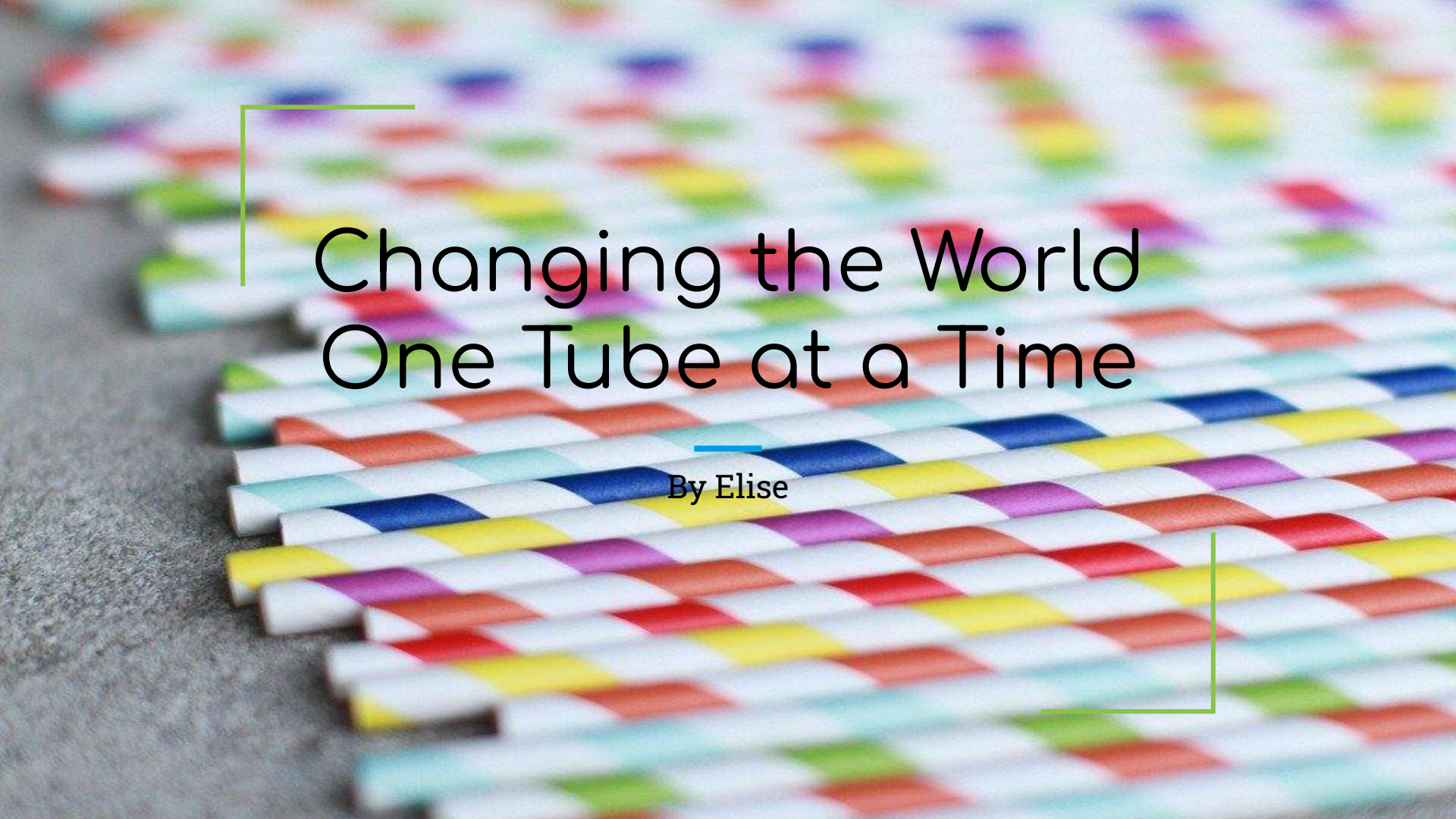


Changing the World One Tube at a Time

By Elise

Testable Question

What is the best biodegradable or renewable straw in terms of temperature, the ability to last a long time and compostability?

