

MCEN 5151-001 Flow Visualization

Assignment : Get Wet

Title: Extraterrestrial

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Title Image – Extraterrestrial



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Introduction:

The project for Get Wet was driven by a thought of optically simulating something out of the world and hence the theme Extraterrestrial. Adhering to the popular, stereotypical approach to bring an out of the world sci-fi effect, a glow color scheme was envisaged. The classic milk in vinegar experiment was used to form the shapes. The method described may not return the same effect seen in the picture but a similar one out of the infinite possibilities.

Materials:

The materials used for the project are listed below

1. 2" X 3" X 4" Glass container
2. 20 W UV lamp
3. Canon T3i DSLR Camera with 18-55 IS II Kit Lens and Tripod
4. Whole Milk 10 ml
5. Fluorescent Highlighter Ink 5 ml
6. White Vinegar – 5% acidity – 400 ml
7. Medical Syringe – 5cc – 1 no.
8. Black Cardboard – 1 sq. foot
9. PPE (Gloves, UV goggles & water resistant clothing)

Methods:

1. The glass container was filled with vinegar till 80% and oriented with the wide side facing.
2. 10 ml whole milk was infused with 5ml highlighter fluid and drawn into the syringe.
3. The UV light was placed 15 cm above the glass container to get uniform lighting
4. The black cardboard was placed vertically along the rear wide face of the glass container.
5. The camera was placed on the tripod to face the front wide face of the glass container. The lens center line was lowered 1 cm below the glass container center line and was pitched +10° to get a view of top vinegar surface.
6. The following camera settings were used
 - a. Manual Exposure
 - b. Shutter speed = 1/15
 - c. ISO 1600
 - d. Aperture = 8
 - e. Focal length 23mm
 - f. Aspect ratio = 3:2
7. The UV light was turned on and the normal room lighting was turned off.
8. The dyed milk was introduced completely, one drop at a time into the glass container and pictures were taken.

Post Processing:

The best image out of the series of shots was chosen and was cropped to 3:4 ratio to avoid unnecessary information like the side walls of the glass container.

There is no other post processing involved.

Physics:

Milk curdles (precipitates) when comes in contact with vinegar.

The downward streaks formed on top represent the paths traced by falling milk droplets immediately reacting to vinegar.

The bottom donut rings are vortex rings formed by heavier precipitate curdling as it falls.

The spike and ring shapes are retained due to curdling of milk, preventing diffusion. They are time frozen streak and vortex ring patterns.

The upward spikes are mirror images on vinegar surface of the downward spikes.

The perspective of the camera and the symmetric mirror image on the top gives an oval fictional space ship appearance to the precipitate floating on the surface of vinegar.

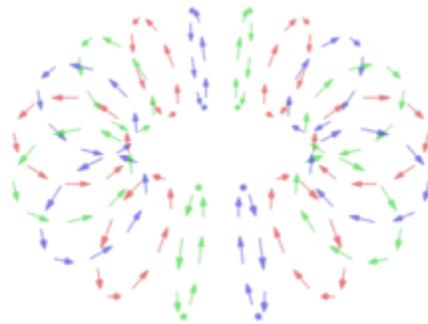


Fig: 2: Flow in a vortex ring (Source: Wikipedia)

Disposal:

As the consumables used in the project are bio degradable, they were discarded into the normal drainage water line after dilution with water.