

A Small Donation Can Lead to Water Purification

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Question and hypothesis/Prediction

Question: Which method of purifying water to drink works the best out of a filter(life straw),boiling it,adding aquatabs water purification tablets or UV sunlight rays/solar disinfection.

Hypothesis: Usually when there are more methods or chemicals used to purify water, the result usually means the water would be more pure than only using one method like how when you use chemical packet they include more than one chemical to purify the water.Therefore, I think the Aquatabs will work the best

Prediction: If I were to try using a filter(life straw), boiling it, adding aquatabs water purification tablets or uv sunlight rays to purify non-pure water,I believe the Aquatabs would work the best and make the water have the least amount of bacterial colonies.

Variables

Independent Variables:The method or material used to clean the water.

Dependent variables:The amount of colonies on the petri dish from a swab from the water after using each method.

Controlled variables:The same kind of sterile test tube,sterile container,petri dish,sterile swabs,and sterile syringe

Materials

- One sterile syringe
- 3 sterile containers
- 15 glass sterile test tubes,
- 15 sterile swabs,a boiling pot,
- A Life Straw,
- 3 Aquatabs water purification,
- 15 petri dishes,
- Tweezers,
- Water from a lake
- Tap water

Procedure

1. Go to a lake
2. Dip your sterile syringe and suck in the water
3. Inject the water into the sterile containers and seal it with the cap (do step two and three four times until you fill up the containers)
4. Suck in the water from one of the containers into 4 different sterile tubes and seal the lids
5. Boiled water: take off the lid of the tube so it doesn't pop open
6. Boil tap water in a pot
6. Once boiled, pick up the tube with tweezers
7. Dip it into the boiling pot and leave it until the water in the tube boils
8. Place the tube in a place it won't fall
9. Solar disinfected water: grab another tube and leave it in the sunlight for 8 hours
10. Aquatab disinfected water: open a packet of aquatabs and put one of the tabs in one of the tubes

Procedure Part Two

11. Stir it for ten minutes and after let it rest for 30 minutes

13. Life Straw: use your syringe again to suck in water from the sterile container

15. Put the lifestraw in between the syringe and a sterile tube

16. Use the straw as a funnel and inject the water through it leading to the sterile tube until its filled up

19. Dip your swabs in each water (including the control which was water you did nothing two)

20. Swab them using the streak method on their own petri dish each(make sure to not overlap)

22. Wait 3 to 4 days and then count how many colonies each kind of water has.(repeat process 4 to the end 3 times and then find the average. Also only reuse the tweezers, pot, and life straw for best results)

Background Research 1

- Water is extremely important since our body is made up of 50 to 75% percent water with 65% being the average
- Our earth is also vastly covered with water at an immense amount of 70 percent of our planet
- We can not survive if we don't have water for 3 days due to dehydration and many other factors because we need water to control our body
- All living things must need water to even exist and that's why astronomers look for water on different planets before even searching for life.
- Water helps us regulate our body temperature by cooling our body down through perspiration and heating it up by modulating our blood flow
- Plants also need water to live and they produce many things such as foods we can eat for nutrients,also oxygen which is very crucial since you need it to breath or else you will suffocate
- Water helps us move nutrients through our body and plays a crucial part in digestion
- It also helps us fight off viruses

Background Research 2

- Water is very crucial but 2.2 billion people don't have access to safe drinking water, while 4.2 billion people do not have safe sanitation service, and around 3.6 billion people have a deficiency of hand washing facilities.
- On top of that, approximately 3.5 million people are victims of lack of water and die because they don't have a basic necessity in life.
- In developing countries they also have to use dirty or sewage water to water their plants, to feed people which end up making them really sick due to this problem
- Sometimes in droughts they also have no clean water and only dirty water, so they have to use it for everything although it is not healthy or sanitary
- Due to the estimate of there already being 75 to 199 tons of plastic waste in our oceans and about 33 billion pounds being added every year, soon countries that once had safe water will no longer have it due to pollution.
- We are missing an easy, efficient method where we can help those with limited access to clean drinking water so we can make it drinkable and hopefully reduce the amount of sickness/dehydration deaths.

