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Group Assignment 3
5/2/13

Flow Visualization Spring 2013

Tonic Water under Black Light

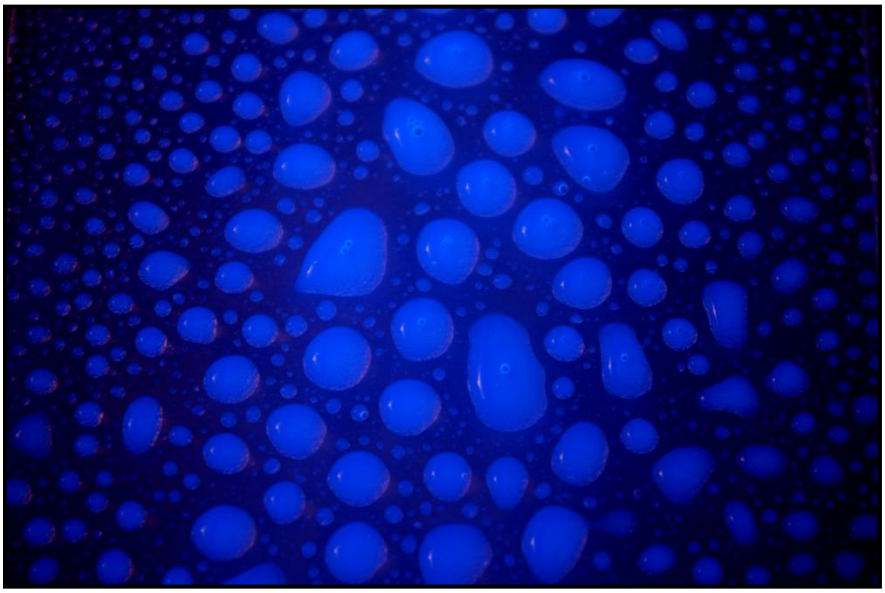


Image 1261 (from Middle of Time Lapse)

For this third image for my flow visualization course, I was looking to capture how the spray was forming droplets on the bottom of a plastic container. We used flat tonic water which contains quinine with is the fluid that is glowing under the black light in my images. After I took a bunch of images I decided to put it together into a short time lapse that shows how the drops form and join after each spray from the spray bottle. The set up used for these images is very repeatable and I wish I had continued past just 23 images so that the time lapse could have been longer but I didn't think about this until post processing and compiling of the images into the movie. I would like to thank Hans Loewenheath and James Shefchik for their help with taking these images.

The apparatus consisted of a spray bottle full of flat tonic water, plastic container, black light and camera set up. The spray bottle was held at an angle to the bottom of the container and held about six inches from the surface. The camera was set up on a tripod looking down at the bottom of the container about nine inches from the bottom. The camera was left in the same position and settings for all the images, in between each picture, a single squirt from the spray bottle were distributed on the bottom of the container.

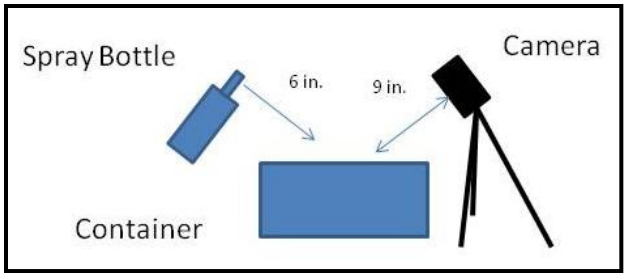
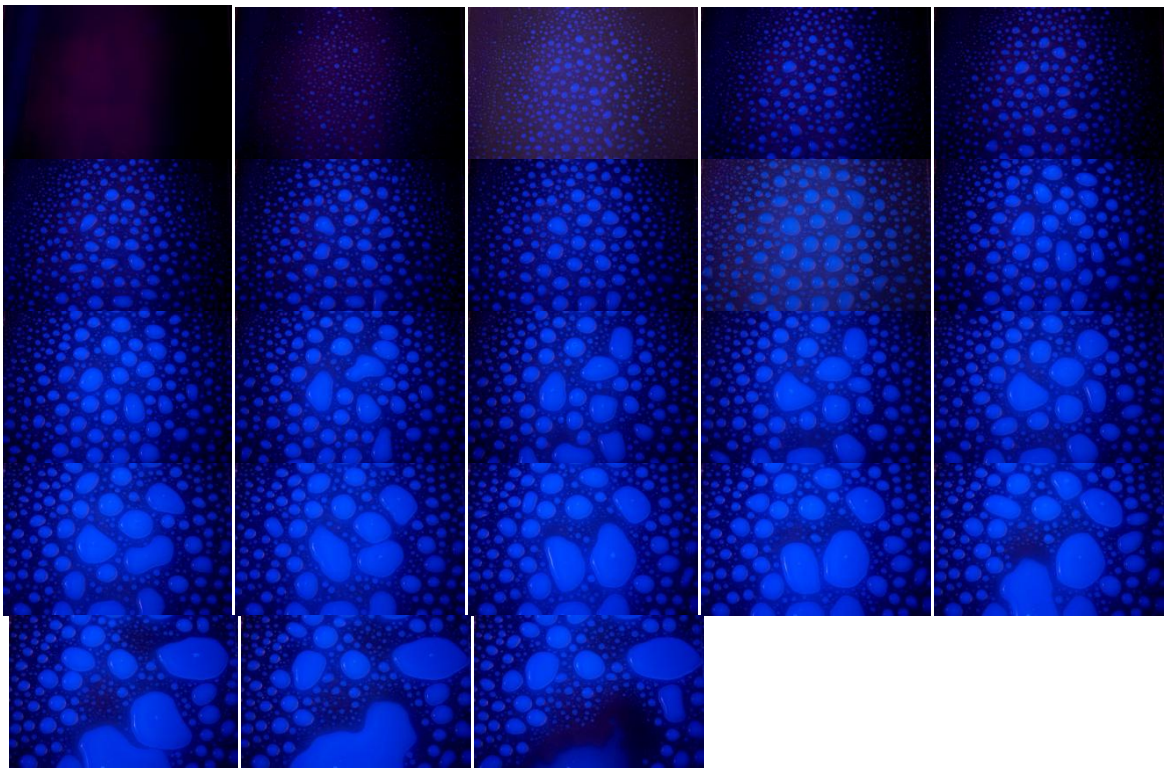


