Opinion

Waterborne pathogens in drinking water-existing removal techniques and methods

Abstract

Waterborne pathogens in drinking water affect the lives of millions worldwide especially in the rural areas of developing countries. Access to clean drinking water and modern water purification system is rare in rural community, therefore low maintenance, cost-effective and easy operational point-of-use water purification methods need to be employed to improve the quality of water in rural areas. Thus, the present manuscript gives an idea of the different techniques employed and use of ecofriendly, sustainable and cheap resources for effective removal of pathogens.

Keywords: pathogens, *e coli*, water, purification, viruses, bacteria, sewage, cryptosporidiosis, giardiasis

Volume 3 Issue 6 - 2017

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Received: November 03, 2017 | **Published:** November 24, 2017

Introduction

The accessibility to clean drinking water is one of the increasing and burning problems being faced in many parts of the world particularly in developing countries. The presence of waterborne pathogens in drinking water such as bacteria, viruses, fungi and protozoan accounts for around 1.3million deaths of children worldwide every year.[1] These biological pollutants are mainly released into water bodies from human sewage and run off from animal husbandry facilities. Besides, Algal bloom and rise in water turbidity also contributes to increase of microbial populations in water system.[2] Diseases such as diarrhea, giardiasis, cholera, cryptosporidiosis, gastroenteritis, shigellosis, salmonellosis, typhoid fever are common outbreaks in rural areas of developing countries due to consumption of water that are infested with pathogens.[3] Among all the pathogens, the presence of coliform bacteria-*E.coli* in drinking water is significant as it serves as a faecal indicator for monitoring of water quality. Though some of *E.coli* strains are harmless, many other strains are very pathogenic causing severe illness such as diarrhea pneumonia, respiratory illness and urinary tract infection.[4] Therefore, removal of such pathogens is important for safe water treatment.

Myriad researches have been going on till date focusing on removal of waterborne pathogens from drinking water. Many improvised techniques and treatment process have been developed in recent years such as bactericidal paper impregnated with silver nanoparticleshave been used in water treatment for inactivation of *E. coli* and *E. faecalis*.[3] While Magnetic graphene composite have been employed for efficient removal of pathogenic bacteria.[1] Chlorine and ferrate (VI) have also been widely used as a disinfectant against bacterial community.[5] Other processes suchasboilling, distillation, reverse osmosis, water filtration, ozonation, use of fiber filters, ceramic filters, UV irradiation softeners, activated alumina, sediment filter have also been employed to remove certain pathogens from water.[6]

However, there are certain disadvantages of the above mentioned techniques, making it less applicable to real world situations. Treatment process such as magnetic graphene composites and silver nanoparticles cannot be easily deployed by majority of the communities. The use of chlorine and other disinfectants alter the taste of water leading to low aesthetic quality of the treated water and by products such as trihalomethanes that can be toxic and carcinogenic.[7] Moreover, the production cost involved in reverse osmosis, UV irradiation, fiber filters etc. is high, making it unaffordable by the rural community. Boiling of water can also help in eliminating pathogens but it does not ensure complete removal. Therefore, techniques and treatment methods which are cost effective, sustainable and easily operational by the rural communities with available resources around them is desired. The use of sand supported carbon filters for complete removal of *E.coli* removal from rural wastewater has been reported by Pongener et al.[4] Their study showed 98-99% removal of coliform bacteria from real wastewater by using sand supported bioadsorbent. Similar studies have also been reported by Mohanty et al.[8] using biochar and sand for effective removal of *E.coli*.[9] Activated carbon-soil-sand filter unit has also been employed for 98-99% reduction in bacteria. Such methods that are cost effective, easily operational and can be prepared from readily available natural resources will not only allow marginalized people for purifying water but also will improve their lives by preventing waterborne diseases.

Conclusion

In our view, different techniques and methods involving natural available resources such as sand, carbon, soil, bricks and so on would make water purification easier for the rural community. This would help in reducing mortality rate due to waterborne diseases. However, the durability of such methods is short and still needs more furnishing. Therefore paramount research towards treatment methods using natural resources need to be formulated which will have higher removal percentage, environmental friendly, cost effective, easily operational and has longevity.

Acknowledgements

The Authors Aola Supong and Parimal Chandra Bhomick are thankful to DST-INSPIRE Fellowship for financial assistance.

Conflict of interest

The author declares no conflict of interest.

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Citation: Supong A, Bhomick PC, Sinha D. Waterborne pathogens in drinking water-existing removal techniques and methods. *MOJ Toxicol.* 2017;3(6):146–147. DOI: 10.15406/mojt.2017.03.00072