

A Review on The Potential Threat of contacting COVID 19 Disease in Drinking Water

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ABSTRACT

The emergence of the pandemic caused by the Severe Acute Respiratory Syndrome Coronavirus 2 (SARS-COV-2) has generated a lot of attention globally and forced the world to come to its knees through its sporadic spread and eventual increase in the number of infected persons and mortality. However, many means of infection have been described but little is said about any prospective spread through water, since water is a vital means of life support for all. So it is of great importance to scrutinize if it is possible for the COVID19 virus to be spread through water and what can be done to stay protected from the COVID19 virus should there be a possibility of waterborne spread of the coronavirus. A quick review of the virus, its pathogenicity tendencies and what can be done to inactivate the virus in water before being consumed was done vis-à-vis the intervention of suspended sediment load present in water.

Keywords: COVID19, SARS-COV-2, CORONAVIRUS, WHO, Drinking Water.

INTRODUCTION:

The expediency of having potable water available to everyone cannot be overemphasised. As at 2017, about 26% of the world population which amounts to 2 billion people consumes water with faecal contamination (WHO UNICEF, 2019). This contaminated water has a high tendency of comprising protozoa, bacteria and viruses which are linked with a plethora of diseases which comprise the quality of public health. Water that is not safe, poor hygiene and even improper sanitation are accountable for deaths from diarrheal globally (UNICEF, 2012). According to the data of World Bank, annual global economic loss due to lack of safe water and sanitation amounts to USD\$260 billion (WHO, 2012).

Absence of potable water immensely affects populace living in rural settings in developing countries and also populace in developed nations as well with modernized facilities for drinking water and wastewater are shielded totally from tendency of outbreak of waterborne disease.; this is typified in the between 2009 – 2010 where the United States of America reported drinking water related disease from about 33 outbreaks (CDC, 2013).

Bacteria are known to cause diarrhoea which is transmitted through contaminated water; however, viruses in drinking water are demystified as well as their adverse effect on human health. Viral pathogens in water are known to have various impact on health ranging from moderate to high effects such as astrovirus, hepatitis A and E viruses, norovirus, etc (WHO, 2011). There is a potential spread of virus in water through excretion in urine such as polyomaviruses, cytomegalovirus and more so, suggested cases of influenza and

coronaviruses (WHO, 2011; Cannon *et al.*, 2011). These viruses are known to majorly cause of ailments such as diarrhoea, abdominal cramping, vomiting and fever (Gall *et al.*, 2015). Water is an integral constituent that supports life in every aspect (Thilza *et al.*, 2015). More so, the sixth goal of the Sustainable Development Goals (SDGs) is Water supply as well as its accessibility with a target of support and sustain the environment (Duru *et al.*, 2017). Based on history, efforts have been made for feasible access to potable water for various purposes with a sizable attention to the source water (Israr *et al.*, 2017). Developing nations have common problems of insufficient water supply as well as problems of pollution (Oludairo and Aiyedun, 2015). This problem is majorly caused by poor hygiene and also poorly managed water and wastewater treatment infrastructure if any at all which brings potential pollution (Kuta *et al.*, 2014).

More so, as at August 2020, the outbreak of the COVID19 disease cases of infection report has been more than 17.5 million which is from about 180 countries and mortality from this infection report has been over 680,000 people (Dong *et al.*, 2020). The most conspicuous symptoms associated with COVID19 is breath shortness, cough and fever and if the disease prolongs for weeks to transition to severity, it can ultimately lead to more drastic health conditions such as kidney failure and death (Huang *et al.*, 2020; Wang *et al.*, 2020). On the average, the typical range period of incubation the COVID19 virus is between 3 to 7 days with a corresponding statistical median of 5.1 days and a 99th percentile of 14 days hence the arrived generally accepted period of isolation being 14 days (Lauer *et al.*, 2020; Zhu *et al.*, 2020)

What is the Novel Coronavirus?