Hypothesis

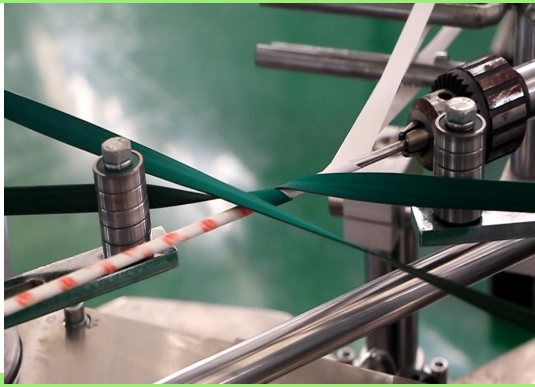
My hypothesis is that if I test four different types of straws then bamboo straws will be the most resilient to high temperatures because bamboo does not conduct heat whereas a straw made out of metal would conduct heat and therefore, it would heat up very quickly. If I am examining durability, then metal straws will be the best durability wise because it is made out of stainless steel and stainless steel is generally really strong and good for long term use. Then, in regards to compostability, paper straws will be the straw to decompose the fastest because paper straws composts within a time of 2-6 weeks and that was the fastest time I found in my research. Then in the results of each test the straw that has the most factors is the best compostable/renewable straw.

Background Research Introduction

My experiment is that I want to find out what type of drinking straw is the most durable and environmentally friendly straw. I am going to test how different types of straws withstand high and low temperatures. I will also test the durability and compostability of the various types of straw. I am going to test which type of straw best withstands high temperatures by placing the different straws in boiling water. I am going to test durability by setting the straws out for long periods. I am going to test composability by setting them in soil and pouring water over this soil frequently. This research is important because I am trying to find out which straw is the best straw for the environment and is also the most durable and that can help everyday people who want to help the environment and have a durable straw. My hypothesis is that If I test four different types of straws then bamboo straws will be the most resilient to high and low temperatures because bamboo does not conduct heat whereas a straw made out of metal would conduct heat and therefore, it would heat up very quickly. If I am examining durability, then metal straws will be the best durability wise because it is made out of stainless steel and stainless steel is generally really strong and good for long term use. Then, in regards to compostability, paper straws will be the straw to decompose the fastest because paper straws composts within a time of 2-6 weeks and that was the fastest time I found in my research. It is important to use reusable straws because you can reduce your carbon footprint and get a eco-friendly straw that won't end up in landfills like plastic straws. Plastic straw's have a bad impact on the environment, which is why so many media sites has discriminated against them. People are realizing and caring that plastic straws are going into oceans.

Background Research - Paper Straws

My first component is paper straws. There are a lot of positives to using paper straws. Paper straws are biodegradable and decompose in 2-6 weeks (Knoonin, 2018), which was the fastest time I had found in my research. Paper straws first developed back in 1888 (Painter, ND). Most paper straws are safe because they meet Canadian health standards (Painter, ND). A downside (to paper straws in that they do not do well in high temperatures (Painter, ND). On a positive note, paper straws are also one of the cheapest options for straws (Painter, ND). Paper straws use 15.1 kJ of energy to make (Appropedia, ND). They produce 38.8 grams of carbon dioxide emission which is the same as the bamboo straw (Appropedia, ND and Woo, 2019). A single paper straw costs about $0.04 (Appropedia, ND). With all of this information in mind, the paper straw is the cheapest and decomposes the fastest because 2-6 weeks is the quickest time I have found in my research.



Background Research - Bamboo Straw

My second component is bamboo straws. Fun fact about bamboo straws is that they are biodegradable but take 4-6 months to decompose (Anderson, 2019) (Plastic Phobia, 2019). It is important to know that Bamboo straws also do get moldy if you don't clean them properly (Plastic Phobia, 2019). Bamboo straws are also steam cleaned and pressure washed when they are made to be safe (Jungle straws, 2019). In comparison to metal straws, bamboo straws don't conduct heat from hot drinks, therefore, bamboo straws are good for use with hot temperatures (Jungle Straws, 2019). Bamboo straws can also go in the dishwasher (Jungle Straws, 2019). Bamboo straws cost $1.20. A bamboo straw's carbon dioxide emission is 38.8g Metal straw carbon emission is 217g which is a lot higher (Woo, 2019). The energy needed to produce this fine straw is 754 Kj (Woo, 2019). In conclusion, bamboo straws would be the best choice for use with hot temperatures because they do not conduct heat unlike metal

