I used two foam blocks to sandwich the phone to keep it in place.

Once the experiment is set up, start your video then shake both bottles for 1 minute. Then set the bottles in the view of the camera and just walk away. For the solvents used in my video, it took the Mega Foam 15 minutes to dissolve until it reached steady state, whereas the Strip Wash showed foam stability.

III. Flow Phenomenon

This photograph is a prime example of foam instability and foam stability. The Mega Foam shows that as time went on the foam dissipated being an example of foam instability. There are a few things that affect the quality of bubbles such as the size of the bubbles, the strength of the bubble, and the humectancy of the bubble.

Various surfactants will give you various sizes of bubbles. For example, sodium lauryl ether sulfate tends to give a large bubble, whilst sodium lauryl sarcosine will give very small bubbles. This means the foam from sodium lauryl ether sulfate will be light and airy, because it is made of large bubbles (more air to surfactant/water). Sodium lauryl sarcosine foam will be heavy and dense, because it is made of smaller bubbles, so it is less air to surfactant/water. The Strip Wash used in this case study is a sodium lauryl sarcosine foam. Whereas the Mega Foam was a sodium lauryl ether sulfate foam.

The second thing that affects the quality of the foam is the strength of the bubble. In absence of any modifier, some surfactants will give a long-lasting bubble, and some will give bubbles that burst almost immediately. The two versions of these can again be seen in this video.

The third thing that affects the quality of the foam is the humectancy of the bubble (how much moisture is held in the bubble vs how much evaporates). Because bubble walls are made up of surfactants and water when the water evaporates the bubble bursts. The humectancy of the

bubble also affects how big it can get without bursting. If the bubble wall hangs onto the water very well, you can stretch that wall more thinly and make larger bubbles. Alternatively, you can leave the bubbles normal size and they just last a lot longer. Therefore, you can make your foam last a lot longer by adding a modifier, such as glycerin, to your soap. The glycerin holds the water in the bubble wall much longer than the surfactant alone will.

IV. Photographic Technique

The camera used for this image was a DSLR Cannon Rebel T7, which comes with a 0 to 55 mm zoom lens. The camera was placed about 4 inches away from the bottles using the 55 mm zoom which gave the field of view of the camera to be 4x5 inches. The settings where set to the following specifications, F5.61 aperture value, 1/160 shutter speed, an ISO speed of 640, and using manual focus. These settings where used to compensate for the low lighting in the room. The original photograph can be seen in Figure 2 below which has 6020 x 4015 pixels. This was then cut to 1300 x 846 pixels.

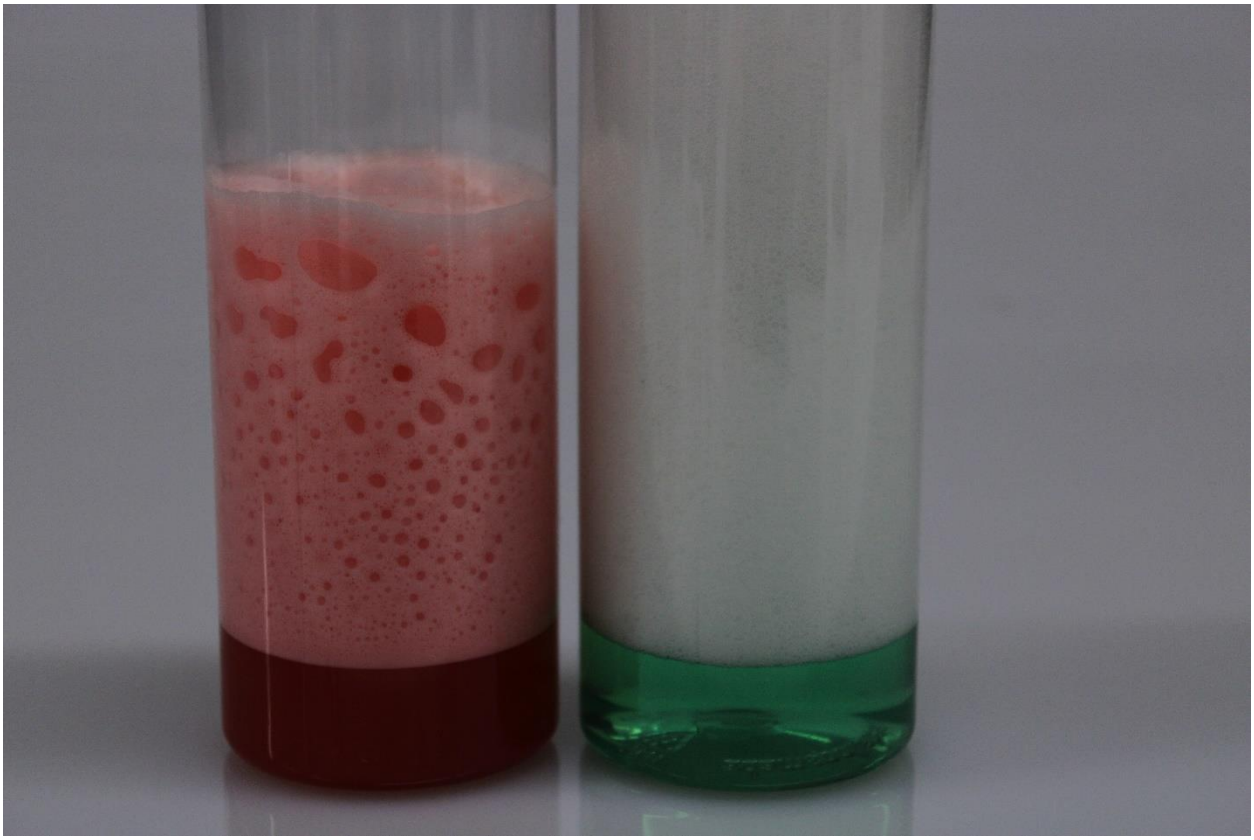


Figure 2: Image of Foam

To shoot the video, I used an iPhone 12 on time lapse with automatic focus. The post processing on video for this experiment was done in iMovie. The only adjustment would be adding the picture in the beginning and the title page. I also increased the speed a bit more so that the total video length that was originally time-lapse without add-ons was 18s then went to 14s.

V. Conclusion

This photo shows the phenomenon of foam instability and stability. The biggest challenge in achieving this video was making sure the video stayed in focus. Once finding a set up that is either a stand or a tripod that works for whatever you are using the experiment is straightforward. To improve upon this experiment, I would suggest putting a timer in the video so that you can really have a sense of time moving on. To improve upon this experiment, I would probably use more types of solvents to show in-betweens of the two soaps I used.