My Project

-My project will help our society to take a step forward to finding cost-effective methods to create a simpler way to clean our water to have the least amount of bacteria

- All of my methods will be affordable so countries don't need to invest billions of dollars for clean access water since most of these countries already lack money too.

-My project will also cover ways that people already clean their water so we can see if it is efficient and safe to drink or if the more modern options are safer.

-My project will also show how we can solve big problems with cheap materials to show that if we raise as a world enough money for people who do not have clean water and it will not be this very expensive thing which people think resulting in those rich countries not donating.

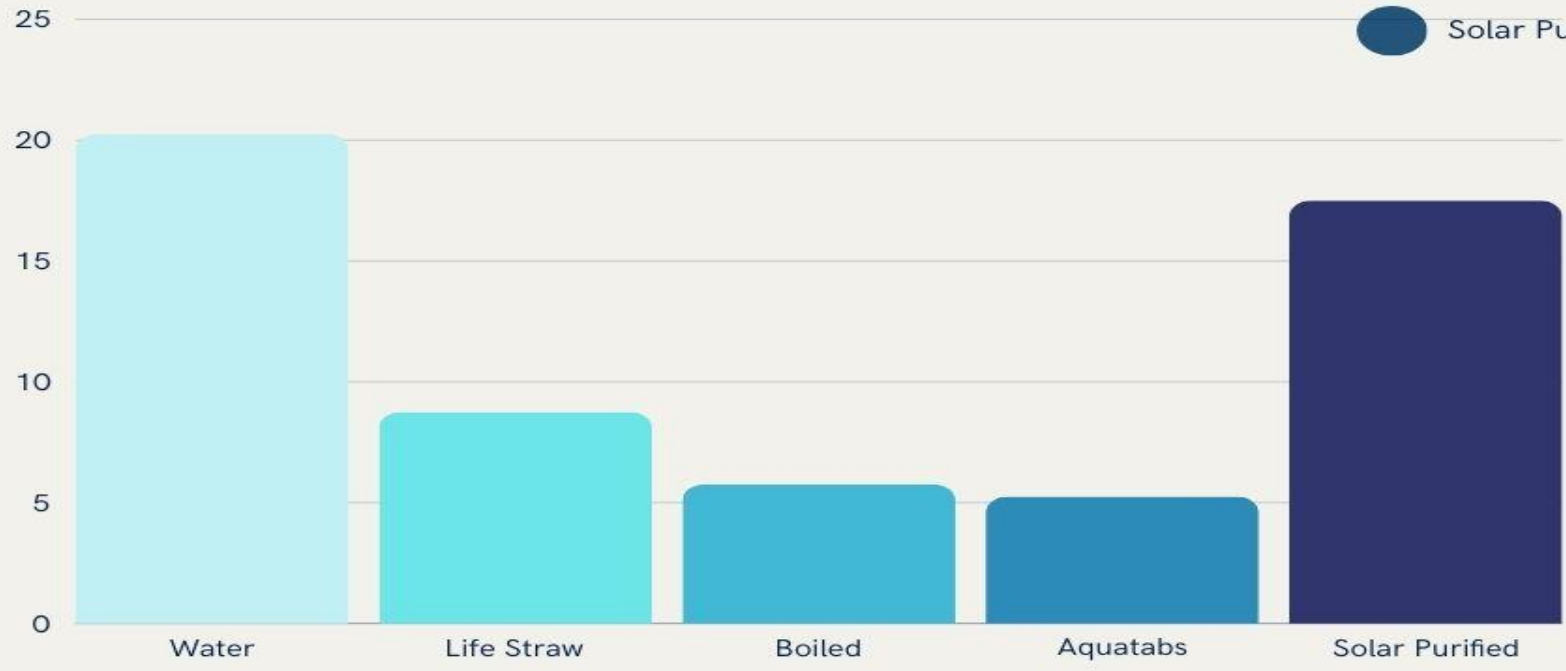
Bacteria colonies in Chestermere Lake water after using various water purification methods

