Adding Surfactants, Such As Dish Soap, Shampoo, and Shaving Cream to Mint Mentos In Diet Coke Increases Mentos Eruption Height By 31%

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Summary:

In this experiment, the effect of surfactants on the height of a mentos eruption was investigated. A surfactant is a substance that tends to reduce the surface tension of a liquid in which it is dissolved; the one's used in this experiment were dish soap, shampoo, and shaving cream. Previous research, conducted by Carly C. and Jenn A., has found that the non-coated mentos had the shortest height compared to the coated mentos (dish soap).[1] The average eruption height of five mint mentos, without surfactants, was 284 cm. when added to a 1.25 liter bottle of coke. In this experiment we added 3 very common surfactants including dish soap, shaving cream, and shampoo. The average height for these surfactants were, 307 cm. for dish soap, 366 cm. for shampoo, and 455 cm. for shaving cream. We then did the experiment again but changed the control group to only 3 mentos and a 16oz bottle. The average eruption height of the control group without surfactants in this experiment was 76 cm. The average eruption height for the three surfactants with 3 mentos added were, 102 cm. for dish soap, 81 cm. for shampoo, and 89 cm. for shaving cream. This may have to do with the surfactants' physical change it undergoes with the coke, added with the reactibility of the mentos. Surfactants such as shampoo, shaving cream, and dish soap, lower the surface tension between substances. Therefore, since the reaction of the mento and coke is caused by the tiny pores and and low surface tension, these surfactants will help this reaction reach full potential which was the main focus of this experiment.

Introduction:

A mentos eruption occurs when mentos mint are added to soda. According to a study conducted by Professor Tonya Coffey, the caffeine within the diet coke has very little effect on the eruption, but the ingredients potassium benzoate and aspartame do, which are both surfactants.[2] Matt F. And Alex M. found, as one might expect, that the height of a mentos eruption is roughly proportional to the number of mentos used.[3] Interestingly, Erin M. and Barbara S. found that the stream height increased slightly when aspartame was added with mentos. To see more of this group's trials, refer to the corresponding report.[4] Surfactants are known to reduce surface tension and therefore are likely to increase the height of a mentos eruption[4], this was the focus of this study.

Materials:

- 4 to 5 packs of Mint Mentos
- Eight 16 oz. diet cokes and Eight 1.25 Liter bottles of Diet Coke
- Towels
- Geyser tube (Make sure all attachments/parts are correctly on the geyser tube)[6]
- Meter stick(s) or similar device capable of measuring heights up to four meters
- Paper and writing utensil to record data
- Digital recording device
- Stopwatch for a constant delay time
- Shaving Cream

- Shampoo
- Dishwasher Soap

All three additives will be used

Procedure:

1. Set-up the experiment by setting down the towels flat on the ground.
2. Place a diet coke on the towels.
3. Prepare the geyser tube[6] by putting in 5 mentos and sealing the cap of the geyser tube, being careful not to accidentally pull the pin on the side. After each trial, the geyser tube should be thoroughly cleaned with water and dried.
4. Carefully open the coke, and quickly screw on the geyser tube. The time allowed for this is 20 seconds.
5. Pull the pin once it has been 20 seconds, and get out of the way. Record the actual eruption with a video-taking device and record the data and observations.
6. Repeat steps 2-5 for the three other groups of 5 mentos, but add a different surfactant to the geyser tube along with the mentos by coating them with your fingers.
7. Repeat the experiment, but with 3 mentos and the surfactants in the geyser tube. At the end, there should be a total of eight trials.
8. Clean up the experimental area using proper clean-up procedures.

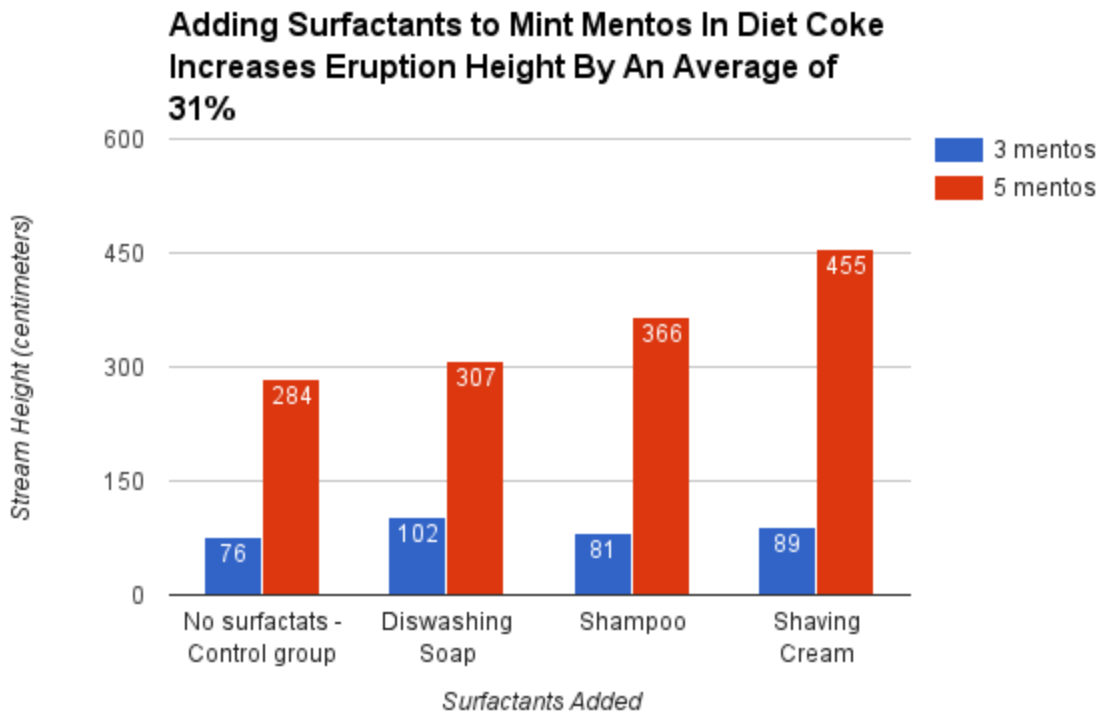
Safety:

