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Get Wet Image Report

The intent of my image was to study a fluid density separation. The fundamental inspiration and overall goal of the image was to capture a magnified oil water boundary separation along with any other fluid phenomenon present because of this division.

The setup for the image capture involved the following equipment:

1. One glass vase (21cm height x 13cm base x 4.5 cm neck)
2. Matte black poster board
3. 120 watt Black light bulb
4. Cinder block
5. Corn oil
6. Tonic water

The apparatus used to create the image was simply a glass vase filled with tonic water and a layer of corn oil was added to the top. The vase was sitting on a cinder block with a matte black poster board providing a backdrop. A diagram of the experimental setup is shown below in figure 1

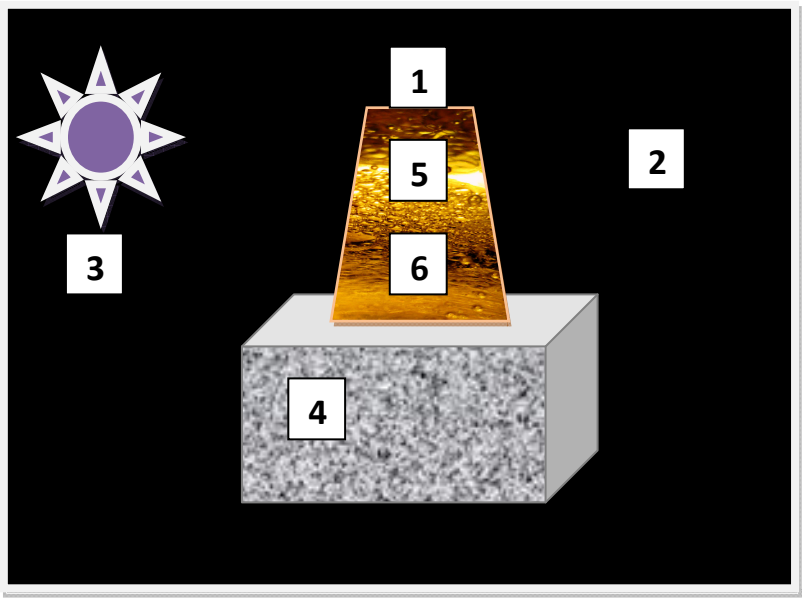


Figure 1: Experimental setup

The scale of the final image was about 11 cm high by 5 mm wide. The tonic water was 10 cm deep in the vase and the oil layer on top of it was around 3 cm thick. The fluid properties presented in the image are of several fundamental fluid principles including density, buoyancy, and effervescence. The separation is caused by the hydrophobic character observed in hydrocarbon-based oils. The oil and water have very strong dipole repulsions and therefore do not readily dissolve in each other. This separation is further enhanced by the density differences between the two substances. Corn oil's density is usually around 0.925 grams per cubic centimeter and water is close to 1 (1). Oil is less dense than water, so 1 cubic cm of oil weighs less than 1 cubic cm of water. Therefore, the upward buoyancy force on the oil, which is equal to the weight of water displaced, is greater than the downward force of gravity on the oil. To reach equilibrium the oil will rise in the water. This density separation effect is an extremely important physical occurrence and is used commonly in industry to separate various metals, separation of combustible from incombustible non-metals, cleaning and separation of polymers, removal of non-organics, and in the cleaning of contaminated sands. This is done in varying processes from rising current separation, heavy medium separation, jigging, and using spiral separators but all rely on the fundamental density separation effect (2).

The technique used to capture this image relied heavily on the lighting conditions. It is well known that any carbonated beverage, such as the tonic water, will form bubbles when the dissolved carbon dioxide is depressurized. This was used to form a type of bubble emulsions at the oil water boundary that was created. Tonic water will also fluoresce under ultraviolet light because of the presence of quinine. Quinine is a natural white crystalline alkaloid having antipyretic (fever-reducing), antimalarial, analgesic (painkilling), and anti-inflammatory properties and a bitter taste indigenous to the higher eastern slopes of the tropical Andes in South America (3). A Black light or UV Light is a lamp emitting electromagnetic radiation that is almost exclusively in the near ultraviolet range, and emits very little visible light. The tonic water's molecular fluorescence spectroscopy is based on the emission of light by its molecules, which are excited to emit their characteristic spectra by exposure to UV light of the specific wavelengths mentioned earlier (4). The backlight was used to add a greenish tint to the picture but additional light was needed so the flash o the camera was also used. A straight flash on the vase would create a bad glare though so the flash was covered and redirected under the separation layer to add to the separation effect. The camera settings used are shown below in figure 2.