Trial	Chestermere Lake Water	Solar Purification	Life Straw/ Filter	Boiling	Aquatabs
1	19	17	7	4	4
2	21	20	9	8	6
3	18	16	8	6	7
4	23	17	11	5	4
Average	20.25	17.5	8.75	5.75	5.25
Cost P/L	Free	Free	\$0.03	Free	\$0.25

AMOUNT OF COLONIES EACH WATER HAS

- Water
- Life Straw
- Boiled
- Aquatabs
- Solar Purified

Amount of Colonies Grown



Conclusions

My Results Came out to be that the aquatabs work the best just like I predicted in my hypothesis. But this is not shocking due to many factors for example, when doing more research I found out that when boiling cools down some of the bacteria comes back and the only reason it did good was because I swabbed it when it was hot so it should have done way worse. Also, when using the sun's UV sunlight rays it does not work that well because the sun emits many different things than UV rays like radiation so that is why in treatment plants they use concentrated UV rays only so it can directly flash on the bacteria and kill it. When using a lifestraw it also is not efficient because it only has a few seconds for the filter to actual do its job unlike the aquatabs where you mix sodium dichloroisocyanurate which is basically chlorine and let it rest so it can go everywhere and neutralize the bacteria. Also, boiling and solar purification are free and the aquatabs cost 25 cent for tab which can purify up to a litre. A life straw on the other hand show it cost 0.03 cents per litre but you have to buy a lifestraw for 30 dollars a one time and it supposedly says it can purify as much water as the average person would drink in 5 years which is 7500 litres. So, the best cost effective method is boiling because it's free and works the second best but Aquatabs are better if you are look to eliminate diseases.

Next Steps

- Get a petri dish with more agar since the bacteria was very hard to spot due to the lack of it
- Get an actual UV ray concentrated light instead of using the sun to see if it is better than all the methods which many websites claim and even our own city uses it.
- Get an incubator to put the petri dishes in it at 37 degrees where bacteria grows the best rather than room temperature.
 - Wait for the boiled water to cool down and than swab because sources claim that some of the bacteria returns when cooled down and people drink the water usually when its cold when boiling it unless they are making tea anything you drink hot.
- Make the methods synergistic and saw which combination would do the best such as boiling it and then using Aquatabs to neutralize and kill all the bacteria so it does not come back.
- If countries donated enough money we could design and build a water tower which the lake water would be pumped up to. It would go through a series of water purification methods when pumped up like first it is boiled, then it goes through a filter like the lifestraw, than UV rays are flashed on it, all topped off with aquatabs being thrown into it and than all pumped down to the people

Resources

[-https://aquatabs.ca/pages/faqs#:~:text=The%20ingredients%20in%20Aquatabs%20are,%20C%20Adipic%20Acid%20C%20Sodium%20Carbonate](https://aquatabs.ca/pages/faqs#:~:text=The%20ingredients%20in%20Aquatabs%20are,%20C%20Adipic%20Acid%20C%20Sodium%20Carbonate)

[-https://www.cdc.gov/healthywater/emergency/making-water-safe.html#:~:text=2](https://www.cdc.gov/healthywater/emergency/making-water-safe.html#:~:text=2)

[-https://lifestraw.com/pages/our-technology](https://lifestraw.com/pages/our-technology)

[-16 Reasons Why Water Is Important to Human Health \(healthline.com\)](#)

[-How Much Water Is in the Human Body? \(thoughtco.com\)](#)

[-Clean Water - Our World in Data](#)

[-U.N. report finds 1 in 4 people don't have access to clean drinking water : NPR](#)

[How does LifeStraw work? - LifeStraw Support Center](#)