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**Short communication**

# Role of water under the covid-19 pandemic: beneficial or/and detrimental?

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The COVID-19 pandemic represented a global phenomenon during 2020. It has spread over most of the countries in the world, leading to the infection of millions of people with a death rate of 2-3% simultaneously causing a serious economic crisis. It resulted in significant pollution reduction, but effects to combat COVID-19 led to an increase of some special pollutants. In such circumstances water can be considered as a cleaning and diluting agent for pollutants, providing hygienic conditions, as well as valuable raw material for the production of a variety of goods necessary for combating COVID-19. On the contrary, water can be viewed as a potential threat in relation to the virus spreading. Within the context of the human water cycle, we have identified possible hotspots related to risks of infection spreading. It may occur when contaminated water is reused (grey and black water), or insufficiently purified water enters the environment, which might interfere with drinking water.

**Keywords:** coronavirus, water resources, public health, wastewater, water reuse

## 1 Material and methods

The role of water is immense, in particular as it serves as a universal solvent for various substances of inorganic and organic origin from both natural or/and human-made sources. It circulates not only through the hydrological cycle, but also flows through living organisms (Grabić et al., 2020), simultaneously contributing to diverse interactions with living – non-living nature. This complex role of water, which includes the impact of human societies and economies, is presented in Fig. 1. This implicates different or even contradictory roles of water, i.e. clean water vs. polluted water. Especially during the COVID-19 pandemic, water has a dual role. Its positive role is, in the first place, clean drinking water, which keeps supporting general health and good immunity. Another role is keeping hygienic conditions and diluting pollutants. Clean water is an essential raw material for the production of various goods (disinfectants, drugs, etc.) necessary in the fight against COVID-19, as well as for the production of safe food (Grabić et al., 2020).

On the other side, the negative role of water and water-based body fluids (e.g. saliva, urine, blood) during the COVID-19 pandemic is the ability to carry and spread undesired compounds, in this case, coronavirus. It is confirmed that the most common way of spreading infection is by direct contact with an infected person by droplets after sneezing and coughing, and by aerosol (WHO & UNICEF, 2020a). The second question is about the survival of coronavirus in drinking water.

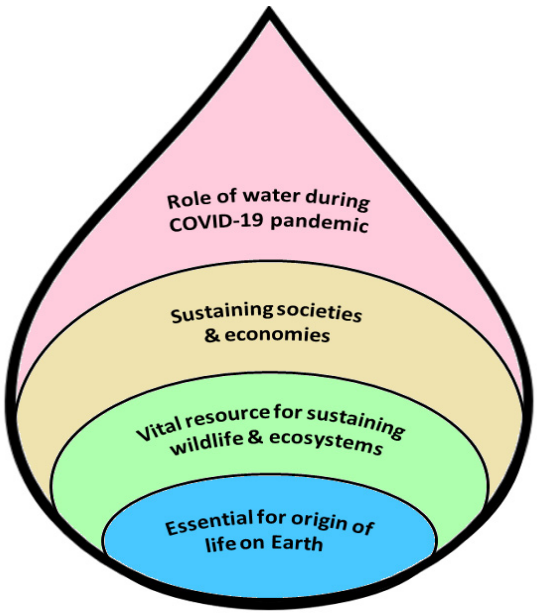



**Figure 1** Diverse roles of water apart from and during the COVID-19 pandemic

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A study conducted on other coronaviruses in tap water demonstrated a 99.9% die off within 10 days at 23 °C and over 100 days at 4 °C (Gundy et al., 2009). Bearing in mind that coronaviruses are susceptible to chlorination and UV radiation, there is a predominant opinion that the virus is not likely to be found in drinking water after proper preparation (WHO & UNICEF, 2020b). The third question is related to the presence of the virus in wastewater (WW). Recently, coronavirus has been confirmed in untreated WW in Australia (Ahmed et al., 2020). However, the duration of coronaviruses survival in WW is just 2–4 days (Gundy et al., 2009) and preliminary results showed no infectivity for receiving rivers.

Even efforts to fight pandemics can result in certain water pollution, e.g. remedies used to cure COVID-19 patients (Yang et al., 2020), increased use of disinfectants. Finally, water is also used in the production process of various goods produced exclusively for the prevention of spreading and curing COVID-19 patients, among which are: diverse medical equipment, protective clothes, drugs and vaccines, etc.

## 2 Results and discussion

The human water cycle is a complex covering all aspects where water is consumed by humans including both clean water uptake and WW generation. Bearing in mind the contradictory role of water during pandemic conditions and to mitigate and overcome the crisis, special attention has to be paid to two aspects:

1. providing sufficient quantities of clean water for drinking and handwashing,
2. adequate treatment or/and management of WW (Fig. 2).

The first aspect addresses water supply services. Namely, it is believed that up-to-date disinfection methods used for drinking water preparation are adequate for coronavirus elimination; nevertheless, water supply services are put to a new challenge, since patterns of distribution have been changed (Cooley et al., 2020). Furthermore, sufficient amounts of water at the required quality are also necessary to satisfy the needs of industry-producing goods intended to suppress the pandemic.

