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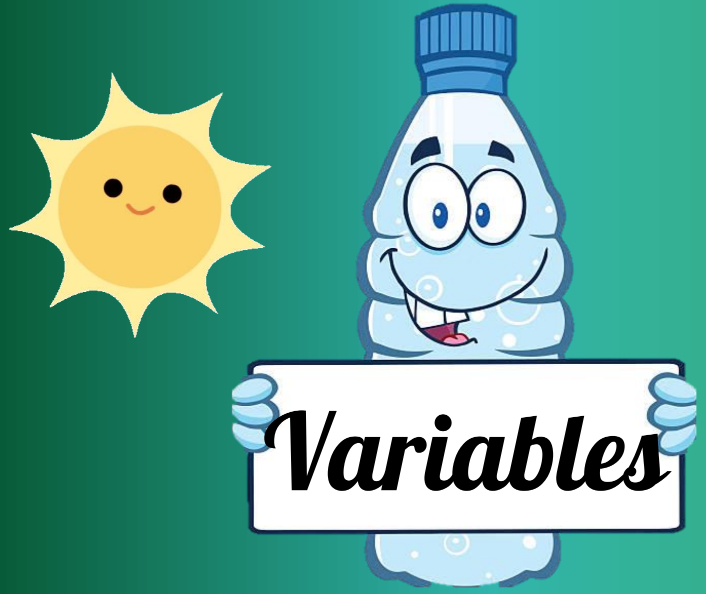
Which material is Safer for Conserving Water in Sunlight?

Problem

This project consists of seeing which material is the safest to store water under sunlight. This helps raising awareness to pay more attention on how water is stored.

Hypothesis

The researchers assume that the best option is the glass bottle. Toxins and bacteria are emitted upon creation, but the glass bottles have the smallest amount of harmful chemicals.



- The **independent variables** are the materials that each bottle is made of.

- The **dependent variables** are the toxins, bacteria and pH present in each water bottle.

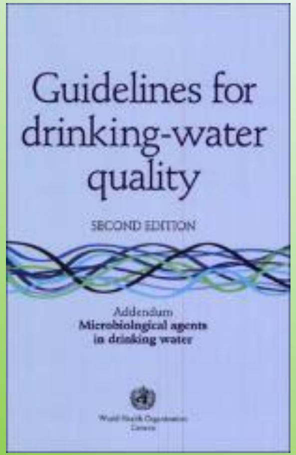
- And the **control** is the type of water, box and temperature.

The research team followed some steps in order to test the quality of the water samples. They repeated the procedure for each bottle. The investigators made two attempts of the experiment to verify their results.

https://youtu.be/IQJZiMH0ppc

Data Analysis

The team, on their final day, only tested twice. In the first attempt it was cold due to a cold front moving in, making it colder than usual and the second test had typical weather conditions.