Image Apparatus

So from the start of the time lapse to the end there were 22 sprays. I was interesting in seeing the coalescence of the droplets as more and more liquid become present. The original image is looking at about a 4 in x 6 infield of view, so for my analysis I am going to look at the change in size of the images as the images progress in the video. Below is a table of the image number in the sequences and the largest droplet that is present in the in the field of view. The size is based on the longest dimension of the droplets.

Image # in Sequence	Size of Droplets (in.)	Image # in Sequence	Size of Droplets (in.)
1	0	13	1.125
2	.125	14	1.365
3	.25	15	1.365
4	.375	16	1.5
5	.375	17	1.875
6	.5	18	2
7	.5	19	1.875
8	.5	20	2.125
9	.625	21	2.75
10	.875	22	3.75
11	.875	23	3.75
12	1		

As expected as the drops got bigger, they would run into each other and combined. This caused the droplet growth between the later images to be much greater than the growth between the earlier images. In the final image the largest drop has actually flowed out of the field of view leaving a giant gape with no droplets in its wake.



For my images I used ultra-violet light (black light) as my visualization technique. The quinine glows a brilliant blue when put under black light, so the contrast between the dark background and the bright blue drops gives an awesome effect to the photos. It was difficult to get enough light for the camera to get a good image, but because my system was stationary and I had the camera on a tripod, I could leave the shutter speed low, in this case at a full second. This as well as a low ISO gave me the light and sensitivity to be able to visualize the droplets. Below is a table of the setting that the camera was set at for all of the images.

Field of View	4 in x 6 in
Distance to Object	12 in
Camera	PENTAX K-5
Lens	SMC Pentax-DA L 18-55 II
Focal Length	55mm
Dimensions (original and final are same size)	4950 x 3264 pixels
Aperture	f-stop 5.6
Shutter Speed	1 sec
ISO	100

***Setting were the same for all 23 images in time lapse**

Even though the settings were the same on the camera throughout all of the shots, not all the shots came out with the same lighting. As the droplets got bigger and bigger, they reflected more black light creating a brighter image. In my post processing I tried to get the brightness the same throughout. I used PhotoShop for my post processing and for most of the images set the bottom and top points on the color curve to the same spots, (0, 25) for the low and end and (225, 250) for the high point. This work for the most part throughout the images, though there are a couple images that you can probably pick out that needed a little more adjustment.

Though I was not able to get all the images to have exactly the same brightness and contrast, I was very happy with the outcome. The only things I would have change were the number of images and better post processing. With more images I would have been able to make a longer time lapse and the transitions between the images could have been shorter so that it looked more like fluid motion. In terms of the post processing, I am sure that if I was more knowledgeable in PhotoShop I could have made them all appear with the same contrast, but I am not. The only reason for this is that then people would focus more on the droplet formation and less on the change in background noise as the time lapse moves through. This time lapse is one of those things that should be expanded on, if someone has the time to take a 100 plus image of this phenomenon and in smaller increments of fluid added between, they would be able to get a really awesome time lapse with much more detail. Hope that someone takes the time to take this idea farther.