Study of Residual Chlorine Concentration Within Water Supply Distribution System In Mumbai City Households before And After Water Flowing Through Domestic Water Purifiers

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Abstract- *This paper is accomplished to evaluate the concentration of residual Chlorine (RC) within water supply distribution system in Mumbai city households before and after water flowing through domestic water purifiers. Seven water purifiers in Mumbai city were selected for the test to take the drinking water samples. The samples were taken during July to September 2019(during rainy season).The results showed that the concentration of RC, before entering the domestic water purifier was above the recommended limit ,mostly due to overdosing which is commonly practiced in rainy season. RC concentration in water after passing through the domestic water purifier was found reduced in five out of seven cases and only in one case was it zero which was below the recommended limit of residual chlorine and hence not safe for drinking .*

Keywords- Residual Chlorine (RC),orthotolidine test.

I. INTRODUCTION

Chlorine is rated as one of the regularly used disinfectant by water utilities and water service providers to kill and inactivate microorganisms so that they cannot reproduce and infect human hosts. This disinfectant is readily available, cheap, easy to transport, occur in gaseous, liquid and solid form. However, when injecting chlorine in water and is transported through water pipes of distribution network, it under goes reactions with water and with the inner pipe wall naturally along the distance of travel. The reactions result in the dissipation and loss of residual chlorine. These phenomenon pose a major threat in weakening the barriers against water safety and create the chances of recontamination. More over when water passes through the UV water purifier concentration of RS gets attenuated to that level which makes water not potable. The presence of chlorine residual in drinking water indicates that:1) a sufficient amount of chlorine was added initially to the water to inactivate the bacteria and some viruses that cause diarrheal disease; and, 2) the water is protected from recontamination during storage. The presence of free residual chlorine in drinking water is correlated with the absence of disease-causing organisms, and thus is a measure of the potability of water.

According to world health organization standard, a limit for residual chlorine concentration atpublic water taps was set up to be 0.2 –0.3mg/l at 30 minute contact time, less than this, the water is not fit for direct consumption. (WHO).CDC (the centres for disease control)recommends not exceeding 2.0 mg/l due to taste concerns. It was also estimated that 3.4 million people mostly children die every year from water related diseases (World Health Organization,2002a). A free chlorine level of 0.5 mg/l of freechlorine will be enough residual to maintain the quality of water through the distribution network, but is most likely not adequate to maintain the quality of the water when this water is stored in the home in a 'bucket or can' for 24 h.

Chlorine demand is the difference between the amount of chlorine added to water and the residual chlorine remaining after a given contact time.Chlorine demand may change with dosage, time,pH, and nature and amount of the impurities in the water. When chlorine is added to water, it forms hypochlorous acid and hydrochloric acids within few seconds at temperature between 49 °F and 212 °F and disastrous effect on most form of microscopic organism.

Cl_2+ H_2O [pH>5] =HOCI + HCL. Hypochlorous acid is unstable and may break into hydrogen ions and hypochlorite ions.

$$HOCI\ [pH>8\ ] \rightleftarrows H^+ + OCl^-$$

The above reaction is reversible and depends upon the pH value of water, which controls the amount of dissociation at pH>5; Chlorine exists as elemental or molecular chlorine and does not react with water at pH <5. At

pH value between 5 to 7, HOCI will generally exist without dissociating into OCL^- ions and at a pH greater than 10 only OCL^- ions are found. As the hypochlorous acid is more destructive, the pH value of water during chlorination is generally maintained slightly less than 7, so as to keep the dissociation of HOCl to minimum..

II. MATERIAL AND METHOD

The study area is located in Mumbai city in India. RC was tested at seven locations in Mumbai city households .The samples were taken directly from the consumer taps .The period of tests was during July-September 2019. Water samples were collected from inlet and outlet of the purifiers and tested for the concentration of residual chlorine using Chloroscope (Orthotolidine test).

Procedure.

In this test ,10 ml of chlorinated sample of water is taken after the required contact period ,in a glass tube . 0.1 ml of orthotolidine solution is added to this .The colour is observed after 5 seconds. The formation of yellow colour normally indicates the presence of free chlorine in the water. More yellow the colour greater is the chlorine residual. This has to be matched with the colours in the chloroscope.

III. PRACTICAL SIGNIFICANCE

Chlorine and chlorine-based disinfectants are used worldwide to destroy germs in drinking water and swimming pool. One of the reasons for the widespread use of chlorine disinfectants is that they provide a "residual" level of protection against water borne pathogens. Chlorine residual is a low level of chlorine remaining in water after its initial application. It constitutes an important safeguard against the risk of subsequent microbial contamination after treatment-a unique and significant benefits for public health. The presence of free residual chlorine in drinking water is correlated with the absence of disease-causing organisms, and thus is a measure of the portability of water making the study significant.

IV. RESULTS AND DISCUSION

Water sample site	RC concentration at the inlet of water purifier	RC concentration at the outlet of water purifier
1.Hamza towers,Belvedere hill road ,Mazagaon ,Mumbai (UV filter)	0.5	Less than 0.5
2.Abdul Rehman's Hostel (3rd floor) (Dhobi Talao, CST, Fort, Mumbai) (UV filter)	0.5	Less than 0.5
3.Abdul Rehman's Hostel (4th floor) Dhobi Talao, CST,	0.5	0.00
4.Abdul Rehman's Hostel (6th floor) (UV filter) Dhobi Talao, CST, Fort, Mumbai)	0.5	Less than 0.5
5.MHSSP (2nd floor),Byculla - 8,Mumbai	1.00	0.5
6.B.I.T Chawl, Bellasis road K.K marg,Mumbai 8	0.50	Less than 0.5
7.Bhaat Bazar ,Masjid Bunder west, Mumbai)	0.5	Less than 0.5

V. CONCLUSION

After comparing the concentration of residual chlorine in water before and after domestic water purifiers ,we found that purifier reduces the level of residual chlorine in water. Even though domestic water purifier is using UV rays for disinfection, it does not possess any residual property and therefore suitable only for instant consumption and not for storage. The public should be made aware of the same for the proper usage of water purifiers .

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