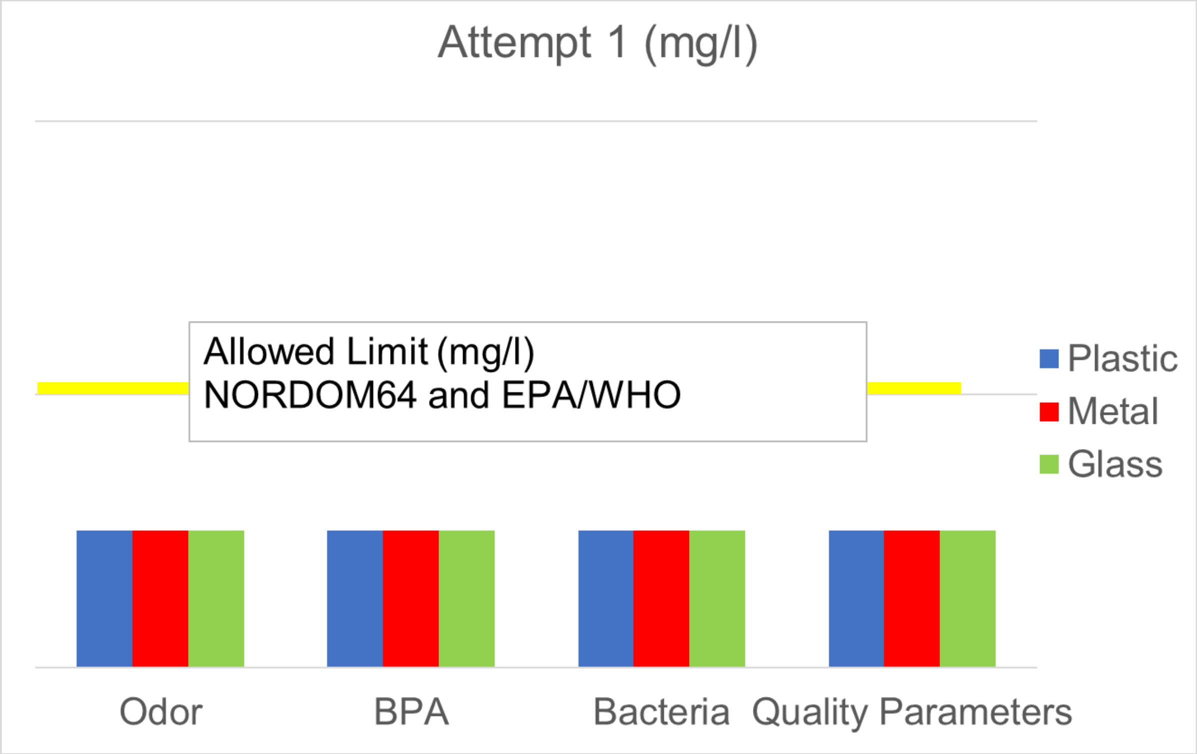
Attempt #1

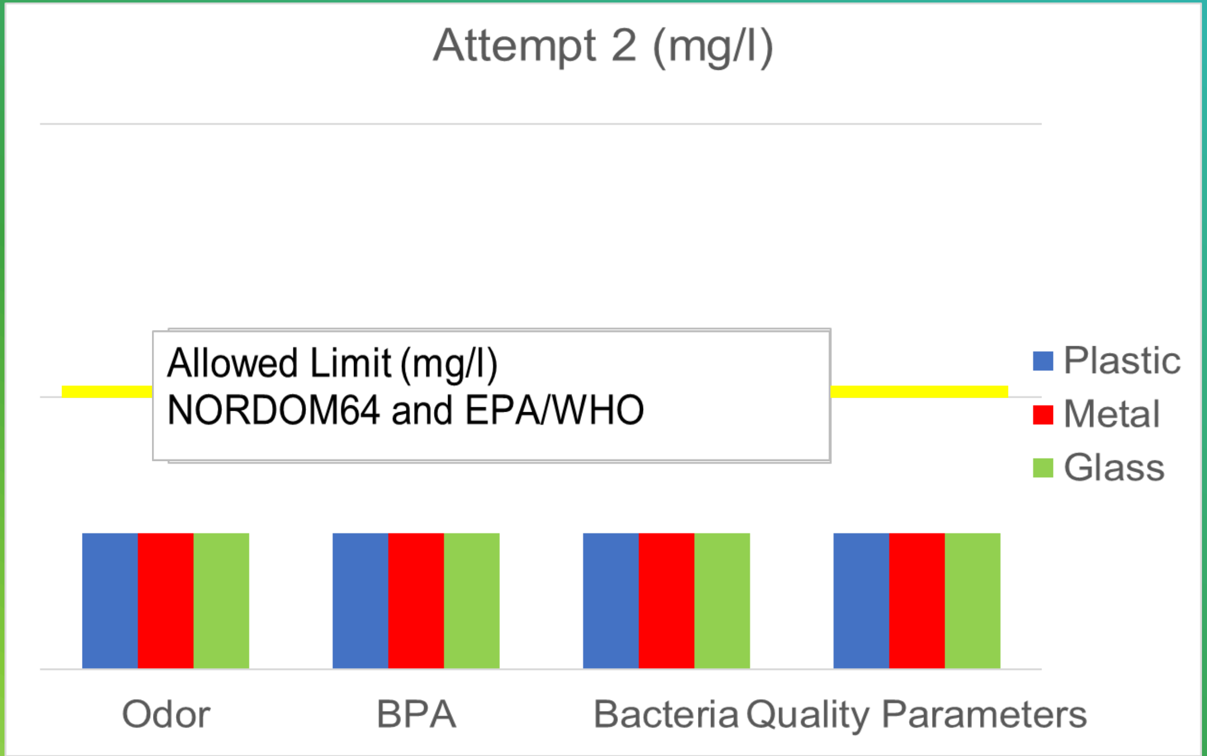
		3/14/2020					
unit mg/l			Tested values			Accepted Values	
Inside °C	Outside °C	Parameter	Plastic	Metal	Glass	NORDOM64	EPA/WHO
35.9	29.1	Temperature °C	32	33	35		
		Odor	None	None	None	None	None
		BPA	Neg	Neg	Neg		<0.00001
		Bacteria	Neg	Neg	Neg	Neg	Neg
		Total Hardness	70	50	25	<500	<600
		Free Chlorine	0	0	0	<1	<1
		Iron	0	0	0	<0.3	<0.3
		Copper	0	0	0	<1	<1
		Lead	0	0	0	0	0
		Nitrate	0	0	0	<10	<10
		Nitrite	0	0	0	<1	<1
		MPS	1	1	1	<1	<1
		Total Chlorine	0	0	0	<4	<4
		Fluoride	0	0	0	<1.3	<2
		Cyanuric Acid	0	0	0	<0.07	<50
		Ammonia Chloride	0	0	0	<0.3	<0.3
		Bromine	0	0	0	<3	<3
		Total Alkalinity	40	40	40		20-200
		Carbonate	40	40	40		<180
