WHAT LIQUIDS DO ALKA-SELTZER TABLETS CREATE THE MOST GAS WITH?

Justin Stone
Cary Academy.

ABSTRACT

The purpose of this study was to determine which way that an Alka-Seltzer tablet creates the most gas. There are many experiments similar to this one such as measuring how much time it took for the Alka-Seltzer tablet to dissolve in different amounts and different types of liquids. An Alka-Seltzer tablet was put into different amounts of water to see how much gas was produced by measuring the diameter of the balloon. The Alka-Seltzer tablet created the most gas in less water and the hypothesis was incorrect. This is because the less water there is this means that there is less water for the gas to travel through because the Alka-Seltzer tablet sinks to the bottom.

INTRODUCTION

Alka-Seltzer tablets fizz and create gas and air when put in the water. This is because Alka-Seltzer tablets have aspirin, citric acid and sodium bicarbonate (baking soda). When put into the water the sodium bicarbonate (baking soda) reacts with the citric acid and this causes foam and bubbles which are made out of carbon dioxide. This same reaction happens when baking soda and vinegar are mixed. This is because vinegar is an acid and baking soda is the sodium bicarbonate. The white foam is the same as the baking soda just not as significant of a reaction.

An experiment that is similar to this one is the temperature affecting the rate of the reaction. This experiment is similar because in the experiment it is simply measuring the rate. The temperature was being changed and the rate was changing with the temperature (example- 2 (cm) per second). This experiment would have been harder but definitely interesting to see the results. Another experiment is an experiment where the height of Alka-Seltzer rocket ship was measured depending on how much water is filled in the canister. This experiment was conducted similar because it was conducted with an object that was trying to be moved. This is also different because in the experiment measuring how far the car went, it wasn't just adding water it was changing what liquid/sodium carbonate was in the water.

Another experiment that was conducted from a student at Cary Academy middle school was testing to see if the different type of soda (Sprite, Seven up and Ginger-ale) including water for the independent variable would change the time that the Alka-Seltzer tablet was dissolved. This experiment showed that the water dissolved the tablet the fastest at 66 sec. The data also showed that the Ginger-ale also dissolved the tablet fastest out of the sodas and this is because it has the highest acidic level out of the sodas. Coleman's scientific theory of his results was that the more acidic drink dissolved the fastest.

Coleman Mitchel conducted another experiment trying to see if the number of Alka-Seltzer tablets depends on the dissolve time. This experiment shows that one tablet takes the longest to dissolve
and then two tablets goes actually takes the shortest amount of time and three tablets is just a little shorter than one tablet. Coleman claims that this happened because when there are two tablets it is the perfect amount not taking up too much room but when there are three tablets it takes up room and is causing them to take longer to dissolve.

Another experiment done by Coleman Mitchel was testing to see if the different amounts of water affected how long it took the Alka-Seltzer tablet to dissolve. This experiment is similar to the one conducted for this project because instead of measuring how much gas was produced it was testing how long it took for the Alka-Seltzer tablet to dissolve. The data on his graph shows that the less amount of water the longer it took for the Alka-Seltzer tablet to dissolve. This is interesting because it is very similar to the experiment conducted in this experiment and it shows that the Alka-Seltzer tablet took longer to dissolve meaning it had more time to produce gas. Coleman notices that the different amount of water doesn’t affect how much the Alka-Seltzer tablet gets dissolve but a very small decrease in the data.

What exactly is an acid? An acid can be very powerful, so powerful that it can burn through metal, but the acids used in these experiments are not harmful. An acid is usually a little sour or bitter tasting. An acid is usually measured on a PH scale, anything under a 7 on the PH scale is considered acidic, anything over a 7 is a base but no bases were used in these experiments.

A PH scale is how acids and bases are measured. PH stands for Potential of Hydrogen, and seven on the PH scale is a neutral object anything under a seven is an acid anything over a seven is a base. Some acids are very powerful and strong and it would not be safe to work with them, some of the acids can burn and penetrate skin, melt metal, and is overall very dangerous. But the acids used for this experiment are not harmful and are very safe to work with. Here is a simple PH scale of different solids and liquids. The PH scale shows that the battery acid is a very powerful acid at one on the scale but wine is only at 4 or 5. A piece of specialized paper can be dipped in to a liquid and will change to one of these colors and if the PH chart is used the liquid can be clarified as an acid, base or a neutral object.

MATERIALS AND METHODS

Baking soda, vinegar, tape measurer, Gatorade bottle, small water bottle, large water bottle, toy car, balloons, Alka-Seltzer tablets, hot pad, beaker, lemon juice and tape were used in these experiments.
In the first experiment a Gatorade bottle was used to put different amounts of water in 25 (ml), 50 ml, 100 (ml) and 400 (ml)). An Alka-Seltzer tablet was put into the balloon and was slipped over the top of the Gatorade bottle. Then the diameter of the balloon in (cm) was measured and this process was repeated three times and an average was taken.

For the second experiment different amounts of lemon juice 50(ml), 100 (ml), 150 (ml), 200 (ml) and 300 (ml) were put into the balloon and slipped over the Gatorade bottle (as done in the first experiment). Then the diameter of the balloon was measured in (cm) and the process was repeated three times and an average was taken.

As the third experiment different amounts of vinegar was in the water 15 (ml) 25 (ml), 50 (ml), 100 (ml), 200 (ml) and 300 (ml) while 10 teaspoons of baking soda was put into the balloon along with the Alka-Seltzer. Then the diameter of the balloon was measured in (cm) and this was done three times and an average was taken.

