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WATER POLLUTION ASSOCIATED WITH BIOMEDICAL WASTE GENERATED DURING COVID-19 PANDEMIC: CHALLENGES AND RECOMMENDATIONS

Ratnum Kaul Wattal[1]* and Devender Mudgil[2]

[1]Department of Botany, Zakir Husain Delhi College, Delhi-110002, India.
[2]Department of Environmental Studies, Zakir Husain Delhi College, Delhi-110002, India.

***Corresponding Author: Ratnum Kaul Wattal**
Department of Botany, Zakir Husain Delhi College, Delhi-110002, India.

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ABSTRACT
Water is a vital component of life and therefore is required for sustainability. It is an extremely threatened natural resource today. Despite tremendous efforts towards providing safe and affordable drinking water to all, there still exists a large population who do not have access to the same. Problem of water pollution is continuously increasing. The recent outbreak of Covid-19 has made the situation worse. The pandemic has resulted in generation of large volume of biomedical waste. There already were different sources of water pollution but enormous use of chemicals, protective gear, sanitizers, radioactive compounds, drugs, swabs, sharps, syringes etc. have further compounded the problem. Generation of the biomedical waste being collected in landfills or in open dumping sites is resulting in leaching of toxic compounds into the ground water. Immediate stringent policies and measures need to be implemented before it is too late to reverse the catastrophic effects.

KEYWORDS: Water, Pollution, COVID-19, Biomedical waste.

INTRODUCTION
Water, air and soil are the precious gifts to mankind and these are needed for their very survival. Water is essential to plants, animals and human beings for their metabolism. Polluted water has badly affected all living organisms globally. There is an urgent need to devise new technologies for effective water treatment as well as to implement strict guidelines for the use and reuse of water. According to Sustainable Development Goal 6, the provisions need to ensure universal and equitable availability of safe and affordable drinking water to all. It also includes work towards quality and sustainability of water resources. There is a lot of progress towards providing clean and safe water to masses. According to SDG 6.3 the target of improving water quality by reducing pollution also needs to be met by 2030. This is to be achieved by eliminating open dumping sites and minimizing release of hazardous chemicals and materials into ground water. Attempts need to be made towards reducing the amount of untreated waste water and increasing recycling and safe reuse globally.

The recent outbreak of SARS-CoV2 virus belonging to the family of corona viruses has resulted in global devastation in terms of human life. World health organisation initially called this out break as public health emergency at the international level and on March 11, 2020 it was given the status of pandemic. With the onset of COVID-19 pandemic, human survival became the prime focus of all research.

There is tremendous research going on globally to figure out the possible mode of transmission of this virus. There are several reports indicating the presence of SARS CoV2 virus in sewage treatment plants. Therefore, pollution of water bodies became a great cause of concern.[1] A lot of research work is going on to investigate the impact of SARS-CoV-2 on water bodies and the associated water treatment systems. Its major focus is on devising effective waste water treatment technologies. During this pandemic, hygiene and sanitation have also played a pivotal role in mitigating the spread of the disease and hence are a major challenge in front of public health and services. New management, policies and technologies are being developed to deal with this life-threatening situation. In addition to the drinking water systems, the need of the hour is also to explore better water management techniques, effective engineering processes for waste water treatment, proper sanitation and public health systems which can have far reaching effects in future. Another point of major concern is the enormous biomedical waste being created. Proper handling and disposal of waste are matters of grave concern. There are different water sources and contamination of these depends upon their origin and the location.[2]

Sources and toxicity of water pollution

1. Point source pollution

When source of water pollution is known or pollutants that are entering into water are from identifiable source like ditch, pipe industry, sewer drain and sewage treatment plants etc. pollution is known as point source pollution. It can be distinguished from other pollution sources.

***2*. Non-point source pollution**

When source of water pollution is not known or pollution does not come from single discrete source; this type of pollution is known as non-point source pollution. It is very difficult to control non- point source pollution and may come from different sources like pesticides, fertilizers through agricultural runoff, industrial wastes etc. Non-point source pollution is the main and leading cause of water pollution in several locations.