		pH	6.2	6.4	6.2	6.5-8.5	6.5-8.5

Attempt #2

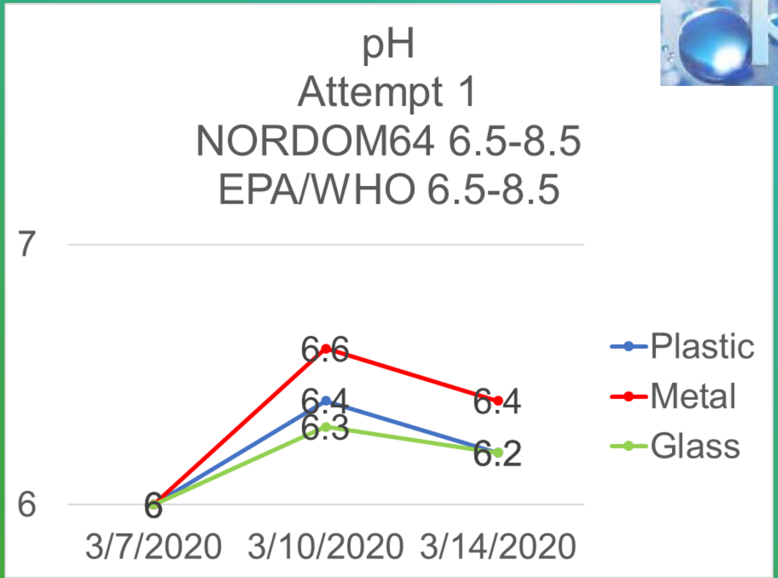
		3/21/2020					
unit mg/l			Tested values			Accepted Values	
Inside °C	Outside °C	Parameter	Plastic	Metal	Glass	NORDOM64	EPA/WHO
45	33	Temperature °C	44	45	41		
		Odor	None	None	None	None	None
		BPA	Neg	Neg	Neg		<0.00001
		Bacteria	Neg	Neg	Neg	Neg	Neg
		Total Hardness	120	50	50	<500	<600
		Free Chlorine	0	0	0	<1	<1
		Iron	0	0	0	<0.3	<0.3
		Copper	0	0	0	<1	<1
		Lead	0	0	0	0	0
		Nitrate	0	0	0	<10	<10
		Nitrite	0	0	0	<1	<1
		MPS	1	1	1	<1	<1
		Total Chlorine	0	0	0	<4	<4
		Fluoride	0	0	0	<1.3	<2
		Cyanuric Acid	0	0	0	<0.07	<50
		Ammonia Chloride	0	0	0	<0.3	<0.3
		Bromine	0	0	0	<3	<3
		Total Alkalinity	40	40	40		20-200
		Carbonate	40	40	40		<180
		pH	6.4	6.8	6.6	6.5-8.5	6.5-8.5