In the fourth experiment the water was put at different temperatures 20 c, 30 c, 40 c, 60 c, 80 c and 100 c and put into the Gatorade bottle along with the Alka-Seltzer tablets as done in the first experiments. This experiment was done with 200 (ml) of water in the Gatorade bottle. This was done three times and an average was taken.

As the fifth experiment different sized bottles, big water bottle (500 (ml)), normal Gatorade bottle (375 (ml) and a small water bottle (200 (ml) were filled to the top and had one Alka-Seltzer tablet inserted into the bottle with a balloon and the diameter was measured in (cm). This was done three times and an average was taken.

For the sixth experiment the normal sized Gatorade bottle was taped to the back of a car and different types of liquid (vinegar and baking soda, lemon juice and water) was put into the bottle and an Alka-Seltzer tablet was put into balloon and pulled over the bottle. Gas was produced and pushed the car forward and how far the car went was measured in (cm). This was done three times and an average was taken.
RESULTS AND DISCUSSION

First experiment- These results show that the least amount of water in the bottle creates the most gas. This is because the Alka-Seltzer tablet does not float and sinks to the bottom. Water is much heavier and thicker than air so when the Alka-Seltzer tablet is at the bottom the air has more water to go through. The longer that the air is underwater some of it starts to fade away creating less air that is able to get out and into the balloon. The hypothesis was not correct for this experiment because it was thought to be that the Alka-Seltzer tablets floated and the more water would bring the tablet closer to the balloon and but this was incorrect.
Second experiment (graph on other page) –

This experiment was done with different amounts of lemon juice. This graph shows that the more lemon juice that was in the bottle creates more air. At the beginning the graph is decreasing just as the first experiment but at around 175 (ml) of water the air in the balloon raises by 5 (cm). This is because the lemon juice created a lot of fizz, because lemon juice is very acidic. The fizz didn’t reach the balloon until the water was high enough. Soon at 175 (ml) of lemon juice the fizz was able to reach the balloon and cause more air to be made and some fizz actually got into the balloon. When the balloon was taken out a lot of fizz spilled out onto the table and this is a sign that it was able to get into the balloon. The hypothesis for this experiment was not correct, it was suspected that the same thing would happen that happened in the first experiment but was incorrect.
Third experiment-

This experiment was conducted with ten teaspoons of baking soda with different amounts of vinegar in the bottle. This experiment shows the exact opposite of what happened in the first experiment. The baking soda and vinegar did not create much gas because the balloon didn’t get very big until the fizz got to the top of the bottle. The fizz was the only reason the balloon blew up so much. So much fizz got in the balloon that the bottle almost fell off the table because of the weight of it. The fizz would rise at a rate of almost 3 (cm) per second. At first the balloon was small, small… small… then the fizz hit the balloon and boom! The balloon was huge. The size of the balloon when there was 300 (ml) of vinegar, the balloon blew up to almost 60 (cm) and that is about as much air that an adult can blow in three or four big puffs. The hypothesis for this experiment was correct because it was already known that the more vinegar the more fizz is creating making more gas.

Figure 3- This shows the diameter of the balloon when different amounts of vinegar were added to the bottle and every time ten scoops of baking soda were added.
Fourth experiment-

This experiment was done with a hot pad heating the water at different temperatures. This experiment did not go as expected. Nothing really happened until the water got over 100 °C. This was because it was boiling and boiling was causing bubbles to come out of the water which were popping and sending small amounts of gas up to the balloon. Even though it looks as if there is a big spike in the data there is not because the diameter of the balloon was only affected by 2 cm which isn’t much. The hypothesis for this experiment was correct that the hot water would create the most gas to fill up the balloon.
Fifth experiment- (graph shown above)

For this experiment three different sized bottles with the same diameter were tested to see if the height and shape affected the diameter of the balloon. The data shows that the 500 (ml) volumes (the big water bottle) had the biggest diameter of 16 (cm). This happened because the bottles where all the same diameter but the taller one had more space for the air to expand but the smaller one the air got trapped and was very compacted so not as much air could enter into the balloon. The hypothesis was not correct, the hypothesis said that the small bottle would create the least and the middle bottle would create the most. This is because it was thought that the bottle was so tall that the Alka-Seltzer tablet would have to travel really far to get to the top where the balloon is (the bottle was filled all the way to the top).
This chart shows how far a car moved with different liquids.

6th experiment (graph shown above) –

This experiment was conducted with a small water bottle taped to the back of a car. The data above shows that the baking soda and vinegar moved the car the most at 30 (cm). This was a surprising result because the hypothesis said that the lemon juice would move the car the most. This was suspected because the baking soda and vinegar created a lot of fizz which is heavy and would weigh the balloon down but in a surprising matter the baking soda and vinegar had created enough air to push the car. As in the introduction the baking soda and vinegar is the same thing as the Alka-Seltzer tablets but much more significant therefor causing the car to move farther because of the amount of gas created.
CONCLUSION

The data shows that the baking soda and vinegar produced the most air. The Alka-Seltzer tablet is the same as baking soda and vinegar mix but the baking soda and vinegar is much more significant creating more fizz, more mess and more gas and this is why it is popular for lots of experiments. This can be helpful because people can become sick and the tablet can be very successful if the right liquid is used. The Hypothesis was not correct for the first and last experiment, the first experiment it was thought that the more water that is put into the bottle creates more gas, but was found to be the opposite, same as the last experiment, it was thought that the lemon juice would move the car the most, then Alka-Seltzer tablet and the baking soda and vinegar would move the car the least because of its weight. Some experiments that could be done in the future are measuring the time that it takes for the Alka-Seltzer tablet or measuring what liquid has the biggest effect on how the tablet works on a sore throat.

CITATIONS


<http://acswebcontent.acs.org/iycit/booklets/L1_AlkaSeltzer.pdf>.