The second aspect is associated with WW management. The research confirmed that the COVID-19 has been found in the faeces of COVID-19 patients, which opens the possibility for fecal-oral transition (Xiao et al., 2020). The duration of the WW treatment process contributes to a decrease in the concentration of coronavirus in the treated WW. However, collateral negative effects may arise from the increased use of disinfectants and antibiotics decreasing the efficiency of the water purification process, especially the biological part of WW treatment.

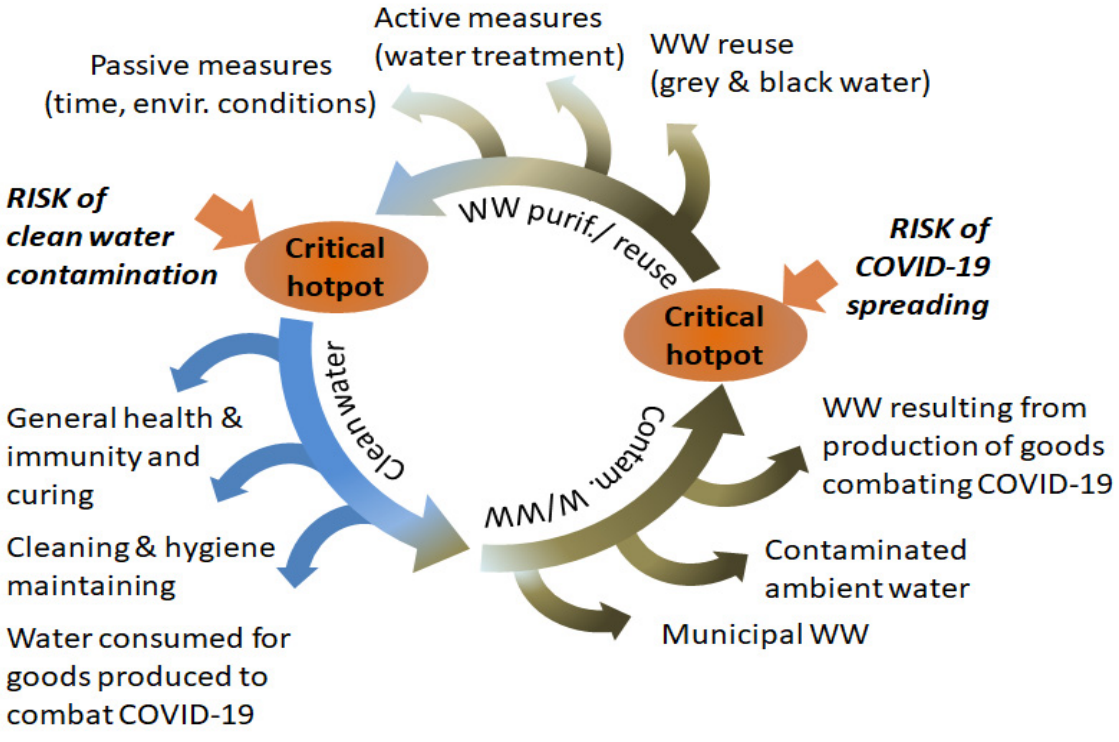



**Figure 2** Multiple roles of water during COVID-19 pandemic and critical hotspots

Additionally, there are questions of WW reuse and the use of ambient water where the presence of coronavirus has been confirmed. WHO and UNICEF (2020a) advise never to release "untreated faecal sludge and WW from health facilities... on land used for food production, aquaculture or disposed of in recreational waters". Regarding irrigation, special attention has to be paid to sprinkler irrigation. Namely, this irrigation type produces fine droplets, which are easily turned into aerosols. During the COVID-19 conditions, if there is a concern that water is contaminated by the virus, the application of such irrigation practice should be restricted. Similarly, greywater application has to be restricted only to the irrigation of outdoor greenery, while it should be avoided when it comes to the irrigation of plants intended for food (especially fruits and vegetables) (Grabić et al., 2020). Using contaminated water on farms poses a risk for farmers to get in touch with the virus during harvesting fruits or vegetables, or conducting daily routines related to raising domestic animals. Finally, to conclude, during the pandemic, uncontaminated water – virus-free – is a crucial component in the production of safe food (Grabić et al., 2020). As a precaution measure, wearing protective clothes, gloves, and facial masks for workers, engaged in WW treatment/reuse, must be applied as obligatory (Dabić et al., 2018). Another recommendable measure is WW testing on the presence of COVID-19 and acting according to the results.

In developed countries, obligatory WW treatment enables the elimination of the virus during the process of WW treatment, and only in cases of incomplete WW treatment, a small portion of the virus can survive. Since the problem of water pollution is more pronounced in developing countries (UNESCO & WHO, 2019), there is a risk of coronavirus spread off using contaminated untreated surface water and unprepared drinking water originating from contaminated surface waterbodies.

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