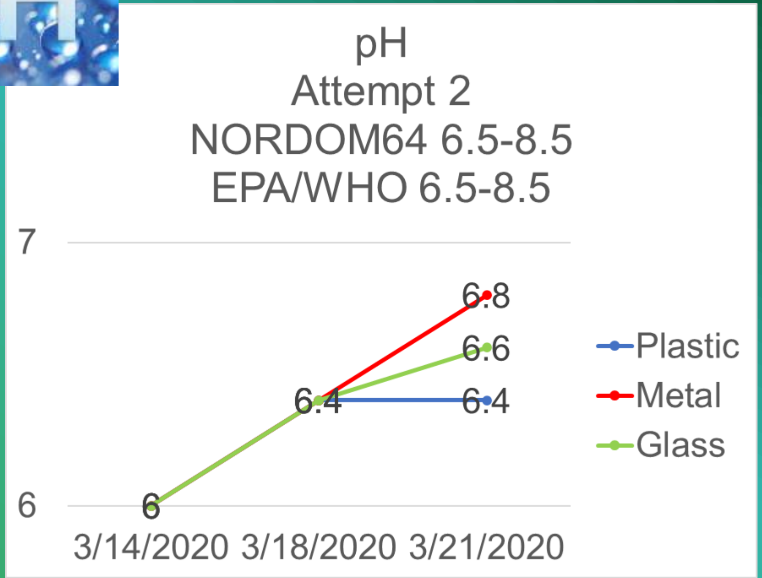
No odor, BPA or bacteria were present, so the quality of the water stayed within safe regulations. BPA needs a specific temperature (65ºC) for it to leach into the bottles.

