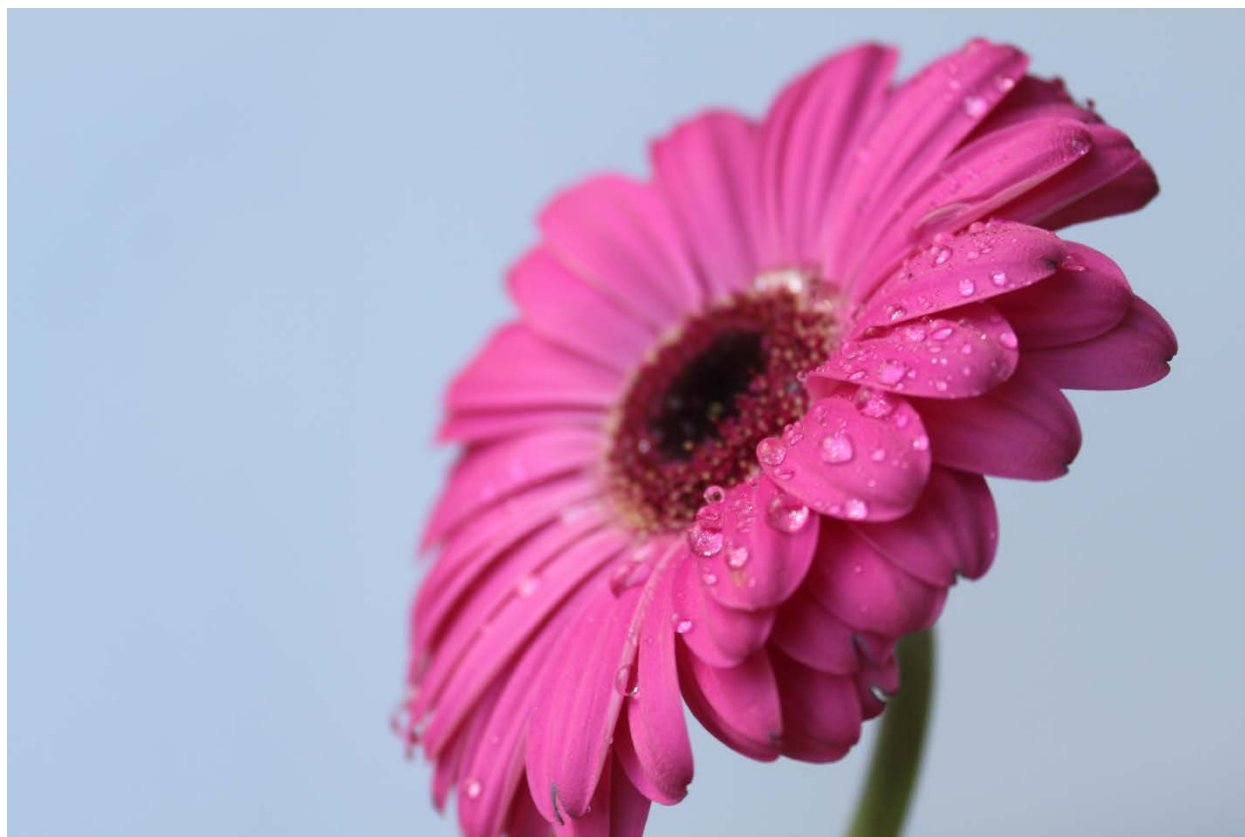


Flower Dew



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Collaborated with Allie Banks

Flow Visualization – Spring 2014

University of Colorado at Boulder

I. INTRODUCTION

The intent of this photo was to capture one last image of flow visualization. The goal of this particular image was to capture a morning like dew on different flower types. In the final image a pink daisy was used to show the effects of a superhydrophobic adhesive surface.

II. FLOW APPARATUS

Water has a few main properties and two of them are adhesion and cohesion. Adhesion is trait that water is attracted to other substances and cohesion refers to water being attracted to itself. Cohesion allows for the water to form droplets which is what we see on the flower in the image. The high surface tension creates the dome like shape of the drop. The bipolar nature of water molecules made the smaller drops of water on the petals attracted to the larger groups forming larger and larger drops on the petals.¹

Flower petals are known to have superhydrophobic adhesive surfaces. Up close the petals have projections which are known as micropapilla. These structures allow the flowers petals to have enough roughness for water to adhere even when the flower is tilted or upside down.² The wetting and adhesion mechanism on a superhydrophobic adhesive surface occurs; air gets trapped between the hydrophobic surface and the water sitting on top. This allows for the water to be anchored to the surface of the petal.³ In the image some trapped air can be seen in the individual water droplets.

