Microbial Contamination in Drinking Water of Saggiyan-Lahore, Pakistan

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Abstract: The present study was carried to evaluate the physico-chemical parameters and microbial contamination of drinking water in the area of Saggiyan, Lahore. The tested water samples (S1-S30) were found to contain 199.6-402 mg/L TDS, 196-260 ppm EC, 196-260 ppm Hardness, 0.8-17 NTU turbidity, 169-290 mg/L alkalinity, 0-0.1 ppb arsenic and 0-0.1 ppm fluoride contents. 95% of the water samples were found contaminated with fecal coliforms while 27% of the samples had shown the presence of E. coli. Though the physico-chemical parameters of most water samples were found in the safe limits of WHO, however, the presence of microbial contamination rendered it non-suitable for drinking purposes.

Keywords: Microbial contamination, drinking water, most probable number (mpn), coliforms.

Introduction

Water is an essential and life-sustaining drink for all living beings (Ahmed et al., 2013; Sudarsan et al., 2018). Water resources are greatly degrading due to many anthropogenic activities like urbanization, excessive use of fertilizers, industrialization, mining and improper disposal of waste (Ali et al., 2012; Daud et al., 2017; Singare et al., 2014). Microbial contamination of drinking water is commonly observed in various parts of the world (Pu et al., 2016; Ashbolt, 2015) and is considered one of the most serious threats to human health (Nabeela et al., 2014). It may cause severe health issues like dysentery, hepatitis, gastroenteritis, cryptosporidium infections, diarrhea, intestinal worms, giardiasis, typhoid etc. (Butt et al., 2007; Daud et al., 2017).

Water contamination has been considered as a leading cause of morbidity and mortality in children of low- and middle-income countries (Nketiah-Amponsah et al., 2017). In the developing countries, the people mostly have no access to the safe drinking water (Ali et al., 2012). In Pakistan, about 70% of rural population is deprived of safe and clean drinking water. The surface and ground waters are mostly contaminated with microbial agents, metals and dangerous chemicals (Ali et al., 2012). Pakistan ranks at 80th number among 122 nations regarding the drinking water quality (Raza et al., 2017). The contaminated water from streams, rivers, lakes or ground water may contain variable quantities of E.coli, Total coliform, Fecal coliforms etc. (Azizullah et al., 2011; Sudarsan et al., 2018). Presence of these organisms is usually checked by the “Coliform test” and this method is accepted globally to check the microbial contamination (Farooq et al., 2008). The evaluation of pathogenic bacteria in water is of great importance with regard to human health (Antiochia et al., 2015).

This study was carried out to evaluate the physico-chemical parameters and bacteriological/ Microbial contamination owing to total coliforms, fecal coliforms and E. coli in drinking water of Saggiyan, Lahore.

Materials and Methods

This Research work was conducted from November 2017 to March 2018. Thirty ground water samples (S1 to S30) were collected from different sites of Saggiyan (Lahore, Pakistan) and were subjected to tests for microbial contamination. The sites of collection along with their respective locations are displayed in Table 1.

A GPS (Global positioning system) was used to find the longitude and latitude of sample locations. Necessary precautions (washing and sterilization of hands) were considered before collecting the water samples. The tap from where water samples were collected, was left open for about five minutes to exit all the previous standing water. The tap was cleaned and closed with tissue paper and also blazed with fire lighter to kill any germs; it was then allowed it to cool. Tap was opened again after cooling and kept on for one more minute. The bottle without touching with water tap, was placed under the tap for filling water for about one minute. After filling the water sample, the bottle was closed with cap tightly. Before every experiment, the glassware was carefully rinsed with deionized water. The pH was calculated and noted by a pH meter at the time of sample collection. The instruments used for the determination of physico-chemical analyses include pH meter (HI 83141) for pH, conductometer (Hanna 2300) for electrical conductivity, turbidity meter (HI83414) for turbidity and atomic absorption...
bacteria. After incubation, those tubes which receive differential prepared liquid media for counting in the potable water samples. In the MPN method, the used for total coliform detection. The EC broth was Brilliant Green lactose bile (BGLB) growth media was the most probable number samples are counted. The Most Probable Number (MPN) method was used for the fecal coliform detection and determination. Levine Eosin-Methylene Blue (L-EMB) agar was used for confirmation of E.coli.

### Results and Discussion

30 water samples (S1-S30) were collected from various regions of Saggiyan, Lahore (Pakistan) and subjected to physico-chemical and microbiological tests. The obtained results for pH, TDS, EC, hardness, turbidity, alkalinity, arsenic and fluoride contents are summarized in Table 2.

