

Team Third Report

MCEN 5151 Flow Visualization

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Introduction

For this Team third assignment, I did a Skittle's candy rainbow experiment. The image is shown in figure 1, it is very successful. The color of the image is pretty good, and it looks like what I expected before.



Figure 1 Rainbow

Fluid

The fluid concept of this experiment is very simple. Sugar outside the skittle candy contains food dye, the hot water hit the mixed with color candy increase the density of water and formed 'sugar fluid'. Because the plate has a relatively lower center, the 'sugar fluid' will flow into the center due to the gravity. The sugar diffused in water is follow the Fick's law, which is shown below:

$$J = -D \frac{d\phi_{[1]}}{dx}$$

The flow rate could be solved if we get the surface of the plate. In this case $J = -10^{-5} \text{ moles.m}^2.\text{s}^{-1}$, the flow rate could be calculated as $\text{flowrate} = 10^{-5} \times 0.03 = 3 \times 10^{-7} \text{ mole/s}$

And in my experiment, the sugar flow toward center cost about 10 second, which is almost follow the Fick's law.

The gravity flow of the sugar water model is shown in figure below:

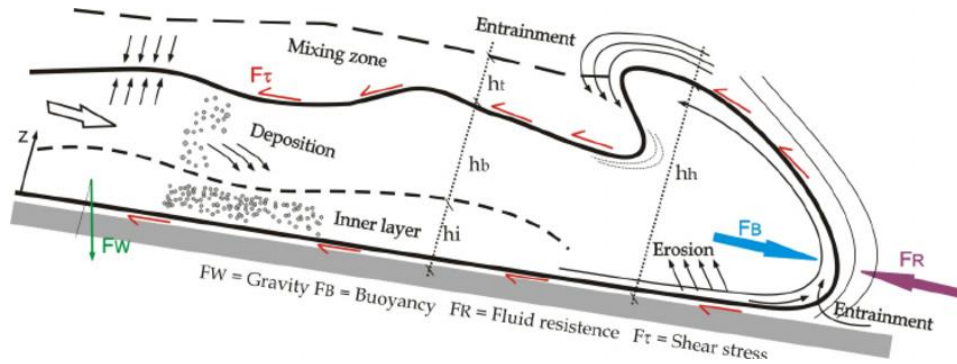


Figure 2 Gravity Flow [2]

The drag coefficient of surface plat and viscosity of the fluid is to be the main factor of the diffusion time. I use the normal paper dish plate which has relative low friction surface. So, the diffuse time for this experiment is pretty short, about 10 second all food dye were met in the center.

Photograph

I used iPhone 7 as the camera to take this picture, the original image is shown below.



Figure 3 Original Image

You can see I have about 20 Skittle's candy in the edge of the plate, and the center of the plate is lower than its edges. After I took the picture, I use a circle cutting tool to chop off the surrounding objects and put a black layer to the bottom of the image. This make image looks better and professional. Then I drag the color curve of the image to make it darker, to hide the plate original color and give it a better feel of rainbow's color.

Conclusion

This experiment is successful, I am satisfied with the final image. The improvement of this experiment would be having more skittle candies around and with a brighter plate made by plastic or ceramic, that would give better color of the final image and would be reusable also.

Reference

- [1]. Rough diffusion rate of sugar water through a larger volume of water, John Rennie, February2016
- [2]. *Sediment Gravity Flows: Study Based on Experimental Simulations* - Rafael Manica - January 2012