Water pollution is the prime cause of variety of diseases and consequent deaths globally. A lot of environmental factors like ground water availability, soil type, geology, precipitation, and vegetation greatly influence water quality. Needless to say, human interference and industrial revolution have also immensely contributed to it. In developed countries, industrial and sewage effluent discharge, agricultural industry, illegal garbage disposal and leakage of leachate from landfill are the biggest threat to water quality. Mining and urban development in developing countries also contribute to this menace.[3] Most of the times waste water treatment plants act as the hot spots of pollutants. These effluents are rich in pharmaceutical residues, drugs, antimicrobials and antibiotics. Although most of the industrial businesses have their own wastewater treatment plants, but over production of the effluent discharged on a daily basis can sometimes complicate the situation. Also, the quality of treated waste water depends largely upon the effectiveness of the treatment plant. Conventional treatment plants fail to remove these pollutants with great efficiency. Excess pollutants pose a serious problem for drinking water treatment plants (DWTPs), which use river water as their main sources for safe drinking water production. It is extremely essential to ensure a safe and reliable potable water supply before it is provided for the consumption of the society at large.

Biomedical waste generation during Covid -19

According to world health organization the term "Bio-Medical Waste" (BMW) includes all the waste from any medical practise in healthcare amenities, research centres, diagnostic facilities and pathological laboratories.[4] The health care activities like disease diagnosis, vaccination, treatment, pathological investigations and immunization of human beings as well as animals lead to generation of large amounts of medical waste. This waste may be generated at home, any health care centres or research laboratories. Hazardous effects of the waste depend upon types and characteristics of the contents present in the waste. The classification of the components of the waste is based on presence of infectious substances, radioactive compounds, presence of sharps, toxic chemicals. In a study these pollutants have been shown to affect the cell or its genome and have also been found to be responsible for biologically aggressive behavioural alterations in various life forms. Management of this waste requires strict regulatory guidelines by the government. The associated health risks with the management of BMW need to be addressed under provisions of Environment Protection Act 1986. All stakeholders who are responsible for the generation, collection, storage, treatment, recycling and disposal of biomedical waste come under the purview of the biomedical waste management and handling rules 1998. These rules have been revised from time to time. They were last revised in 2018 to take care of proper segregation, transportation and disposal of BMW to reduce environmental impact of biomedical waste.[5] Use of face masks, gloves, shields and other safety equipment have become part and parcel of the dress code during covid era. Apart from this use of PPE kit and associated single use medical care equipment are the main cause of large amounts of non - biodegradable solid waste being generated during the time of pandemic. There is generation of large volumes of infectious and hazardous biomedical waste in the form of syringes, cotton swabs, disinfectants etc being used in the medical care. This has resulted in the production of enormous volumes of yellow category of biomedical waste (Y-BMW). According to WHO, the production of PPE kits has increased tremendously during pandemic. World health organization has indicated monthly rise in its production to the tune of 40% from the pre covid era.[6] Although there is considerable improvement in health care sector and hospitals, clinics and nursing homes are mushrooming all around but still the proper segregation of BMW and Y-BMW is only 28% and 40% respectively. According to estimates Wuhan in China produced more than 240 metric tons of medical wastes every day during the time of the outbreak.[7] This is far above the volume collected during pre-COVID era. According to another study in the city of Ahmedabad in India, the amount of medical waste generated during covid time was almost double the weight before the lockdown.[8] Such abrupt increase in the amount of Y-BMW, during the covid outbreak has taken a serious toll on waste water management systems globally. According to the statistics provided by the Asian Development Bank reports the amounts of BMW generated per day were to the tune of 280 tonnes in Manila, 212 tonnes in Jakarta and 210 tonnes in Bangkok per day during COVID times.

Water pollution and biomedical waste associated risks

Covid-19 is one of the severest human adversities so far. It has impacted the global economy as well as the environment. Although there are reports that during the lockdown air quality improved but it has directly or indirectly impacted the water resources very badly.[9]

Sea beaches have been found to be heavily littered with biomedical waste. It has given rise to a new type of pollution called PPE pollution which is no longer restricted to land but have reached seas and oceans as well. In a recent survey of Hong Kong beach by NGO it has been observed that a lot of trash hits the shores with every high tide. This has gravely impacted the marine life. The non-biodegradable biomedical waste is being ingested by the aquatic life forms with dangerous consequences.[10] These hazardous pollutants have their long-term implications. They enter the food web and result in bioaccumulation of the pollutant, which in turn directly or indirectly affect various life forms. Management of BMW in improper way results in several problems including spread of infectious diseases and different forms of environmental pollution.[11] It has been established that 10–25% of BMW is dangerous. [12] This unsorted and untreated BMW poses threat to whoever is exposed to it or comes in contact with it. Prolonged storage of waste on the landfills have been shown to be inflicting damage to the environment. The continuous seepage of toxic chemicals to the underground water results in water pollution.