Background Research - Metal Straw

My third component is metal straws. They are very durable and will not degrade over time (Beckworth&Co, 2019). One problem with metal straws is that, to make one metal straw you could use that same amount of energy and make ninety plastic straws, in other words, a metal straw is a lot more expensive (Alvaro Limos, 2019). It takes 2420 Kj to create one metal straw (Woo, 2019). It costs about $3.00 to produce a single metal straw (Woo, 2019). A metal straw's Co2 emission is 217g (Woo, 2019). They are also easy to clean, which is a good quality (Beckworth Co, 2019). I would encourage the use of metal straws because if everyone used a metal straw they could avoid the use of 600 plastic straws (Woo, 2019). Metal straws are very durable and are reusable, which makes them great for use.

Background Research - Plant-Based Straw and Conclusion

The fourth straw is plant-based straws, which you can get at Jugo Juice. There is not a whole lot of information about that type of straw but they are 100% compostable (Jugo Juice, ND). Plant-based Jugo Juice straws are 100% plant-based and renewable (Jugo Juice, ND). Plant-based straws are not only decomposable there also made out of plants so, therefore, they are very naturally made and probably have less chemicals in them

When I do my experiment, I am interested to know the results to see which straw is the best choice. This will help people because they will know which one is eco friendly and the best for usage. This will also help the ocean because if more people use reusable biodegradable straws then the ocean will be cleaner. In conclusion, the basics about the four straws and the facts about each of them have been explained and I have developed my hypothesis from the information that I have gained from my reading.

Variables

Manipulated: Type of straw

Responding: If the straw falls apart and if the straw decomposes.

Controlled: Pot, water, fork, soil, cup, cherry cola, plastic food wrap, house and the person testing

Materials

Materials for Experiment #1

1. Soda stream
2. One-fourth cup of cherry cola sodastream liquid
3. Four identical glasses
4. Measuring cups
5. Plastic wrap
6. Sodastream bottle (large one)

Materials for Experiment #2

Cups (party cups would be preferred)

1. Soil (potting soil)
2. Biodegradable plant-based straw from Jugo Juice
3. Paper straw
4. Scissors
5. Tablespoon measure or fill a fourth cup with water and pour half in one cup and a half in the other cup
6. Water

Materials for Experiment #3

1. Medium-sized pot
2. Water
3. Stove with burners
4. Metal straw
5. Paper straw
6. Biodegradable plant-based straw from Jugo Juice
7. Bamboo straw

Procedure for Experiment #1

1. Go to the store and buy all the materials listed for experiment #1
2. Open the package of cups and take out two cups
3. Fill each cup with one cup of soil
4. Take the paper straw and cut the straw in quarters with scissors and place the straw in the cup with the soil
5. Take the Jugo Juice plant-based straw cut the straw in quarters with scissors and place the straw in the cup with the soil
6. Water everyday with two tablespoons of water to each cup
7. Wait for them to decompose and get the results

Procedure for Experiment #2

1. Gather materials for experiment #2
2. Fill the sodastream bottle till the black squiggly line with cold water
3. Put the bottle in the machine
4. Pull the bottle down
5. Press the one water droplet
6. Mix one fourth cup of cherry cola sodastream in the sodastream bottle
7. Pour into four identical glasses
8. Cover with plastic wrap
9. Grab each of the different straw and get them out of there packages
10. Poke a whole in each of the plastic wrap glasses
11. Put each different straw in each cup
12. Observe for 11 days and record results

Procedure for Experiment #3

1. Go to the store and buy all the required materials for experiment #3
2. Grab a medium-sized pot
3. Fill the pot with 4 cups of lukewarm water
4. Turn the knob to high and place the pot on the burner
5. Once the water comes to a boil place a metal straw in the boiling water
6. Observe for five minutes
7. Then repeat all the steps above with each of the different straws
8. Record the results

Observations for Experiment #1

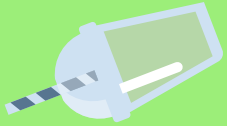
Day	Observations
Dec 23, 2020	Just placed the straws in the soil, nothing is happening yet.
Dec 25, 2020	The paper straw is more submerged than the purple straw. Paper straw has a little patch that is turning yellow which means it is oxidizing. Oxidation means losing hydrogen and gaining oxygen, essentially changing its molecular structure. The purple straw is not demonstrating any signs of composting.
Dec 27, 2020	The paper straw is turning yellow which means it is oxidizing. and is half submerged. I submerged the purple straw under the soil so it could compost more effectively.
Dec 29, 2020	The paper straw is gaining more and more yellow patches which tells us it is oxidizing more. The purple straw is still not demonstrating composting.