The pH values of the investigated samples were found
in the range of 7.0-8.0 (Fig. 1). The observed values were lying within the standard limits (6.5 to 8.5) of WHO (Edition, 2011).

Evaluation of Total Coliforms

The results have shown that all the samples were highly contaminated with microorganisms (Table 3). More than 95% of the water samples were microbiologically contaminated with total coliforms. The amount of total coliform was lying from 44 to 444 MPN/100ml of water sample which if far beyond the standard limits of WHO (Edition, 2011). According to WHO, there should be zero presence of any coliform in every 100 ml of water sample (Edition, 2011).

Table 3 Total Coliforms in tested water samples (S1-S30).

| Sample No. | BGLB tubes Confirmed Coliforms | MPN index/ 100ml of sample | Sample No. | BGLB tubes Confirmed Coliforms | MPN index/ 100ml of sample |
|------------|--------------------------------|-----------------------------|------------|--------------------------------|-----------------------------|
| S1         | 3                              | 1                           | S16        | 3                              | 2                           |
| S2         | 3                              | 1                           | S17        | 3                              | 2                           |
| S3         | 3                              | 1                           | S18        | 3                              | 2                           |
| S4         | 3                              | 1                           | S19        | 3                              | 2                           |
| S5         | 3                              | 1                           | S20        | 3                              | 2                           |
| S6         | 3                              | 1                           | S21        | 3                              | 2                           |
| S7         | 3                              | 1                           | S22        | 3                              | 2                           |
| S8         | 3                              | 1                           | S23        | 3                              | 2                           |
| S9         | 3                              | 1                           | S24        | 3                              | 2                           |
| S10        | 3                              | 1                            | S25        | 3                              | 2                            |
| S11        | 3                              | 1                            | S26        | 3                              | 2                            |
| S12        | 3                              | 1                            | S27        | 3                              | 2                            |
| S13        | 3                              | 1                            | S28        | 3                              | 2                            |
| S14        | 3                              | 1                            | S29        | 3                              | 2                            |
| S15        | 3                              | 1                            | S30        | 3                              | 2                            |

Table 4 Fecal coliforms in tested water samples (S1-S30).

| Sample No. | EC Tubes Confirmation of Fecal Coliforms | MPN index/ 100ml of sample | Sample No. | EC Tubes Confirmation of Fecal Coliforms | MPN index/ 100ml of sample |
|------------|----------------------------------------|-----------------------------|------------|----------------------------------------|-----------------------------|
| S1         | 2                                      | 3                           | S16        | 2                                      | 3                           |
| S2         | 1                                      | 3                           | S17        | 2                                      | 3                           |
| S3         | 1                                      | 3                            | S18        | 2                                      | 3                            |
| S4         | 1                                      | 3                            | S19        | 2                                      | 3                            |
| S5         | 1                                      | 3                            | S20        | 2                                      | 3                            |
| S6         | 1                                      | 3                            | S21        | 2                                      | 3                            |
| S7         | 1                                      | 3                            | S22        | 2                                      | 3                            |
| S8         | 1                                      | 3                            | S23        | 2                                      | 3                            |
| S9         | 1                                      | 3                            | S24        | 2                                      | 3                            |
| S10        | 1                                      | 3                            | S25        | 2                                      | 3                            |
| S11        | 1                                      | 3                            | S26        | 2                                      | 3                            |
| S12        | 1                                      | 3                            | S27        | 2                                      | 3                            |
| S13        | 1                                      | 3                            | S28        | 2                                      | 3                            |
| S14        | 1                                      | 3                            | S29        | 2                                      | 3                            |
| S15        | 1                                      | 3                            | S30        | 2                                      | 3                            |
Evaluation of Fecal Coliforms

The water samples (S1-S30) were also examined for the confirmation of fecal coliforms. It was observed that all the investigated samples were contaminated with fecal coliforms from 14.8 MPN/100mL (lowest) to the highest 269 MPN/100mL (Table 4).

Evaluation of E. coli

The fecal coliform samples (S1-S30) were finally examined for the confirmation of E. coli. It was found that 27% samples (9 samples out of total 30 samples) were contaminated with E. coli whereas remaining 73% samples (21 samples out of total 30 samples) have not shown the presence of E. coli. It was demonstrated that the samples (S2, S4, S5, S12, S14-S15, S26-S27, S29) containing higher amount of fecal coliform have shown the presence of E. coli. It was observed that the samples (S1, S3, S6-S11, S13, S16-S24, S25, S28, S30) did not demonstrate the presence of E. coli although they had total coliforms (Table 5).

