Don't Burst My Bubble!

Which additive makes bubbles last the longest?

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Abstract

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The purpose of this project was to discover which bubble solution additive would make bubbles last the longest. The experiments involved making a basic bubble solution and dividing that solution into nine separate containers (controlled variables). A different ingredient (manipulated variable) was added to each of eight containers and the ninth container without an additive served as a control. Bubbles were blown using each of the nine bubble solutions, and the life of each bubble (responding variable) was timed and recorded in seconds. All of the experiments were done on the same day in August, and each solution was tested ten times.

The data supported my hypothesis that the additive glycerin made bubbles last the longest. The bubbles made with the glycerin solution lasted more than twice as long on average than the bubbles made from any of the other solutions tested.

I discovered that adding glycerin to a bubble solution will make it last longer than other additives and no additive. Glycerin is a hygroscopic substance which is one that holds water and reduces evaporation.

Introduction

I enjoy blowing bubbles in the summer from both homemade and store-bought solutions, and I have noticed that some bubbles last longer than others. I have also observed that bubbles made with soap last longer than bubbles formed in nature in rivers and lakes.

Through reading about bubbles, I learned how water makes bubbles. Under the surface of water, the water molecules are attracted to each other because the two hydrogen atoms of each water molecule are attracted to the one oxygen atom of each nearby water molecule. Where water meets air, the water molecules are only pulled in one direction: back toward the liquid. This makes water have a stretchy skin that is called surface tension. This skin of water can be stretched around air just like a balloon.

Some substances can help bubbles last longer. Soap reduces surface tension which helps the bubble stay formed instead of being pulled back into a puddle of liquid. Hygroscopic substances, like glycerin and sugar, reduce evaporation and hold in water which helps a bubble stay formed.

All of the bubbles formulas that I researched had soap in them. However, there were different additives. I was curious about which additive made bubbles last the longest. I wondered if other substances at my house might be hygroscopic. As a result, I decided to test the following additives: corn syrup, granulated sugar, gelatin, vinegar, rubbing alcohol, lemon juice, glycerin, and liquid fruit pectin.

Based on finding many homemade bubble recipes that included glycerin as an ingredient and the fact that glycerin is a hygroscopic substance, my hypothesis was that adding glycerin to my homemade bubble solution of soap and water would cause my bubbles to last the longest.

Experiments and Summary of Results

Purpose: To determine which additive makes bubbles last the longest.

Materials and Equipment

3.8 liters distilled water
1 liter Dawn dishwashing liquid
45 ml glycerin
45 ml corn syrup
45 ml granulated sugar
45 ml lemon juice
45 ml unflavored gelatin
45 ml vinegar
45 ml rubbing alcohol
45 ml liquid fruit pectin
Extra large mixing bowl
Metric measuring spoons
Metric measuring cups
9 plastic lids from Kroger brand yogurt containers
9 large plastic cups
1 watch with second hand
10 drinking straws

Procedure

1. Prepare the bubble-making solution. Pour 1 liter of Dawn dishwashing liquid in 3.8 liters distilled water. Stir with a drinking straw being careful not to make suds.
2. Pour 250 milliliters of the bubble-making solution into each of the eight plastic cups. Label each cup with one of the following names: glycerin, corn syrup, granulated sugar, lemon juice, gelatin, vinegar, rubbing alcohol, fruit pectin, and control. Add 45 milliliters of each additive to the cup marked with its name (The "control" will have no additive). Stir each solution with separate drinking straws placing the straw used for stirring next to its container of solution. Place a plastic yogurt lid in front of each container of solution.
3. Test each solution one at a time. Measure 15 milliliters of solution into the upside-down yogurt lid. Hold the drinking straw in the center of the thin liquid layer and blow a bubble until it is the same diameter as the cover. Remove the straw and begin timing the number of seconds on the watch. Record the length of time that the bubble lasts. Repeat the experiment nine more times to be sure the results are about the same each time.
4. Repeat the experiment with each of the other eight solutions, testing each solution a total of ten times. Find the average bubble life span for each solution.