Observations Continued for Experiment #1

Dec 31, 2020	Paper straw is growing mold then when water was poured on top of the straws the mold disappeared. Purple straw's soil is keeping the water up top.
Jan 2, 2021	The paper straw is mouldy and the yellow spots have turned into brown spots. The purple straw is very saturated in water.
Jan 4, 2021	The cups have a lot of water in them and there are little pools around both so I did not water on Jan 3, 2021 or Jan 4, 2021. The purple straw soil is like a soup now so two of the straw pieces have submerged, you can still see the tip of one straw end. The paper straw is looking all yellow so it must be all oxidizing.
Jan 6, 2021	The paper straw is oxidizing a lot. The paper is molding. The mold is fuzzy and grey. The purple straw is a little less watery.
Jan 8, 2021	I have not been watering since Jan 3, 2021. Drying up a little. Paper straw is molding and is flexible. The purple straw is normal.

Observations for Experiment #1

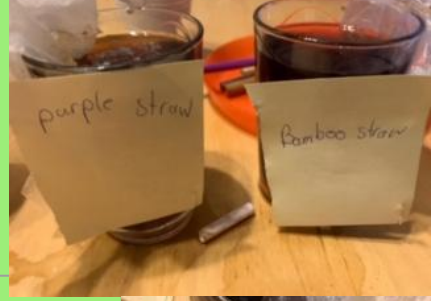
Jan 10, 2021	Finally, watered today. Paper straw is very moldy. Purple straw is not composting. Paper straw has a hole in the side.
Jan 12, 2021	Paper straw is moldy and flimsy. The purple straw is not demonstrating any signs of decomposing.
Jan 14, 2021	Paper straw is molding at the bottom. The purple straw is not demonstrating any signs of decomposing.
Jan 16, 2021	Paper straw is brown and moldy. The purple straw is still not composting.
Jan 18, 2021	Paper straw is brown and covered in soil and is saturated. Purple straw is not demonstrating any changes.



Observations for Experiment #2

Dec 31, 2020	Just put the straws in the liquid. Purple straw floated up and then the Paper straw floated up. Paper straw was bubbly.
Jan 1, 2021	Paper straw is less bubbly. Bamboo straw appears bigger in water. Metal straw is sticky. Purple straw has lowered.
Jan 2, 2021	Paper straw is less bubbly.
Jan 3, 2021	Paper straw is stained brown and flexible. Bamboo straw is stained brown where the cherry cola line is. Metal straw has a brown line where the cherry cola line is. Purple straw is very resistant to water whereas the other straws are absorbing the cherry cola.
Jan 4, 2021	The coke is staining up above the cherry cola line for the paper straw. The paper straw is floating upwards. The bamboo straw looks like it's staining under the cherry cola line. The metal straw is a bit sticky above the cherry cola line. The purple straw has a line of cherry cola just above the cherry cola line.

Observations for Experiment #2



Jan 5, 2021	Paper straw is stained brown. All other straws are the same as when last recorded.
Jan 6, 2021	Paper straw is bendy where the plastic wrap is. Bamboo straw is staining brown.
Jan 7, 2021	Paper straw is really flexible and a light brown colour from cherry cola. Purple straw is sticky.
Jan 8, 2021	Paper straw is bendy.
Jan 9, 2021	All the straws have mold in the water.
Jan 10, 2021	The water is molded. Paper straws water has a lot of green mold. The purple straw has a lot of green mold. The metal has one patch of mold and it looks a bit more fuzzy than the other mold. The bamboo straw has no mold. After ten days the paper straw is a light brown and bendy and has mold on it. The purple straw is not affected. The metal straw is sticky. Half of the bamboo straw is stained brown.

