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Image 1: Get Wet

MCEN 4151

Fire Power

This image displays the phenomenon of powdered coffee creamer rapidly combusting. It was taken for the first photography assignment, titled “Get Wet”. The purpose of this assignment was to introduce the students to basic photography skills, as well as the use of post-processing techniques to enhance artistic qualities of each photo. *Fire Power* is a display of the interface between a solid igniting into a beautiful ball of fire, however this is not the only fluid interface present in the non-dairy coffee creamer phenomenon. The other fluid interface that can be observed is the driving force of the reaction, non-creamer particles in solid form mixing with oxygen present in the atmosphere. This paper will delve deeper into explaining this phenomenon, as well as the testing procedures required for reproduction.

In order to replicate the phenomenon captured in *Fire Power*, one must first obtain the essential components of the experiment. These components include powdered non-dairy coffee creamer, a propane torch, a cup, and all safety equipment stated in the *Combustion Experiment Guidelines*. Figure 1 details the physical setup of the experiment, where the coffee creamer is simply poured on the flame of a propane torch. The distance between the cup and torch should be around 6 inches, making safety gloves and goggles essential for safe photo reproduction. A plastic cup should be filled about a quarter of the way with coffee creamer, and then quickly poured out, onto the propane torch flame.

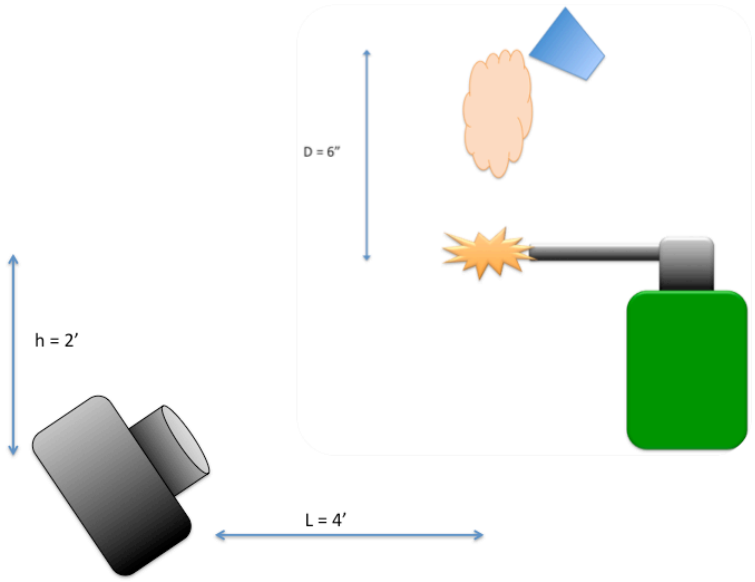

Figure 1 : Experimental Setup

In order to capture the fullness of the image, a Pentax K100D Super camera was used on very specific settings. Since the burst of fire was violent and short-lived, an exposure time of 1/125 was used in combination with an f-stop of f/8. The ISO was then set to 200, for a crisp picture that could convey each flame in the appropriate way. A focal length of 33 mm, and 0 EV exposure compensation, along with a custom white balance set in a lit area helped bring out the color of the image. This method of capturing fire has become popular with many film producers, as it has multiple uses as well as low production cost for a magnificent flame (*Detonation Films*).

The physics behind *Fire Power* are surprisingly simple, considering the magnificent reaction that is occurring. Following a simple combustion equation where a reactant is exposed to oxygen, producing certain oxides and heat, it is the saturated fat molecules present in the creamer that act as the reactant. When sitting in the cup, the coffee creamer will not combust when exposed to heat. This is due to the low oxygen/reactant ratio present in the coffee creamer. However, when the creamer is poured out, the solid particles

disperse and mix with the oxygen present in the atmosphere. At this point in time, the surface area of the creamer particles is perfect for combustion, as well as the amount of oxygen needed to burn into a spectacular flame (*Mad Physics*). The fat molecules within the creamer ignite, and the rapid combustion begins.

Fire Power is an excellent representation of this solid to flame phenomenon, as small particles can be seen streaking through the center of the image. These particles are burning clumps of coffee creamer falling down and the flame accelerates upwards. The image has been altered in a way that highlights the artistic qualities shown in the coffee creamer combustion. The post processing includes cropping and rotating the picture 180o to make the viewer believe that the fire is "falling up". The exposure, contrast, and saturation were all slightly reduced, darkening the background to black and increasing the orange/red colors of the image. With its large base and daunting flames, the photo imparts a feeling of overwhelming power to the viewer. This emotional experience is heightened once the viewer takes in the details of the image, as the burning creamer particles seem to explode upwards.

References:

"Detonation Films." *Detonation Films Presents*. Web. 08 Feb. 2012. <http://www.detonationfilms.com/Fireball_demo.htm>.

"Mad Physics :: Non Dairy Creamer Free Radicals." *Mad Physics :: Non Dairy Creamer Free Radicals*. Web. 08 Feb. 2012. <http://www.madphysics.com/exp/non_dairy_creamer_free_radical.htm>.

"Non-Dairy Coffee Creamer = Rocket Fuel." *Non-Dairy Coffee Creamer = Rocket Fuel*. Web. 08 Feb. 2012. <http://www.diabetesforums.com/forum/dieting-and-nutrition-diabetes/53433-non-dairy-coffee-creamer.html>.