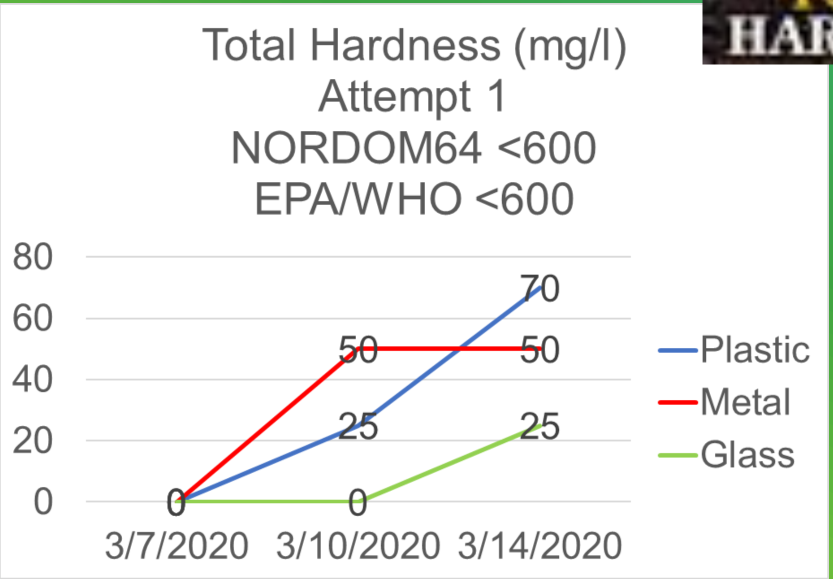


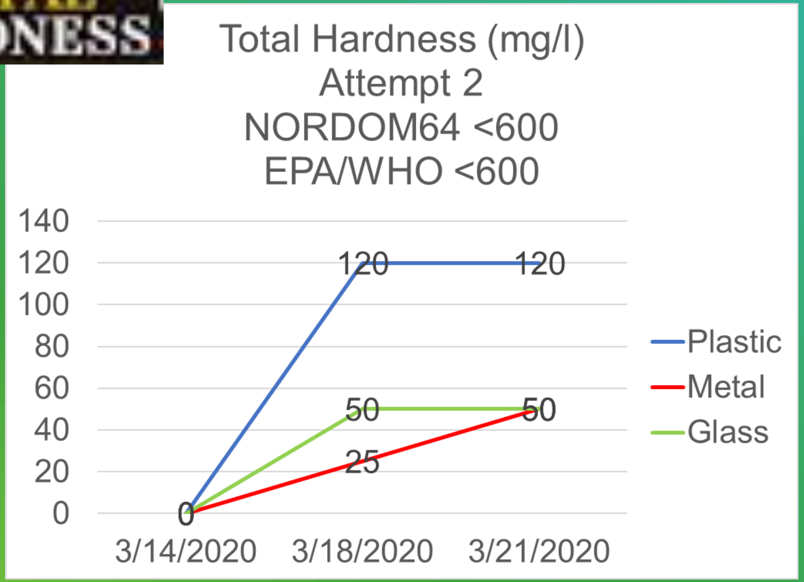


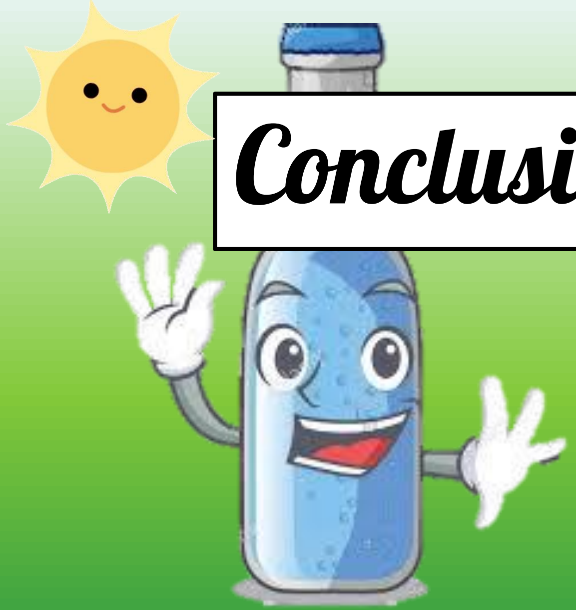
With the 16 parameters being tested, only two changed considerably, the pH and Total Hardness. The pH increased or decreased inverse to temperature, affecting the Total Hardness.











Conclusion

The Research team concluded that there was practically no change in any of the water samples because temperature must be above $40^{o}C$ for any change to happen. The only things that considerably changed were the Total Hardness and pH, but the water samples remained under the quality parameters of NORDOM64, EPA and WHO. It was concluded that it’s a matter of personal preference which bottle to use, since metal is a non-renewable resource, plastic is a major environmental issue and glass is brittle.

Next time, the research team would like to change the variables. They want to either add a heater to get more consistent results or change the container type, thus making the results more dramatic. It would be very interesting to see at which temperature will each toxin be released. The research team could also implement the use of other containers and measure different toxins.

Acknowledgments

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