

SCIENCE LAB: SWIMMING RAISINS

Problem: Do raisins float faster in solutions made up of water and baking soda with more or less vinegar?

Research:

- Baking soda is NaHCO_3
- Vinegar is $\text{C}_2\text{H}_4\text{O}_2$
- Baking soda is also known as Sodium Bicarbonate
- Vinegar is also known as acetic acid
- When baking soda is added to a vinegar solution, it causes gas to form; a chemical reaction takes place
- The five indicators of a chemical reaction are: gas, change in temperature, change in color, change in odor, and a precipitate.
- A chemical reaction is when atoms separate, come together, or rearrange to form new substances with new properties
- The reaction between vinegar and baking soda produces the products of carbon dioxide gas, water, sodium, and acetate ions
- Acetate ions are ions formed by removing the acidic hydrogen from acetic acid, or baking soda.
- It is the carbon dioxide gas that causes the gas bubbles to form; it is these gas bubbles that take make the raisins float.
- The gas bubbles are less dense than the vinegar and will float to the top.

Hypothesis: I believe the raisins in the solution with the least vinegar will have the fastest floating time.

IV- Amount of vinegar added to each solution

DV- Time it takes each raisin to float (in seconds)

Materials:

- 3 large glass jars (example: empty peanut butter jar)
- 3 cups of vinegar
- 6 tablespoons of baking soda
- 12 raisins
- Water

- Timer

Methods:

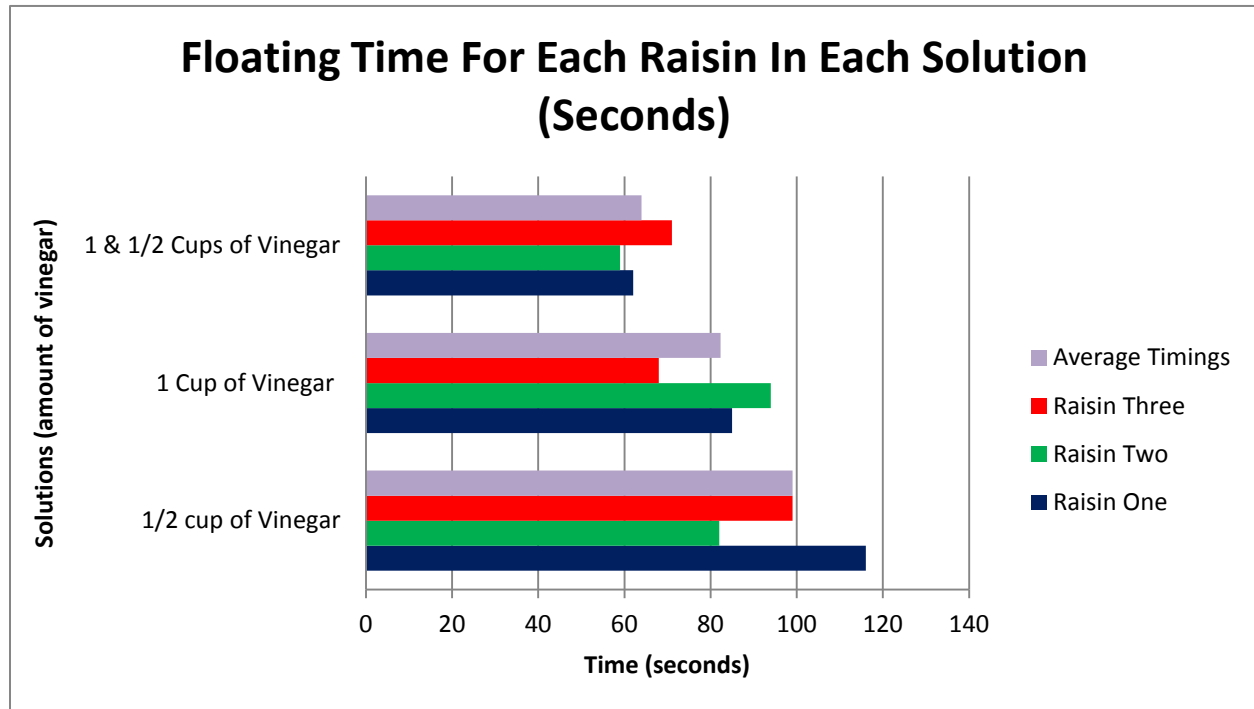
1. Fill one quarter of the jar with $\frac{1}{2}$ cup of vinegar and top up with the water.
2. Stir the solution with a spoon, and add 2 tablespoons of baking soda and stir.
3. Wait for a few minutes until bubbles start to form.
4. Drop in 3 raisins, one at a time, and record the time it took each raisin to float to the top.
5. Next, get the next jar and fill it up with 1 cup of vinegar and top with water.
6. Repeat steps 2 to 4; record timings of each raisin.
7. Get the last jar, and add 1 and $\frac{1}{2}$ cups of vinegar; top with water.
8. Repeat steps 2 to 4, while recording timing of the raisins.
9. Find overall average timing of raisins for each jar.

