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ROLE OF bACTERIA IN DETECTING VIRUSES IN DRINKING WATER IN THE us.

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# Abstract

Drinking water is one of the most important aspects of life but in the eyes of the average Joe, it is often overlooked. The list for drinking water quality parameters is extensive but does not reach into the world of viruses very often. In fact, it is a very specialized process that happens rarely. Viruses can live and travel in water and can cause illness or in some cases lead to death if not properly taken care of. In this report, the lack of frequent virus detection will be analyzed, and other methods will be looked at to see their correlation to viruses. This report will also look at what tests have been performed for virus detection in drinking water, why they are not used more frequently, and what test is most commonly used to help determine if viruses could be in drinking water.

# Introduction

Polio and Hepatitis A were both viruses found to live in drinking water systems (Hendricks, Charles W, 1978). Polio was a fearful disease that caused full paralysis in the 1950’s, but it has been eradicated in the US since 1979 (CDC, 2017). Hepatitis A and most of any other viruses that the modern United States population would need to worry about would originate from human fecal matter. With this, the search for harmful bacteria and viruses in the water can begin with testing if fecal matter is in the water. Testing for fecal matter and bacteria is much easier than testing for viruses, with the easiest test being a coliform test. Coliform tests measure the concentration of total coliform bacteria present that have the potential causing disease (Hendricks, Charles W, 1978). It also directly can test for the presence of Escherichia coli based on the green fluorescence protein in E. coli DNA that makes the organism grow under UV light (Chance, 2019). With this method, a small amount of water from anywhere in the city can be collected and tested. In the lab, a broth is added to the sample which is then incubated at 35 C for 24 hours and if there is an obvious clear to yellow color change, coliform is present. Then the sample is held under a UV light for confirmation on the presence or absence of E. coli via the fluorescent protein (Hach, 2013). It is safe to say that if the sample is positive for either, it is possible viruses can survive the sanitation process as well. It is also possible to conclude that if the sample is absent for any bacteria, it is more than likely also absent of any viruses since the water source has been adequately disinfected (Hendricks, Charles W, 1978). When it comes to our drinking water, however, we want to be certain.

# Recent progress

The Environmental Protection Agency (EPA) implemented the Safe Drinking Water Act (SDWA) which protects public drinking water supplies throughout the whole nation. The EPA sets various standards so citizens can have safe drinking water (EPA, 2012). With these monthly and yearly standards, every public water system must comply with requirements within the SDWA and if they do not, they receive a violation. Viruses are not included in these standards, but the EPA does implement additional testing called the Unregulated Contaminant Monitoring Rule (UCMR) which is updated every 5 years to include new contaminants. UCMR’s test in public water systems with populations of 10,000 people or less, and then they select several random cities throughout the United States (EPA, 2012). Currently cities are testing in the 4th round of UCMR’s, or UCMR4, but UCMR3’s were the only contaminant tests that included virus detection. The two viruses that were of key observation were enterovirus and norovirus, which both contaminate water when exposed through fecal matter. The EPA also suggests how microbial indicators can be used to monitor pathogens and viral co-occurrences in water systems, one of these indicators being a total coliform test. The EPA also shows how total coliforms can be used as a microbial indicator for these viruses (EPA, 2012).

# Discussion

The average total coliform test is about $30, while the average UCMR test can exceed $2,500.00. With this huge difference it is fair to say that using coliform as an indicator for virus surviving the sanitation process is useful and economical (Chance, 2019). Coliform tests are performed in every city, in multiple areas of the city, every month throughout the month. In fact, these results are available to the public via public water supply systems search parameters, or SDWIS. All results from all required testing by the EPA for cities and counties are located on this website, though each state has its own website (ODEQ, 2019). If a coliform test comes back positive, the city is put on a boil restriction and the residents are made aware of the positive result.

As we raise awareness of viruses one issue comes to mind. Measles have begun to rise again in the US, most prevalently in Washington (CDC, 2017). Does this mean the EPA should begin to test for polio in the drinking water again? As more parents choose to not vaccinate their children, dangerous viruses like polio resurfacing is a very real threat. The new UCMR5 testing parameters will begin in January 2021, and polio may have to be on that list.

# References

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