Health Aspect: The greatest challenge to the population is by the water borne pathogens. The disease risk associated with drinking water in developing countries is due to improper sanitation, lack of effective water purification and unhygienic environment. It is often found that sewage is discharged into water bodies without proper prior treatment or ineffective treatment. This heavily pollutes mainly the drinking water.[13] Water through this route brings viruses, bacteria and protozoa as well. Some of the disease outbreaks that have occurred in the past have been due to contaminated drinking water. These water samples were found to contain *Salmonella typhi* and *S. paratyphi*, hepatitis A and E viruses, rotaviruses, and the parasitic protozoa *Giardia lamblia*.[14,15]

Environmental Aspect: The improper disposal of biomedical waste may cause negative impact on the water quality as different pollutants may leach out from the waste dumping sites into the ground water. In a study around municipal solid waste and some of the open dumping sites heavy metal contamination was found in the ground water samples.[16] This clearly indicated migration of metallic contaminants present in the solid waste into the sub soil water. The presence of Mn, Pb, Cu, and Cd indicated high concentration of metals. Greater migration of metal contaminants was observed from open dumping sites. In another study BMW was incinerated. It was found that the incineration of biomedical waste leads to the production of high concentration of heavy metals and polycyclic aromatic hydrocarbons in the residue.[17] Therefore, it was suggested that the toxicity of ash should be removed before its disposal into landfills or used for recycling. Analysis of leachate from these landfills was found to exhibit contamination beyond the permissible limits prescribed by WHO. According to Thind et al (2014) the presence of heavy metals in landfill leachate from biomedical waste causes risk to the ground water the ongoing Covid-19 pandemic is causing severe mental and physical stress to the society. The outbreak has affected not only the health sector but has gravely impacted financial economy as well as the composition of the environment. It has been termed as the worst crisis of this century. Although strict measures are being employed at global level to prevent further spread of the disease but apprehensions are still scaling high about possibility of many more similar or more dangerous outbreaks with the constantly evolving strain of this virus.[18]

Suggestions and recommendations

The crisis brought upon by the COVID-19 pandemic has changed global waste generation dynamics and therefore has necessitated special attention. It is important to find out the present rate of generation of BMW and then its management facilities, need to be reviewed. This will give an insight into the associated risks and management problems related with the waste and its disposal. Based on the data thus procured strict guidelines are required to be implemented. It has been reported by WHO that with advancement in health care and launching of *Millennium Development Goals* we have considerably been able to reduce the impact of disease by providing safe drinking water but have yet not been able to provide proper sanitation to 2.6 billion people.[19] Therefore, it is extremely essential to invest in methods to minimize waste generation, and bring in innovative technologies for effective waste recycling and improved quality of potable water, hygiene and sanitation. Also, it has been suggested that the waste should be managed by using incinerators rather than landfills. This will reduce the storage time of the hazardous waste on the dumping sites, minimize leachate reaching the underground water and also reduce the risk of spread of the infection.

CONCLUSION

The alarm bells are ringing with respect to the deteriorating conditions of the quality and the quantity of potable water across the globe. According to several studies the day zero is fast approaching and the quality and the quantity of water are getting endangered. Our careless attitude towards environment, lack of hygiene and insensitivity towards natural resources are the key factors responsible for the degradation of the environment. Our recent face off with a tiny virus, a link between the living and the non -living, has brought us down to our knees. Our encounter with Covid 19 has impacted mankind globally not only in healthcare, human resource, industry but also in terms of environmental health and its economy. The environment has been greatly compromised by Covid 19. It has gravely impacted our water resources as well. Water economy too has been threatened due to the current pandemic.

Growing human population poses increasing demands of food. To increase agricultural needs, we have to adopt organic fertilizers and technologies which are eco-friendly. Increased use of chemical fertilizers to improve crop productivity are leading to water pollution. Some of the chemicals have a bioaccumulation potential and may enter the food chain harming the mankind. It is extremely crucial to monitor even the agricultural runoff in order to ensure that no chemical pollutants reach ground water or our rivers. Water pollution has achieved newer heights. It is a wake-up call to be economical in water use and adopt the mantra of reduce, reuse & recycle. Environment friendly innovative techniques need to be adopted. Segregation of waste at the point of origin is extremely crucial. It is essential to reduce waste, adopt sustainable recycling measures and maintain hygiene. Also attempts need to be made to stop leakage of contaminated water at the individual domestic point of origin as well. Industries should employ efficient technologies for treatment of the effluent in order to reduce the pollutants. Innovative measures must be adopted for reuse and recycling of even waste water. It is essential to come up with strict policy measures to protect further loss of this natural resource.