:Saturation: 0
:FocalLength: 79/10
:MaxApertureValue: 48/16
:FNumber: 28/10
:ExposureTime: 10/400
:ExposureBiasValue: 0/10
:ExifVersion: 0220
:ExposureProgram: 2
:ProgramMode: 2
:WhiteBalance: 0
:DateTimeOriginal: 2009-01-20T18:00:55-07:00
:MeteringMode: 5
:LightSource: 0
:ISOSpeedRatings (seq container)
:ISOSpeed: 100
:Contrast: 0
:Sharpness: 0
:NativeDigest: 36864,40960,40961,37121,3712
:Flash

Size setting summary

Original size: 2929 x 2211 pixels

New size: 1254 x 2783 pixels

A Sony DSC-W7 Camera was used

Figure 2 : Camera settings and picture size

The image does a fair job of highlighting the important fluid characteristics present in the separation. I personally like the textural elements added by the tonic water and the unique color presented by the oil and tonic. My primary intent was realized but I would have liked to get a sharper focus on the bubble emulsion closest to the camera. I do however particularly enjoy how the image loses focus as it trails off away from the camera after the large bubble and wave. To expand upon this idea I would like to increase the number of boundaries present in the image and see if more distinct color layers could be established.

Works Cited

1. **Jong, T.P.R.** *Density seperation of non-ferrous metals by means of jigging and fluidisation.* s.l. : Delft University of Technology, 4 october 1999.

2. **Pelletier, S.W.** Chemistry of the alkaloids. 1970.

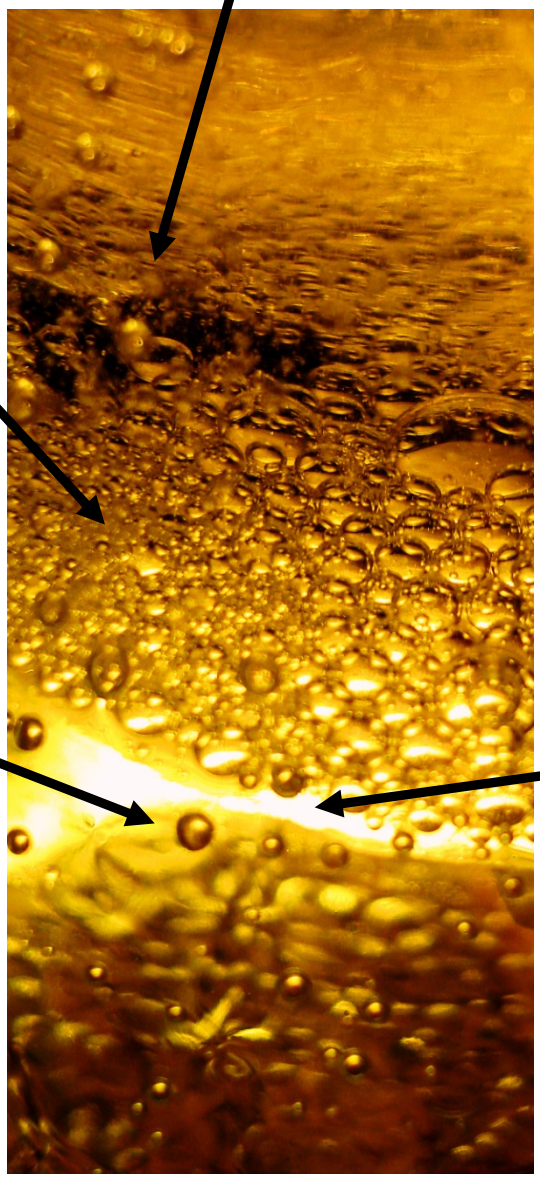
3. *Preformance of the reflux classifier for gravity seperation at full scale.* **Galvin, K.P.** 1, s.l. : Minerals Engineering, January 2005, Vol. 18, pp. 19-24.

4. **S.G.** Fluorescence and Phosphorescence Spectroscopy: Phsiochemical Principles and Practice. s.l. : Pergamon Press, 1979.

Appendix: Image Dissection

The corn oil was poured into the tonic water and was therefore unstable. The resulting wave propagating on the surface can be clearly seen. This adds a very nice dark contrast to the image

A top Layer of corn oil was used to create a distinct separation layer and add a yellow color to the image.



Tonic water was chosen as the base fluid in this picture instead of water for several reasons. The tonic water emits a very steady stream of C02 bubbles which creates a very interesting fluid interaction at the boundary. Also a black light was used to illuminate the tonic water so a light green was added to the yellow of the corn oil.

The flash was used on the camera but redirected under the oil layer with a piece of cardboard over the blub. The image was taken in a rounded vase so the light is reflecting off the glass and along the boundary as well for the distinct lighting separation of the layers.