Summary of Results

I performed the experiments on August 22, 2004 at the kitchen table in my house. The temperature at the time in my house was 73 degrees Fahrenheit (22.8 degrees Celsius) and the humidity was low.

I made a basic bubble solution of Dawn dishwashing liquid and water. I separated the basic solution into eight cups, and I added the following additives to each cup: lemon juice, granulated sugar, liquid fruit pectin, rubbing alcohol, corn syrup, glycerin, gelatin, and vinegar. I added a ninth cup without any additive to serve as the control. All but two of the solutions looked and felt thin and soapy. However, the corn syrup solution was a thick liquid, and the gelatin solution turned into a solid.

I tested each of the nine bubble mixes tens times by blowing bubbles from small amounts of solution poured into yogurt lids. Because the gelatin solution had turned into a solid, I was unable to blow bubbles. All of the other solutions formed soapy bubbles that stretched across the diameter of the yogurt lid, and I was able to time the number of seconds that each bubble lasted. I calculated an average bubble life for each type of solution that was tested.

The solution that produced the longest-lasting bubbles contained glycerin. The glycerin bubbles lasted

an average of 354.2 seconds. The second longest-lasting bubble solution was the vinegar solution with an average bubble life of 140.1 seconds. The lemon juice was a close third longest-lasting bubble with an average of 130.1 seconds. Fourth was the liquid fruit pectin solution with an average of 89.1 seconds. The corn syrup solution was the fifth longest-lasting bubble with an average of 35.8 seconds. The control solution was the sixth longest-lasting with an average of 27 seconds. Seventh was the granulated sugar solution with an average of 24.5 seconds. The rubbing alcohol solution was the eighth longest-lasting solution with an average of 3.9 seconds. The gelatin solution was the ninth and shortest-lasting bubbles with an average life of 0 seconds.

The following tables show the data that I collected from the experiments:

Lemon Juice

Trial	Seconds
1	145
2	94
3	141
4	136
5	140
6	146
7	84
8	49
9	216
10	150
Average	130.1