There should absolutely be total concentration while conducting this experiment. Any horseplay or "messing around" could cause series consequences, such as injuries to peers or experiment viewers. Use prudent lab safety practices in order to make sure none of these occurrences happen.

Results:

Height of Eruption Stream (Centimeters)

Number of Mentos used	Eruption without surfactants : Control group	Eruption with dishwashing soap	Eruption with shampoo	Eruption with shaving cream
3	76 cm.	102 cm.	81 cm.	89 cm.
5	284 cm.	307 cm.	366 cm.	455 cm.



The very first trial that was conducted was the control group (no surfactants) for the 3 mentos. The eruption height was 76 cm. After setting this as the control group, the second trial, with the dishwashing soap, had a stream height of 102 cm. The next trial was with the shampoo, and being the less productive out of the other surfactants, only had an eruption height of 81 cm. The last trial for the 3 mentos group was with the shaving cream additive. This went 89 cm. high when erupted.

The 5 mentos had overall larger heights because of the increase in mentos used. The control group trial had an eruption height of 283 cm. When adding the dishwashing soap surfactant to the eruption, the stream height increased to 306 cm. The third trial for the 5 mentos group was with the shampoo, which erupted to the height of 365 cm. The final trial that was conducted was the 5 mentos with the shaving cream. This eruption had a staggering stream height of 453 cm.

Conclusion:

In conclusion, all the surfactants increased the eruption height. The surfactant that had the overall best effect on this experiment was the shaving cream. The average eruption height with surfactants added was about 31% higher that with no added surfactants. Within the data collected, it was noticed that the surfactants used in all groups increased the stream height significantly. This is shown within all trials. For instance, after concluding that the control group for the 5 mentos was 284 cm., the group added shaving cream. The eruption height for this trial was 455 cm., 170 cm. more than the control. This trial is very important because it provides a possible explanation as to how the surfactants affect the mentos eruption. It is clearly shown within the collected data. Also, the previous study done by Tonya Coffey suggests a deeper explanation for this increase in height.[2] Coffey stated that the reaction between the coke and the mentos is because of the two ingredients, potassium benzoate and aspartame. This is what causes the physical reaction between the two substances. It can be proved that the surfactants used in this experiment increased the stream height. The theory behind this physical reaction is that every mento has thousands of small pores on the surface of it which disrupt the the attractions between water molecules, creating thousands of nucleation spots for gas to gather up and rise out of the pores. Also, in Erin M. and Barbara S.'s study, aspartame was added which is also a surfactant, they had similar increasing results in stream height, ultimately proving the validity of our experiment.[4] A Follow-up experiment can be conducted in order to expand the variety of the data. One of these experiments could be to find a very powerful surfactant that decreases surface tension considerably, then test the see how much higher the eruption goes than the control with this surfactant added. This would go even more in-depth with the previous

study and prove the effectiveness of the surfactants with the different stimulant ingredients. Overall the group who conducted the experiment felt extremely confident with the data recorded and collected.

Endnotes:

1. How the coatings of mentos affects the size of the mentos eruption. Carly C and Jenn A, The Guilford Journal of Chemistry, volume 1 (2007).
2. Diet Coke and Mentos: What is really behind this physical reaction? Coffey, T.S., American Journal of Physics, Volume 76, pp. 551-557 (2008).
3. How the amount of of mentos affects the height of the mentos eruption. Matt F and Alex M, The Guilford Journal of Chemistry, volume 2 (2008).
4. Mentos eruptions increase over ten percent when four packets of aspartame are added. Erin M and Barbara S, The Guilford Journal of Chemistry, volume 4 (2010)
5. Mentos review article: the effect of nucleation sites on mentos. Caleb F, The Guilford Journal of Chemistry, volume 3 (2009).
6. Can be aquired on Amazon at www.amazon.com