Ice Cubes Melting!

Who will win?

Abstract

Do you love ice in your drinks? Have you ever wondered which drink would melt the ice cube the fastest? We wondered exactly that: would changing the liquid in which an ice cube was melting in change the rate at which it melts? Our hypothesis was that yes, in fact it would change the rate at which it melts. The first step was to make all the jars the same temperature with an oscillating fan. The next step was to drop an ice cube in the four different liquids and measure how long it took for the ice cube to fully melt. This process was repeated 3 times for each liquid, for maple syrup, apple cider vinegar, water, and salty water. Surprisingly, the water made the ice cubes melt the fastest with the average being 6.34 minutes. The slowest was maple syrup with the average at 43.8 minutes. In the middle there was salty water with the average being 14.84 minutes and the apple cider vinegar with the average being 19.1 minutes.Our hypothesis was correct and the liquid in which the ice cube was melting in drastically impacted the melting rate. Knowing how fast an ice cube melts in different liquids can possibly help the world understand things like how the glaciers and ice in the sea are currently melting.

Questions and Hypothesis

Question:

Does the liquid in which an ice cube is melting in impact the rate it melts?

Hypothesis:

Yes, the liquid will impact the rate at which the ice melts.

Background Research

Have ever wondered why salt makes an ice cube melt faster? The reason for this is because the salt molecules lower the freezing point of the water, allowing the ice to melt at a lower temperature ("SuchScience", 2024). This means that the ice will melt faster. Similar materials such as sand and sugar all do the same things as salt. For our science fair project we want to test what household liquid an ice cube melts fastest in. If the liquid we are melting the ice cube in is salty or has a lot of sugar in it that could seriously impact the melting rate of the ice. Salt, sand, sugar, and the shape of the ice cube could seriously impact the change in the melting rate of the ice cube. Our scientific question is: Will putting the ice cube in different liquids impact the melting rate?

Background Research

One common piece of misinformation is that everything has a melting point. This is not true because some things just slowly decrease in viscosity until they are a liquid ("Simple Science" 2024,). Substances that don't have a melting point are called Amorphous. Amorphous are non-crystalline objects such as glass, plastic, gels and rubber. Non Amorphous objects include salt, diamonds, metals and of course ice. Ice always has the molecule H^2O in all of its states. Water is a liquid between the points 0°C (32°F) and 100°C (212°F). Gas is the least dense form of water, then ice and water being the most dense (this is why ice floats in water but doesn't in air).

When most liquids melt the molecules of the substance move farther apart and vice-versa. One notable exception is water which the opposite is true for. This causes the difficulty of prying an ice-cube out of the mold. Water expands when frozen due to the rigid shape of water molecules. Water molecules expand because the cold forces the molecules into a fixed open hexagonal position that takes up more space than normal water. The fact that ice takes up more space than water makes it less dense which causes it to float on water.

Background research

Most people consider the only way to change the melting rate of ice is with heat. This in fact is not true, the shape of ice can change its melting rate as well as salt, sugar, sand, whether or not there is flowing water around the ice, and of course, heat. The aspect ratio, which is the ratio of the width to length, has a major impact on the melting rate of ice. The shape of the ice cube changes how the water and the ice interact. Salt, sugar, and sand all lower the freezing point of the water allowing the ice to melt at a lower temperature. When flowing water surrounds ice it changes the melting dynamics of the ice. As water flows it creates turbulence and pockets of different temperature water around the ice. Heat gives energy to the water molecules. Once the molecules have gained enough energy the water will change form into a gas in a process called evaporation.

Background research

In summary, the melting speed of liquids can be greatly affected. It could be affected by the shape of the ice cube. If there's salt involved, and, of course, heat. Ice floats in water because ice expands when frozen. Ice expands when frozen because of the shape of the molecules. The shape of the molecules forces the molecules into a specific shape that takes up more space than water which makes it less dense. This makes ice unlike most liquids.

Materials

Materials:

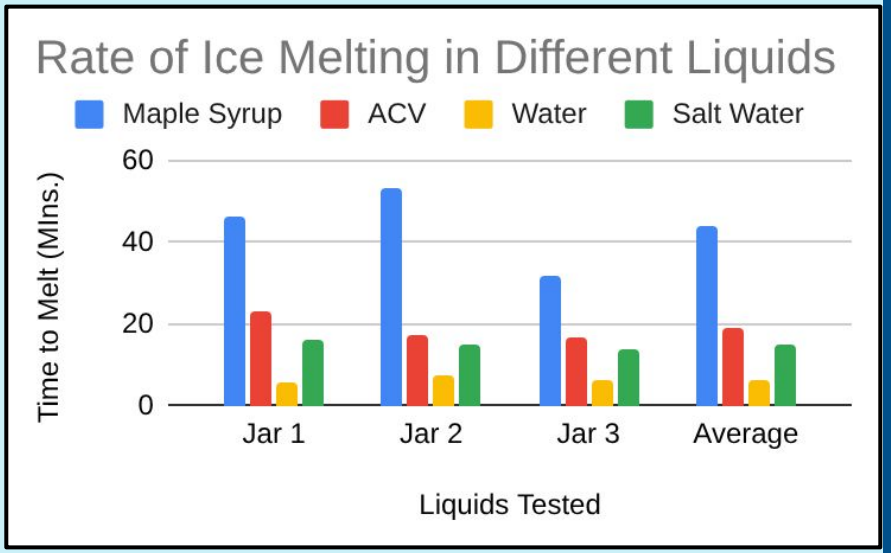
450ml of Maple Syrup
450ml Apple cider
450ml Vinaigrette
15 grams Salt
12 Glass jars w/ lid
Thermometer
900ml Water
20 ml ice cubes
Stopwatch
Oscillating fan

Procedure

1. Fill 6 glasses with 150 ml water each
2. Add 5 grams of salt to 3 glasses with water
3. Stir thoroughly until salt is fully dissolved in each glass
4. Fill 3 glasses with 150ml maple syrup each
5. Fill 3 glasses with 150ml vinaigrette each
6. put lid on all glasses
7. Put all 12 glasses on level surface with fan facing and blowing onto all jars
8. are the same temperature
9. once the temperature is all the same place one ice cube in one jar
10. time how long it takes for the ice cube to fully melt
11. record data in table
12. repeat 11 - 13 for all jars Wait 30 minutes and mix contents every 10 minutes
13. measure contents temperature
14. repeat step 8 - 9 until all jars

Graphs and Results

As you see along the top, below the title we measured for liquids maple syrup (blue), apple cider vinegar (red), water (yellow), and salty water (green). Along the X axis there is which jar had which results and the average for each group. The Y axis tells us how long each ice cube took to melt.



Conclusion

In our experiment the dependent variable is the amount of time the ice cube took to melt and the independent variable is the type of liquid the ice cube is in. After conducting our experiment there were some very surprising things. Our hypothesis that the liquid would impact the melting speed was correct but not in the way we expected. The fastest liquid that the ice cube melted in was water with an average 6.34 minutes. Next was salty water at 14.84 minutes. This was the surprising part because all of our sources said that these should be reversed. Next was apple cider vinegar with an average of 19.6 seconds. And last with a whopping average of 43.8 minutes. This is by far the greatest time and it got pretty boring watching ice melt for almost an hour. The greatest time was jar 2 maple syrup which took 53.06 minutes and the least was jar 1 water which only took 5.75 minutes. To make our experiment better we would need better equipment and more time. The biggest problem is that it was really hard to get the temperatures all the same. In the future a colder, more accurate fridge or something of that sort would improve the results and make them more accurate.