In late 2019, a new type of coronavirus was discovered as a result of consistent rise in the pneumonia cases which had gone viral in Wuhan which is the capital city of Hubei province China. This disease which is very infectious given the name COVID19 by the World Health Organization (WHO). This novel coronavirus is the seventh type of coronavirus which can infect humans and it is named "SARS-CoV-2" by the International Committee on Taxonomy of Viruses (ICTV). The previously known six coronaviruses are: HCoV-OC43, HCoV-HKU1, HCoV-NL63, HCoV-229E, SARS-CoV and MERS-CoV (ANSO, 2020). Coronaviruses are a group of viruses which are enveloped RNA viruses and their diameter ranges from 60nm to 140nm; they also have projections of spikes on their surfaces which make their appearance similar to crowns when viewed with the aid of electron microscope. It is from this crown-like appearance they got the name coronavirus since corona is the Italian name for Crown (Richman *et al.*, 2016). The Severe Acute Respiratory Syndrome Coronavirus 2 (SARS-CoV-2) that causes COVID19 disease has a diameter of 100nm (ANSO, 2020).

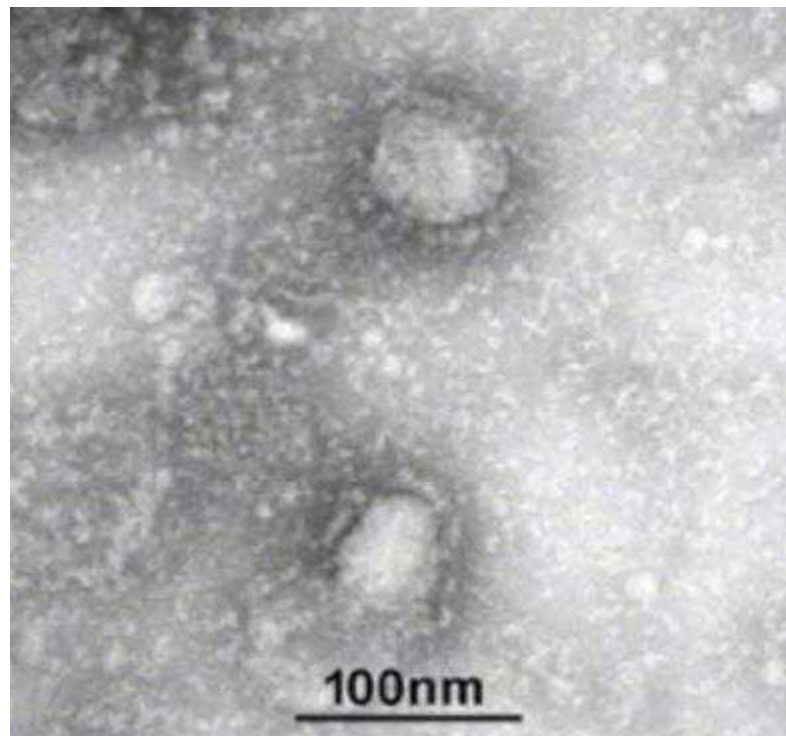


Figure 1: SARS-CoV-2 under the Electron Microscope

The life cycle of this virus revolves around envelope proteins in the areas of pathogenesis, formation and assembly (La Rosa *et al.*, 2020). A closer scrutiny into this envelope shows helical capsid which comprise RNA genome and nucleoprotein as shown in Figure 2