	Raisin One	Raisin Two	Raisin Three	Average Timing (3 Raisins)
Solution with $\frac{1}{2}$ cup of Vinegar	116 seconds	82 seconds	99 seconds	99 seconds
Solution with 1 cup of Vinegar	85 seconds	94 seconds	68 seconds	82.3 seconds

Solution with 1 and ½ cups of vinegar	62 seconds	59 seconds	71 seconds	64 seconds
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Data Table:

Graph:



Analysis:

In this graph, it shows the floating timings for each raisin in each different solution. There are three solutions, and each solution contains a different amount of vinegar. For each of the three raisins, the solution that contains 1 and ½ cups of vinegar almost always has the fastest floating time. For the average times, the solution of ½ cup of vinegar has the slowest floating time, and the solution of 1 and ½ cups of vinegar has the fastest floating time.

Conclusion:

Claim: The raisins in the solution with the most vinegar will have the fastest floating time.

Reasoning: In the experiment, I had three different solutions each with different amounts of vinegar. After making the solution, I dropped three raisins in the solution and timed how long it took each raisin to float; then, I calculated the timings for the average time of each solution. For my first solution, which contained ½ cup of vinegar, the average time it took all raisins to float was 99 seconds, or 1 minute and 39 seconds. Next, for my second solution, which contained 1 cup of vinegar, the average time was 82.3 seconds, or one minute and 22 seconds. Finally, for my last solution, the average timing was 64 seconds, or one minute and four seconds; this solution contained 1 and ½ cups of vinegar.

Reasoning: My claim was that the raisins in the solution with the most vinegar will have the fastest floating time; this was proven true in the experiment. According to the research I found, the reaction between vinegar and baking soda produces the products of carbon dioxide gas, water, sodium, and acetate ions; it is the carbon dioxide gas that is the gas, and these gas bubbles make the raisins float. Furthermore, if the solution and/or chemical reaction of vinegar and baking soda was not taking place, more vinegar was to be added. This was proven true in my lab. This is because when I added more vinegar to my solution of water and then baking soda, the time it took each raisin to float to the top became faster. However, there are also uncontrollable variables in every project; for example, in my project, I could have dropped in the raisins differently or at different times during my experiment. For instance, raisin two in the 2nd solution floated slower than in the first solution. Unfortunately, this is something we cannot control, therefore it is deemed as uncontrollable. Also, from my research, I understood because the gas bubbles are less dense than the overall vinegar solution itself, the gas would rise to the top, taking the raisins along with them. In addition, the experiment could also vary, depending on the type of raisins you use; since I used the same type and brand of raisins, it was okay. All in all, from this experiment, I learned that the amount of vinegar added to a solution of water and baking soda affects the amount of time it takes a raisin to float. Raisins in solutions with more vinegar will have a faster floating time, as opposed to raisins in solutions with less vinegar.

Citations:

- "Rocketology: Baking Soda Vinegar = Lift Off!" *Rocketology: Baking Soda Vinegar = Lift Off!* N.p., n.d. Web. 15 Apr. 2013.
- *Chemistry of Baking Ingredients 1: How Much Baking Powder do Quick Breads Need?* n.d. Web. 14 April 2013. <http://www.sciencebuddies.org/science-fair-projects/project_ideas/FoodSci_p007.shtml?fave=no&isb=c2lkOjEsaWE6Rm9vZFNjaSxwOjEscmlkOjExNDk2MjI3&from=TSW>.
- *A Tale of Vinegar and Hard Water.* n.d. Web. 14 April 2013. <<http://www.humantouchofchemistry.com/a-tale-of-vinegar-and-hard-water.htm>>.
- *Inquiry in Action: Chemical Change.* n.d. Web. 14 April 2013. <http://www.inquiryinaction.org/chemistryreview/chemical_change/>.
- *Rocketology: Baking Soda + Vinegar = Liftoff.* n.d. Web. 14 April 2013. <http://www.sciencebuddies.org/science-fair-projects/project_ideas/Chem_p086.shtml?fave=no&isb=c2lkOjEsaWE6Q2h1bSxwOj>.

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