Fall 2018 Get Wet Coffee Dripper Report

MCEN: 4151

By
Garrett Gerchar

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INTRODUCTION

The Fall 2018 get wet image is a chance for students to get there first experience in photographing fluid flows. This can be taken in any direction the student see's fit. This image is of a Chemex Coffee Dripper, and the capturing of the fluid drip as well as the carbon dioxide release from coffee brewing process. With the technology used in this experiment it was hard to focus in on the fluid drip, whereas the carbon release was easy to capture in the bubbles formed on the surface of the coffee. This experiment's main purpose is to examine the carbon release in the coffee brewing process of a Chemex.

SETUP, PROCEDURE, AND FLOW

Setup for this experiment was a Chemex Coffee dripper. Step one is to bring water to a boil in a container that has a long skinny spout for precise pouring. Next ground about 44 grams of medium roast coffee to a medium-coarse grind, about the size of a grain of salt. Place a Chemex square filter in the Chemex and wet it with cold water to create a seal between the filter and the edge of the Chemex, then place coffee grounds in the filter Chemex combo. Place setup on a scale and tare scale to read zero with the Chemex filter, grounds combo on it. Begin pouring coffee onto grounds in a circular motion from outside towards the center till the scale reads 150 grams. Allow coffee to sit for 50 seconds, this allows the coffee to "bloom" (a preliminary release of CO2). After bloom is complete do a second pour of coffee again in a spiral motion bringing the total weight on the scale to 450 grams. Allow coffee to brew for another 50 seconds and do a final pour bringing total weight up to 750 grams. As the final pour drains through the grounds and filter into the bottom of the Chemex prepare to take your photo using a Nikon J1 with 10-30 1 Nikkor lens. Place lens against edge of Chemex and using a focal length of 11.4 and exposure of 3.5. Use manual focus mode to focus on stream of coffee dripping into the Chemex and snap picture. Refer to figure 1 for setup.

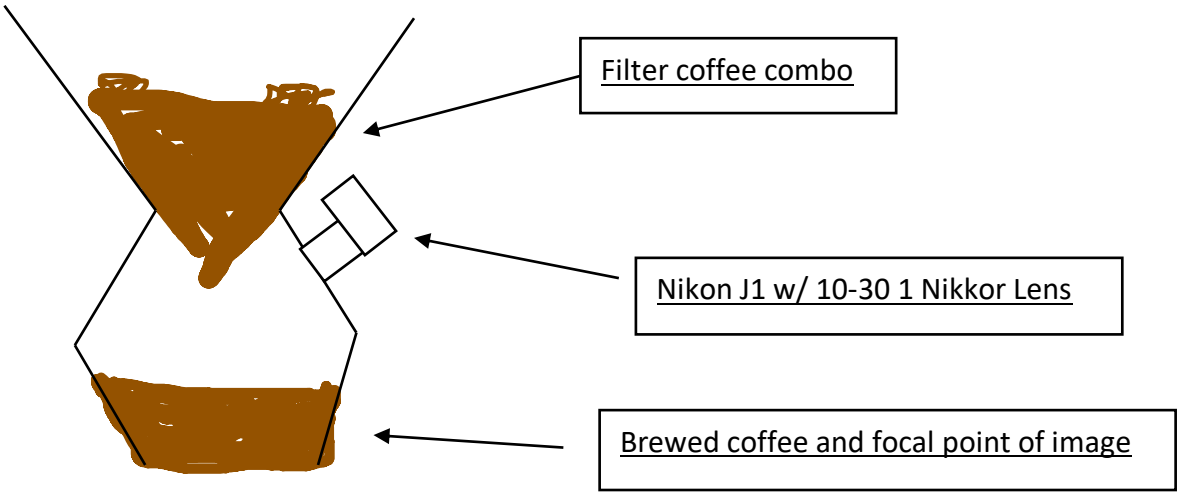

Figure 1: Basic Coffee Brewing and Photo Setup

Figure 2: Raw Image Taken

The flow visualized in figure 2 is that of a fluid drip caused by gravity as it is pushed through a filter and undergone a brewing process, which is a form of extracting the compounds found in coffee into a liquid form. The most common compounds found in a coffee bean are, polysaccharides, proteins, lipids and minerals. When a coffee bean is roasted, the sugars or polysaccharides and amino acids perform a profusion, under the Maillard reaction. During this reaction CO2 is also introduced into the bean to resist oxidation and prolong the shelf life of the beans. These are extracted through the brewing process, the first pour we did in the experiment releases a majority of this CO2 however due to the introduction of heat and the open container of the Chemex. However, some of the CO2 is captured in the fluid as it travels through the coffee grounds and filter into the bottom of the Chemex where it is released as the bubbles we see forming on the surface of fluid container. We also can see the fluid flowing from the bottom of the filter into the carafe, this flow is accelerated by gravity, but is a secondary flow phenomenon to the main objective of the experiment.

VISUALIZATION AND LIGHTING TECHNIQUE

In this experiment we used a basic Chemex coffee dripper to visualize the CO2 release in coffee brewing. We used a 6 cup Chemex, with a Chemex brand natural square filter. Our coffee was Hub roasters Peru roast, ground to a medium coarse grind with an OXO electric coffee grinder. We used an OXO kitchen scale to measure water added. We finished our experiment with 750 grams of tap water with three pours, one of 150 grams and two 300 gram pours. For a ratio of 44 grams of coffee to 750 grams of water. This setup yields a slightly lighter color coffee for better visualization of the CO2 released in the brewing process. Lighting for the shot was a florescent bulb 8 feet above experimental setup and 1 foot to the right. This is the visualization and lighting used in this experiment to view Carbon dioxide release in coffee brewing.

PHOTOGRAPHING TECHNIQUE

This experiment was photographing the fluid phenomenon found coffee brewing where there is a release of CO2 as the coffee is brewed. Figure 1 shows the basic photo setup where the camera is placed directly on the Chemex edge. Figure 2 gives the unedited raw image this particular image has a field of view of 5 1/8th inch diameter, which is the diameter of the Chemex showing the entire brewed coffee and its release of CO2 along the surface. The camera used in

this experiment is a Nikon J1 mirrorless camera with a 10-30 1 Nikkor lens, which has a focal length of 10-30mm and aperture of 3.5-16. The image was taken with a focal length of 11.4, aperture of 3.5, and an exposure time of 1/30. After the raw image was captured the photo was post processed in adobe photo shop using the curves tool to bring make the dark pixels darker and lighter pictures lighter. The final result of post processing can be seen in Figure 3.

Figure 3: Final Published Image

IMAGE AND CONCLSUION

This image clearly shows the CO2 release found in coffee brewing with the bubbles forming on the surface of the liquid. This image was challenging to capture through an enclosed carafe due to the steam and condensation occurring from the heat of the liquid coffee. To better improve this experiment, use of split-level coffee dripper could be implemented to eliminate condensation, as well as a clear focus on the bubbles forming on the surface, versus a split between fluid drip and CO2 release. How does the CO2 get trapped within the liquid as is it travels through a paper filter?

REFRENCES

"Coffee Chemistry Made Simple: A Look At What Happens Inside The Bean." Accessed October 1, 2018. https://handground.com/grind/the-chemistry-of-grinding-coffee-beans