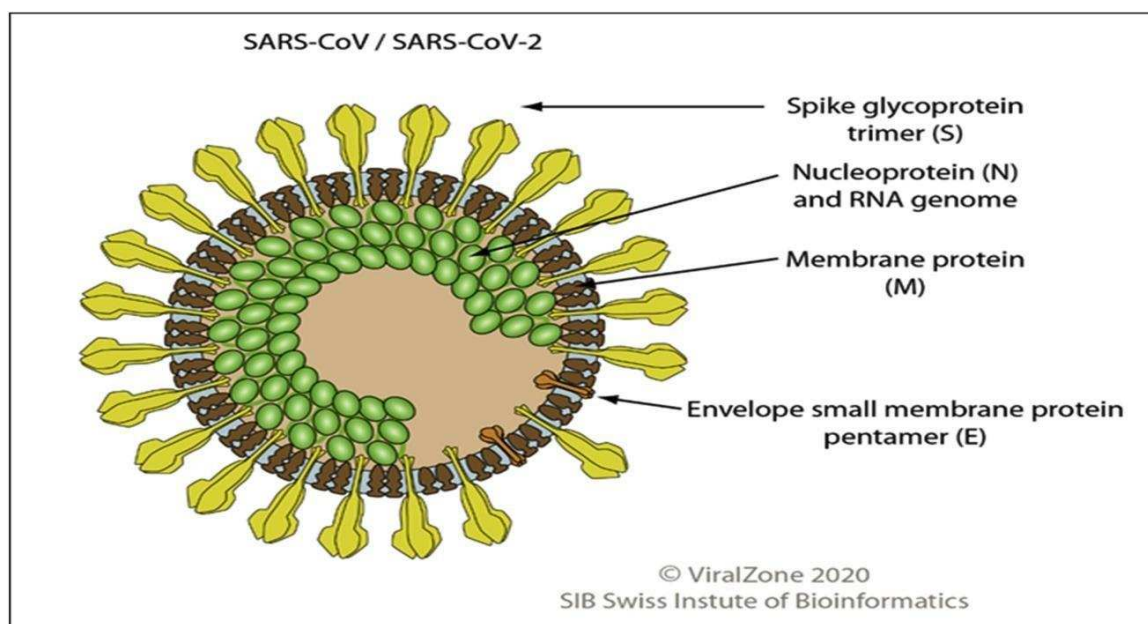


Figure 2: Virus structure of SARS-CoV/SARS-CoV-2
SIB Swiss Institute of Bioinformatics

Pathogenicity of SARS-CoV-2 and Spread of COVID19

There were growing cases of severe pneumonia-like ailments in local hospitals in Wuhan city in Hubei with no known source which was observed in December 2019. The earlier reported cases were connected to have had a common exposure to Huanan seafood market where live animals were also traded as well. There was a surveillance system which was set up after the previous SARS outbreak and this system was activated and samples were taken from patients with symptoms to reference laboratories for proper scrutiny. It was after this China then informed the WHO about the outbreak, subsequently on January 1st 2020 the seafood market was closed. By January 7th 2020 the unknown virus was identified as a novel coronavirus with a homology of more than 95% with the corona virus in bats as well as more than 70% similarity to the SARSCoV. More so, environmental samples taken from the Huanan Seafood market were also tested positive for the SARS-CoV-2 virus and it was indicated that the virus was originated from there. (Xinhua, 2020). There was a sharp rise in the number of new cases of which a sizable number of them never had contact with the Huanan Seafood which implied human-to-human transmission was evident in the spread (Huang *et al.*, 2020). Exodus migration of people to and from China during the Chinese New Year catalysed the epidemic, cases started growing visibly in other provinces as well as some neighbouring countries such as Japan, South Korea and Thailand. More so, health workers started getting infected from patients as reported on January 20th 2020. The data of COVID19 cases in other countries showed patients with no travel history at all which goes on to imply the transmission between humans locally was on the rise (Rothe *et al.*, 2020). It has been alleged that the SARS-CoV-2 originated from bats from which it got transmitted to humans; there are also reports that it **was** originated from snakes and pangolins (Singhal, 2020).

There has been a first account of SARS-CoV-2 in faecal waste which implies the possibility of the virus present in human wastewater (Holshue *et al.*, 2020). More so, samples of human wastewater were analysed in Tilburg, Netherlands which tested positive for RNA virus (RIVM, 2020). This discovery gives credence to wastewater as a tool for surveillance and indication as it was used successfully in the case of poliovirus (Lodder *et al.*, 2012). It is presently not clear if there is a faecal-oral transmission; however, there is evidence of prospective spread in regions even when all preventive measures proposed have been adhered to (Liu *et al.*, 2020). A typical case was reported in USA where a fellow had contacted the COVID19 disease without any prior exposure to infected persons and had not travelled outside the country as well (Ng *et al.*, 2020).

