

Report #6 – Team Third Assignment Fall 2018

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MCEN 4151-001: Flow Visualization

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1 ABSTRACT

The Team Third assignment was the third creative challenge that teams took on in MCEN 4151-004: Flow Visualization. The intent of the assignment was to build from the first and second team assignments and apply what was learned from those initial assignments into the third. In our case, we took on a new visualization in the magic milk phenomenon, mixing milk food coloring with dish soap .

1 Physics Revealed

The phenomena studied in this report focuses on molecule composition and the breakup of this composition through the mix and grouping of non-polar and polar molecules. Simply put, milk is made up of water, vitamins, minerals, proteins and fat. Water is a polar molecule and the milk fat is a non-polar molecule, as they both exist in the whole milk container that we bought from Safeway. As dish soap is dropped into the food coloring, the non-polar or micelles structure breaks up and attracts the other non-polar molecules in the milk fat[1]. This slowed process takes time and the visualization of this phenomena is seen below.

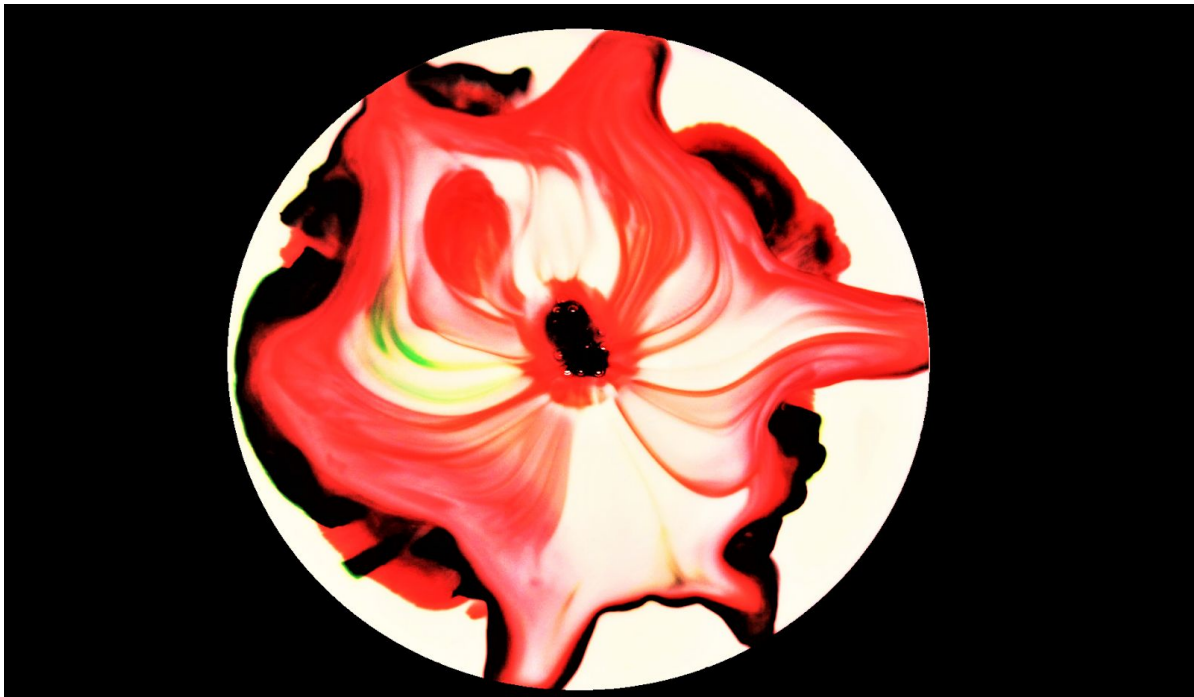


Figure 1: Edited Team Third picture of red, green, and yellow food coloring in milk and a drop of dish soap in the middle, producing the flower-like plume.

2 FLOW APPARATUS

The setup to produce this image was fairly simple. The location that the picture was taken on was in the Drop-in Design Lab (DIDL) conference room in Fleming Building where there was nice overhead lighting. The following items were purchased for this experiment:

1. Red food coloring
2. Green food coloring
3. Yellow food coloring
4. Dixie ultra paper bowl
5. Dawn Ultra dish soap
6. Whole Milk Vitamin D - Market Pantry

Around fifteen attempts were done to experiment all the different types of shapes, flows, and visualizations we took pictures of. For the attempt that produced figure 1, three large red food coloring droplets were placed two centimeters apart from each other in the center of the dish, around an inch in diameter. One yellow and green droplet were placed in between. After focusing the camera with our finger, we dropped the drop of dish soap into the center of a red droplet and continuous snapshots were taken as the non-polar fat molecules slowly combined with the non-polar dish soap molecules.

3 VISUALIZATION TECHNIQUE

To create the image, the Cannon SL1 was used. The F-stop was set to $f/5$, exposure time was set to $1/100$ seconds, and the ISO was set to 1600. The ending pixel image was 5184×3456 . The setting of the camera was changed to auto-focus, focused by a finger placed at the approximate location that the dish soap was dropped in, to capture the plume in focus.



Figure 2 : Raw, unedited version of the photo taken with the visualization technique above. Post processing was simply done in Photo Editor that comes with Windows 10. The contrast was set to +20, warmth +10, saturation +10, exposure +15, light +5, these settings were repeated four times, saved and redone to get such a high contrast in the red and white colors. The picture was circularly cropped to remove the distracting elements and patterns on the Dixie Ultra paper bowl.

4 CONCLUSION

Both the post-processed and raw photos reveal the complex motions of molecular polarity. If this experiment were to be repeated, I would have liked to have different colors, blue especially, although the Safeway store we went to only had the three mentioned above. I would have also liked to have a Q-tip to help control the flow a bit more when the dish soap was applied, as we dropped it from the soap container itself. Overall, this was a great bonding and final team project together as we all had food coloring all over our hands by the end, and had to wipe down a white engineering conference room table several times.

5 REFERENCES

[1] Steve Spangler Science (2011, January 19). *Color Changing Milk*

<https://www.stevespanglerscience.com/lab/experiments/milk-color-explosion/>