Granulated Sugar

Trial	Seconds
1	17
2	19
3	15
4	19
5	14
6	21
7	25

8	43
9	42
10	30
Average	24.5

Liquid Fruit Pectin

Trial	Seconds
1	73
2	51
3	72
4	25
5	71
6	292
7	104
8	59
9	50
10	99
Average	89.1

Rubbing Alcohol

Trial	Seconds
1	10
2	3
3	4
4	2
5	3
6	8
7	2
8	1
9	5
10	1
Average	3.9

Corn Syrup

Trial	Seconds
1	20
2	40
3	30
4	30
5	44
6	37
7	31
8	41
9	45
10	40
Average	35.8

Glycerin

Trial	Seconds
1	147
2	220
3	194
4	250
5	102
6	618
7	490
8	648

9	398
10	475
Average	354.2

Gelatin

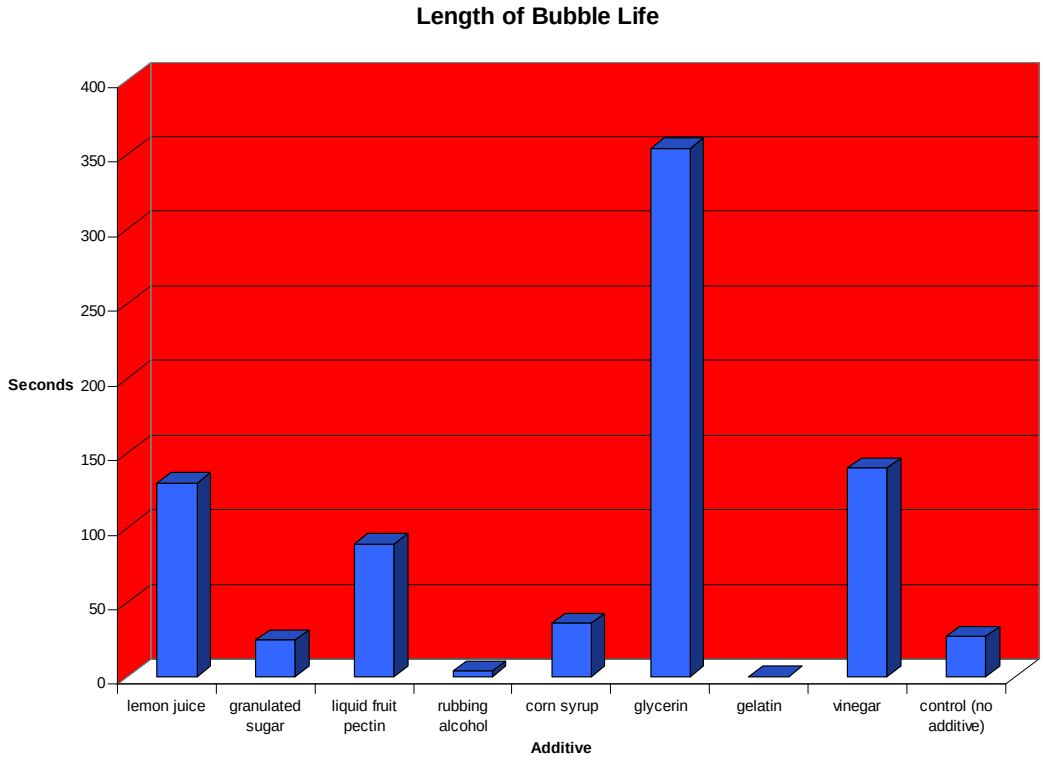
Trial	Seconds
1	0
2	0
3	0
4	0
5	0
6	0
7	0
8	0
9	0
10	0
Average	0

Vinegar

Trial	Seconds
1	151
2	175
3	157
4	342
5	98
6	72
7	169
8	25
9	105
10	107
Average	140.1

Control Solution (No Additive)

Trial	Seconds
1	41
2	13
3	13
4	41
5	40
6	39
7	9
8	22
9	28
10	24
Average	27



Conclusions

I accept my hypothesis that adding glycerin to a bubble solution makes the bubbles last longer than when

other substances are added and when no additive is used. The experimental data supported my hypothesis, indicating that glycerin works to increase the amount of time a bubble lasts. The bubbles made with glycerin lasted over twice as long on average than the bubbles made with any of the other additives and the bubble solution that had no additive. The reason that glycerin caused the bubbles to last longer is that glycerin is a hygroscopic substance. Hygroscopic substances hold water and reduce evaporation.

My findings are important to commercial bubble solution makers and people who like to make homemade bubbles. People who blow bubbles made with the additive glycerin can enjoy their bubbles longer.

An error that might have occurred in my experiment was with adding gelatin to my bubble solution. The amount of gelatin that I added made the bubble solution turn into a solid, and I was not able to use the mix to blow bubbles. Adding less gelatin might have kept the bubble solution a liquid and made a long-lasting bubble.

Some future experiments that involve bubbles might include determining which soaps, dishwashing liquids, or shampoos produce the largest and longest lasting bubbles.

Bibliography

Barber, Jacqueline. Bubble Ology. Berkeley: University of California, 1986.

Gardner, Robert. Experiments with Bubbles. Springfield, New Jersey: Enslow Publishers, 1995.

Hipschman, Ron, "Sticky Water". Bubbles. 1995. Exploratorium. July 17, 2004. www.exploratorium.edu/ronh/bubbles/sticky_water.html.

Nave, C.R., "Surface Tension and Bubbles". Hyperphysics. 2004. Georgia State University. Atlanta, Georgia. July 17, 2004. http://hyperphysics.phy-astr.gsu.edu/hbase/surten2.html.

Wiebe, Ann. Soap Film and Bubbles. Fresno, California: AIMS Education Foundation, 1990.

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