SARS-COV-2 in Water

Although there seem not to be any substantial evidence of the coronavirus being present in source water whether surface or groundwater; however, the possibility of the persistence

of the coronavirus in source water has been generally upheld. More so, the coronavirus that cause COVID19 disease is an enveloped virus whose outer membrane is unable to withstand some environmental conditions such as very low or very high pH, temperature, exposure to disinfectants. The SARCOV2 virus is easily inactivated more rapidly when compared to non-enveloped virus that are waterborne like rotavirus, hepatitis A, etc (WHO, 2020).

Although the coronavirus that cause COVID19 is yet to be detected in the supply of drinking water and the risk associated in terms of evidence is presently low (WHO, 2020). Research done in the laboratory of the coronavirus in a controlled environment showed that the virus could survive in water that has been contaminated with faeces for up to weeks (Casanova *et al.*, 2009).

More so, a scrutiny of figure 3, illustrates that more than 20 countries whose reports were compiled also corroborates findings SARSCOV-2 was detected not just in raw wastewater alone but also in the secondary treatment effluent as well as sludge from wastewater treatment (Rimoldi *et al.*, 2020; Guerrero-Latorre *et al.*, 2020). Going by Bhowmick *et al.* (2019) there are a plethora of paths this virus can infiltrate aqua space typically the urban water cycle, a typical example of the virus infiltrating the water environment is through faecal waste, urine and any form of wastes from infected persons. An established survivability fact of the virus at Mean T_{90} at a high-starting titer (of magnitude 10^5 TCID₅₀ mL⁻¹) in both wastewater and tap water at a temperature of 20°C is 1.6 and 2.0 days respectively in the laboratory (Bivins *et al.*, 2020). Coronavirus may not be effectively eliminated from conventional wastewater treatment especially the primary treatment because of its micro size but a more concise secondary treatment such as membrane filtration, activated sludge have better performance in eliminating this virus (Arora *et al.*, 2020; Chaudhry *et al.*, 2015). In order to attain reliable inactivation of the virus in water, tertiary treatment such as chemical oxidation disinfection like chlorine addition or Ultraviolet light treatment is required (Ji *et al.*, 2021).