Observations for Experiment #3

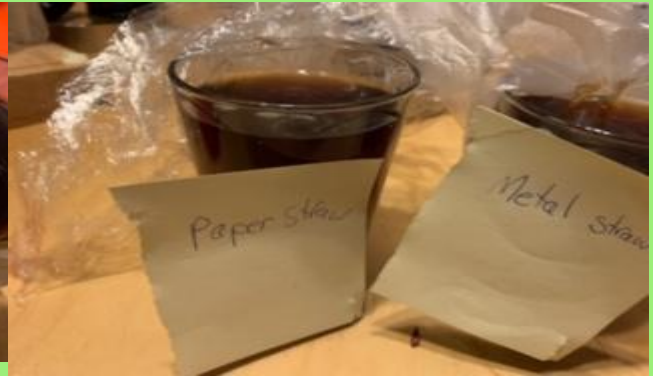
Straw	One Minute	Two Minute	Three Minute	Four Minute	Five Minute
Paper Straw	Bubbles crowding the stra pushing the straw under the surface.	Bubbles coming up to the surface.	The straw is really hot. The straw is fading its colour.	Still Fading colour and bending upwards.	The straw got out of the water and is very flexible. Apers becoming translucent and feels squishy.
Bamboo straw	Instantly turned more yellow.	Bubbles pushing the straw up. Smells like a light pool smell.	The straw is getting taner.	The ends of the straw are browning.	Some of the parts of the straws are browning. Steaming when it came out of the pot. The straw cooled quickly.

Observation for Experiment #3

Purple Plant-Based Plastic Straw	As soon as it touched the water it shivals up.	The straw bended wherever the pressure was. The straw became flimsy.	The straw is bending and moving to the bottom.	The straw is shivling and shrinking.	When I took the straw out it was hard and bent. White was also showing through the straw.
Metal Straw	The metal straw sank right to the bottom and it made clunking noises.	The straw is still making clunking noise. I rolled the straw over.	Still at bottom and making noises.	Still at bottom.	I took the straw out of the water, the straw is hot.

Results

My results were surprising. In the compostability test the paper straw did not fully decompose but it was moldy and was covered in soil. The purple straw did not even start to decompose at all. In the durability test bamboo had the most positive result because it was the only straw that's cherry cola had no mold and the straw itself had no changes except for a faint stain. The metal straw did not change but the cherry cola which it was sitting in had a small patch of fuzzy white mold. The paper straw was strained brown halfway and was flexible, the cherry cola had lots of mold as well. The purple straw had no changes in the straw but its cherry cola which it was sitting in had lots of green mold. In the third experiment the bamboo straw cooled down quickly and had no visible changes. The metal straw also cooled down quickly and had no visible changes. The paper straw was flexible. The purple straw half melted and curved to fit the rounded edge of the pot.



Conclusion

My hypothesis for compostability was correct, the paper straw was the fastest composting wise. My hypothesis for durability was incorrect because the bamboo straw was the only straw that water did not have mold in it. My hypotheses for temperature resistant was partially correct because the bamboo straw had really no changes and cooled down quickly but the metal straw had no changes and did cool down quickly as well. In conclusion the most durable was the bamboo straw because it was lastasted the whole experiment and it was the only straw who did not have mold in the cherry cola. I think this happened because It was the straw who had the least chemicals well it was being produced so the chemicals did not react with the cherry cola.The straw that was the least effective was the paper straw because it went really flexible and strained the straw dark brown. The paper straw also made the water very moldy. In the second experiment the most durable straw was the bamboo straw and the metal straw because they stayed mostly the same in the boiling water and when they came out of the water they cooled quickly. The possibility that they have that result is because they are not made out of plastic or paper because those materials do not do well in heat. Another reason is because metal straw are built with metal which is made to withstand high temperatures.

Conclusion Continued

The people that would be concerned with my results are people that care about the world and don't want the world to be full of single use plastic. An interesting fact is that Justin Trudeau is actually working on a single use plastic ban in Canada. Another thing that cares about my research is ocean animals, because did you know according to National Geographic that an estimated 8.3 billion plastic straws pollute the the worlds beaches this year. In the future someone could look back at this research and put a ban on single use plastic. Another person who would use this information is someone wanting to use a plastic straw replacement but still wanting a durable straw.

If I was to do this experiment again I would try different brands of straws, for example, try a different brand of bamboo straws or metal straws. I would also make sure there was more time for the straws to compost because the straws did not compost in time. I would also use bamboo straws in the compost experiment if I was to do this experiment again.

In final conclusion the best durable and environmental straw is the bamboo straw because it is the one of the two straws that was the most temperature resistant and it was the most effective in long lasting periods in water and even though I did not test it, bamboo straws do decompose.

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