Conclusion

The water samples collected Saggiyan area, Lahore were evaluated for physicochemical parameters and microbiological analysis. The tested water samples (S1-S30) were found to contain 199.6-402 mg/L TDS, 196-260 ppm EC, 196-260 ppm hardness, 0.8-17 NTU turbidity, 169-290 mg/L alkalinity, 0-0.1 ppb arsenic and 0-0.1 ppm fluoride contents. The water of Saggiyan, Lahore was found contaminated with fecal coliforms from 14.8MPN/100mL (lowest) to the highest 269 MPN/100mL (Table 4).

References

Ahmed, A., Noonari, T., Magsi, H. Mahar, A. (2013). Risk assessment of total and faecal coliform bacteria from drinking water supply of Badin city, Pakistan. Journal of Environmental Professionals Sri Lanka, 2 (2), 52-64.

Ali, S. S., Anwar, Z., Khattak, J. Z. K. (2012). Microbial analysis of drinking water and water distribution system in new urban Peshawar. Current Research Journal of Biological Sciences, 4 (6), 731-737.

Antiochia, R., Favero, G., Conti, M. E., Mazzei, F., Tortolini, C. (2015). Affinity-based biosensors for pathogenic bacteria detection. International Journal of Environmental Technology and Management, 18 (3), 185-206.

Ashbolt, N. J. (2015). Microbial contamination of drinking water and human health from community water systems. Current environmental health reports, 2 (1), 95-106.

Azizullah, A., Khattak, M. N. K., Richter, P., Häder, D.-P. (2011). Water pollution in Pakistan and its impact on public health—a review. Environment International, 37 (2), 479-497.

Butt, I., Iqbal, A. (2007). Solid waste management and associated environmental issues in Lahore. Pakistan Geographical Review, 62, 45-50.

Daud, M., Nafees, M., Ali, S., Risawan, M., Bajwa, R. A., Shakoor, M. B., Arshad, M. U., Chattha, S. A. S., Deeba, F., Murad, W. (2017). Drinking water quality status and contamination in Pakistan. BioMed Research International, 2017, 7908183.

Edition, F. (2011). Guidelines for drinking-water quality. WHO chronicle, 38 (4), 104-108.

Farooq, S., Hashmi, I., Qazi, I. A., Qaiser, S., Rasheed, S. (2008). Monitoring of coliforms and chlorine residual in water distribution network of Rawalpindi, Pakistan. Environmental monitoring and assessment, 140 (1-3), 339-347.

Meride, Y., Ayenew, B. (2016). Drinking water quality assessment and its effects on residents health in Wondo genet campus, Ethiopia. Environmental Systems Research, 5 (1), 1-7.

Nabeela, F., Azizullah, A., Bibi, R., Uzma, S., Murad, W., Shakir, S. K., Ullah, W., Qasim, M., Häder, D.-P. (2014). Microbial contamination of drinking water in Pakistan—a review. Environmental Science and Pollution Research, 21 (24), 13929-13942.

Nketiah-Amponsah, E., Afful-Mensah, G. (2017). Source of drinking water and the prevalence of diarrhoea among children aged under-five in Ghana-recent evidence. International Journal of Economics and Business Research, 13 (3), 275-302.

Pu, J., Fukushi, K. (2016). Bacterial water quality and risk evaluation of bottled drinking water in China. International Journal of Food Safety, Nutrition and Public Health, 6 (1), 1-13.

Raza, M., Hussain, F., Lee, J., Shakoor, M.B., Kwon, K.D. (2017). Groundwater status in Pakistan: A review of contamination, health risks, and potential needs. Critical Reviews in Environmental Science and Technology, 47 (18), 1713-1762.

Singare, P. U., Dhabarde, S. S. (2014). Industrial pollution scenario due to discharge of waste water effluents along Dombivali Industrial Belt of Mumbai, India—a physico-chemical study. Interdisciplinary Environmental Review, 15 (1), 20-35.

Sudarsan, J., Annadurai, R., Nithiynantham, S. (2018). A study on quality characteristics of...
packaged drinking water sold in and around Kanchipuram District, Tamil Nadu, India. *International Journal of Environment and Sustainable Development*, **17** (2-3), 228-246.