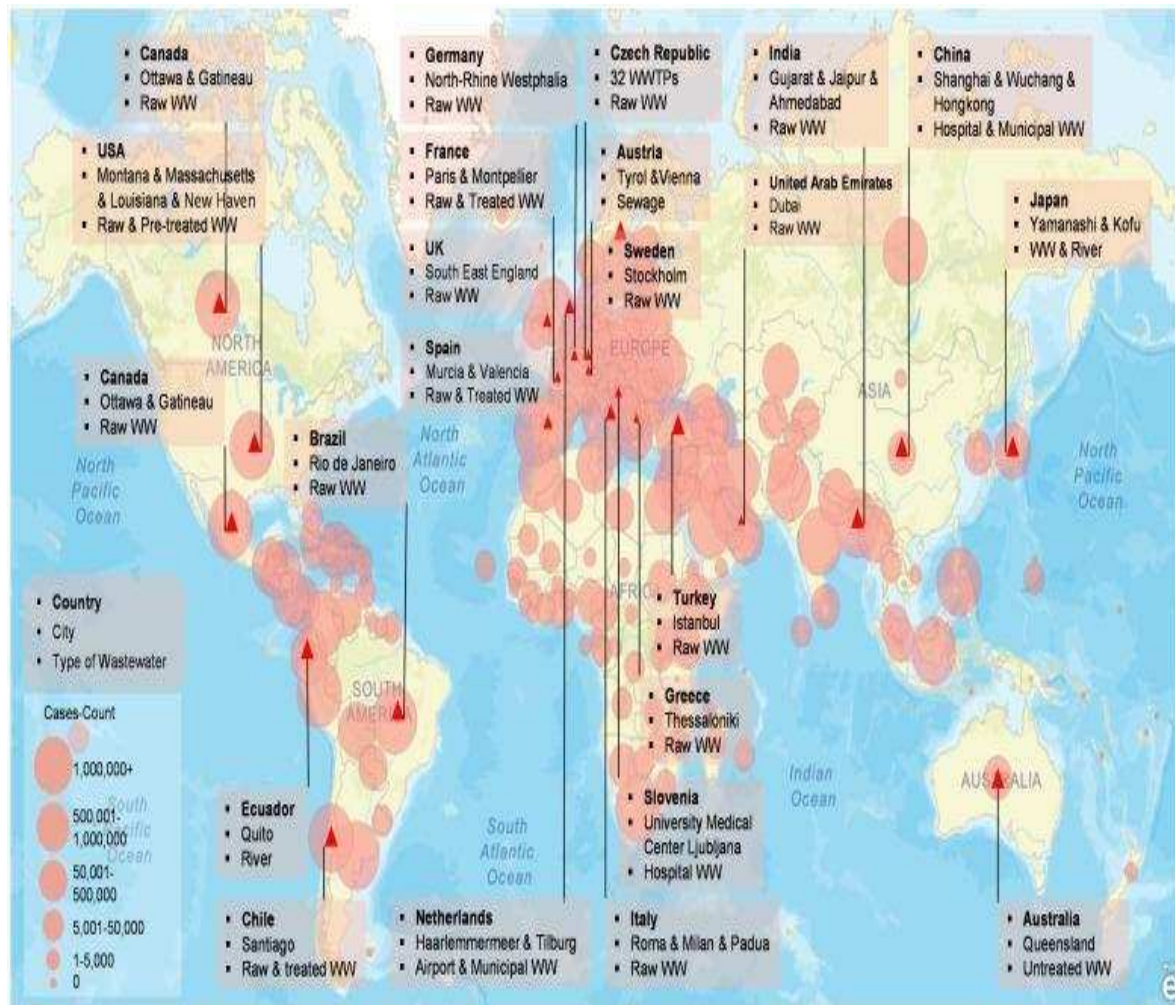


Figure 3: Confirmed cases of SARS-CoV-2 detection in global aqueous environment.
 (Ji *et al.*, 2021)

RECOMMENDATION OF TREATMENT OF COVID19 VIRUS IN WATER

SARS-COV-2 being a non-envelope virus implies that it is unstable when subjected to harsh conditions and so under conventional treatment of drinking water, the virus is inactivated especially when subjected to disinfection through chlorination, ultraviolet radiation or ozonation. So communities whose water supply is from a conventional drinking water treatment plant do not stand any risk from being exposed to the COVID19 virus through water supply while residual chlorine in the distribution system should not be less than 0.5mg/L (WHO, 2020). More so, for communities in developing countries where there are no access to potable water from a conventional drinking water treatment, it is imperative to subject the water to some basic treatment before consumption to eliminate any risk of being exposed to the COVID19 virus through water borne means. The water should be boiled as heat kills the virus; also the water should be subjected to coagulation and sedimentation before applying any disinfectant as suspended solids especially sediment

can shield virus and other microorganisms from being inactivated by applied disinfectant introduced into the water. These processes would help rural communities to also protect themselves from any potential spread through drinking water.

CONCLUSION

There is still a lot that is yet to be known about the COVID19 virus as new discoveries are being made to understand this pandemic; a new discovery has just shown that asymptomatic carrier may not spread the virus which was not the initial narrative. More so, there are no known cases of the virus being spread in drinking water yet but that does not negate that it is impossible as little is known about this virus. However, there have been cases of the virus being detected in faecal sewage and so this gives credence to the possibility of the virus to being spread through water. In order to stay safe while more research is ongoing, it is important to treat water as discussed earlier to avoid any potential spread through water as other preventive measures of hygiene such as wearing of facial mask, observing safe social distance of about two metres from anyone in a public space, frequent washing of hands for at least twenty seconds under running water from a tap or alternatively using an alcohol based hand sanitizer as well as other safety measures as stipulated by the Centers for Disease Control and Prevention (CDC) and the World Health Organization. More so, in the case of water treatment more emphasis should be placed on treatment units such as sedimentation, chemically assisted filtration and disinfection. This is very important as suspended sediment load could aid microorganisms to be shielded from disinfectants and continuous existence in water and the two most effective ways of removing suspended sediments are sedimentation which is preceded by flocculation in the case of wastewater treatment and chemically assisted filtration in the case of drinking water treatment.

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