Any delay in adopting strict guidelines to conserve the quality and quantity of water will affect the atmospheric water cycle and may cause irreparable damage to mankind. We expect this discussion to contribute not only to the current challenges, but also to the conceptualization of new projects and the broader task of mitigating climate change.

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REFERENCES

1. Nghiem, L. D., Morgan, B., Donner, E., Short, M.D., The COVID-19 pandemic: Considerations for the waste and wastewater services sector. Case Studies in Chemical and Environmental Engineering, 2020; 1(April): 100006.
2. Quinete, N., Hauser-Davis, R.A., Drinking water pollutants may affect the immune system: concerns regarding COVID-19 health effects. Environmental Science and Pollution Research, 2021; *28*(1): 1235–1246.
3. Sharma, S., Bhattacharya, A., Drinking water contamination and treatment techniques. Applied Water Science, 2017; *7*(3): 1043–1067.
4. World Health Organization. Report on health-care waste management (HCWM) status in Countries of the South-East Asia Region (No. SEA-EH-593). 2017; World Health Organization. Regional Office for South-East Asia.
5. Goswami, M., Goswami, P. J., Nautiyal, S., Prakash, S., Challenges and actions to the environmental management of Bio-Medical Waste during COVID-19 pandemic in India. Heliyon, 2021; 7(3): e06313.
6. Thind, P.S., Sareen, A., Singh, D.D., Singh, S., John, S., Compromising situation of India's bio-medical waste incineration units during pandemic outbreak of COVID-19: Associated environmental-health impacts and mitigation measures. Environmental Pollution, 2021; *276*: 116621.
7. Saadat, S., Rawtani, D., Hussain, C.M., Environmental perspective of COVID-19. Science of the Total Environment, 2020; *728*: 138870.
8. Somani, M., Srivastava, A. N., Gummadivalli, S. K., Sharma, A. Indirect implications of COVID-19 towards sustainable environment: an investigation in Indian context. Bioresource Technology Reports, 2020; 11: 100491.
9. Nelson, K.L., Murray,A., Sanitation for Unserved Populations: Technologies, Implementation Challenges, and Opportunities. Annual Review of Environment and Resources, 2008; 33(1): 119–151.
10. Sarkodie, S.A., Owusu, P.A., Impact of COVID-19 pandemic on waste management. Environment, Development and Sustainability, 2021; *23*(5): 7951–7960.
11. Rai, A., Kothari, R., Singh, D.P., Assessment of available technologies for hospital waste management: a need for society. In: Waste Management: Concepts, Methodologies, Tools, and Applications, 2020; 860–876. IGI Global.
12. Rao, V.V., Ghosh, S.K., Sustainable bio medical waste management—case study in India. In: Urban Mining and Sustainable Waste Management. 2020; 303–317. Springer, Singapore
13. World Water Assessment Program. The United Nations World Water Development Report 3: 2009. Water in a changing world (UNESCO, London).
14. Ashbolt, N.J., Microbial contamination of drinking water and disease outcomes in developing regions Toxicology, 2004; 198: 229–38.
15. Schwarzenbach, R. P., Egli, T., Hofstetter, T. B., Von Gunten, U., Wehrli, B., Global water pollution and human health. Annual Review of Environment and Resources, 2010; *35*: 109–136.
16. Kanmani, S., Gandhimathi, R., Assessment of heavy metal contamination in soil due to leachate migration from an open dumping site. Applied Water Science, 2013; 2-13: 3(1): 193-205.
17. Heera, S., Kunal., Rajor, A., Bacterial Treatment and Metal Characterization of Biomedical Waste Ash. *Journal of Waste Management*, 2014; 1–6.
18. Cobey, S.,Modeling infectious disease dynamics. Science, 2020; 368(6492): 713–714.
19. World Health Organization, Global health risks: mortality and burden of disease attributable to

selected major risks, 2009; World Health Organization, Geneva.