III. VISUALIZATION TECHNIQUE

This image was captured using natural diffuse lighting, a cloudy day. By taking the entire set up outside the cloudy day offered the perfect amount of lighting to capture the detail of the water droplets on the petals. With enough lighting the ISO was set low. In the schematic a yellow orchid plant was used but other flowers were used in order to get the picture. In order to simulate dew a spray bottle was filled with water and water was sprayed onto the flower petals. Some flowers proved to be more hydrophobic than others and the water droplets would roll right off the petals. The daisy worked perfectly having just the right amount of adhesive

¹ "Adhesion and Cohesion of Water." *Adhesion and Cohesion Water Properties, USGS Water Science School*. U.S. Geological Survey, n.d. Web. 16 Apr. 2014.

² Feng, L. *et al.* Petal effect: A superhydrophobic state with high adhesive force. *Langmuir* **24**, 4114–4119 (2008).

³ Hannu Teisala, Mikko Tuominen, and Jurkka Kuusipalo, "Adhesion Mechanism of Water Droplets on Hierarchically Rough Superhydrophobic Rose Petal Surface," *Journal of Nanomaterials*, vol. 2011, Article ID 818707, 6 pages, 2011. doi:10.1155/2011/818707

membrane properties. Once the flower had the perfect amount of dew it was placed either in a vase to hold it up or an assistant helped hold the flower in front of the white poster board.

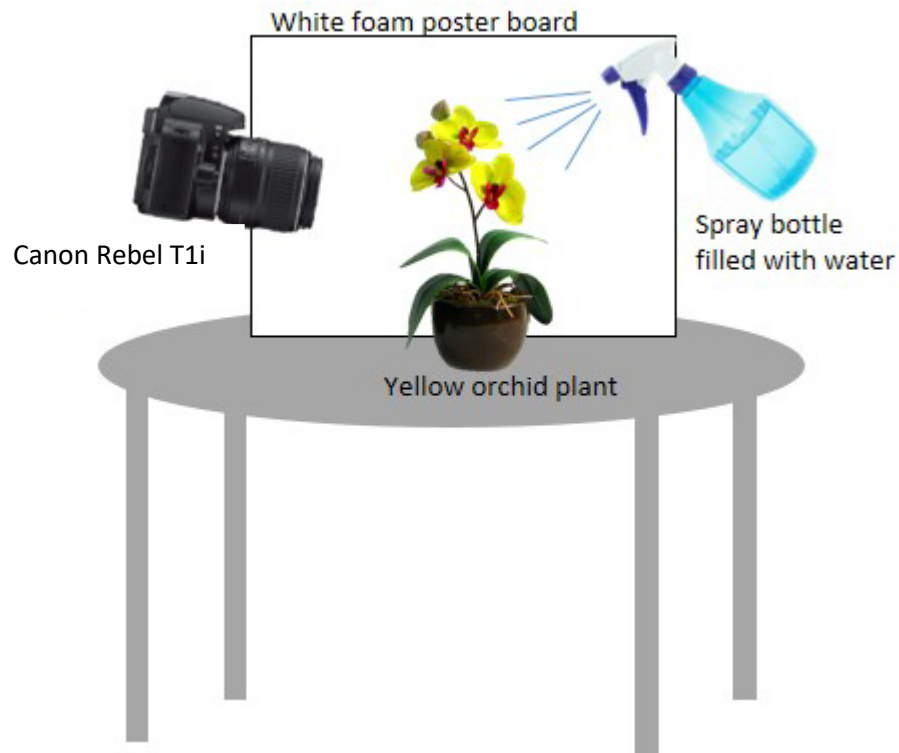


Figure 1: Flower Dew Image Set-up

In order to accentuate the dew drops many different angles were experimented with. The final image was taken from the side in order to focus on the outermost droplets on the flower petals.

IV. PHOTOGRAPHIC TECHNIQUE

The dew on the daisy was captured using a Canon EOS Rebel T1i was used with a Canon EF-S 18-55mm f/3.5-5.6 IS lens. This image was captured at f4.5 with a shutter speed of 1/50 of a second. The ISO value was set to 125 to capture, in full detail, the dew drops on the flower. The focal length was 36 mm allowing for the lens to be super close to the flower but still remaining in focus. The small aperture value allowed the image to have a very distinct focus on the dew drops in the foreground of the photo. The image size is 4,752 x 3,168 pixels. With no post processing the final image is what was originally shot.

V. IMAGE ANALYSIS

What was interesting about this was discovering that different flower petals were more adhesive than others but all the flower petals were hydrophobic. The image focus highlighted the dew but it would have been interesting to capture the dew with the reflection of the flower in it. Despite a few tries the flower reflection in the dew was unsuccessful but trying to reflect other flowers in larger dew drops might be more successful.