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Faisal Bilal Sofi
 M. Tech., Department of Civil
 Engineering, RIMT
 University, Punjab, India

Er. Brahamjeet Singh
 Assistant Professor,
 Department OF Civil
 Engineering, RIMT
 University, Punjab, India

Corresponding Author:
Faisal Bilal Sofi
 M. Tech., Department of Civil
 Engineering, RIMT
 University, Punjab, India

The effect of corrosion in cast iron pipes on the quality of drinking water in South Kashmir (U.T) of Jammu and Kashmir

Faisal Bilal Sofi and Er. Brahamjeet Singh

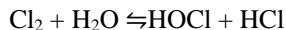
Abstract

Iron pipelines are commonly used in old drinking water distribution systems, adding rust to pipe-borne water. The present study was conducted to assess the water quality of two water supply systems Bumzoo Anantnag (Old Distribution System) and Pampore (New Distribution System) from South Kashmir. The water samples were analysed for physicochemical parameters viz., pH and Chloride. The results obtained through this analysis showed that water is fit for drinking. Chlorine added to water for disinfection could react with iron that leaches from these iron pipelines, thereby reducing available free chlorine for disinfection. The research paper intends to fill the gap between the effect of iron corrosion in cast iron pipes and the quality of drinking water in south Kashmir.

Keywords: Cast iron, corrosion, South Kashmir, disinfection, drinking water, pH of water

Introduction

Water is very important, as it is one of the, important elements that, is necessary for supporting life on, this planet. It is evident that with, increase in the population, there always rises, a need to meet the water requirements, of the new generation. Since water is crucial for all the activities, on earth however there is limited amount of water that is fit for drinking (Seher, 2015) [6]. Water is very important, for life as it is responsible, for carrying and supporting all, forms of life on the earth. The UT of J&K is considered, as a heaven on earth with, adequate water assets, like lakes, waterways, and icy masses, other than groundwater. The primary, waterways that course through the State are Jhelum, Chenab, Indus and Tawi and are of Himalayan. The other incredible, waterways that, begin from glacial, masses in the Himalayan area are the Ganges, and the Yamuna. Significant, lakes in the J&K area are Manasabal Lake, Dal Lake, Nageen Lake and the Wular Lake. There are 1230 water bodies in the UT. From South to the North Kashmir is gifted with the abundant water resources and some of them may be summed as follows: River Jhelum, Indus, Chenab etc. Providing safe drinking water is one of the important millennium development goals set by the United Nations since 783 million people of the global population still lack safe drinking water (U. N, 2012). Even though some populations have easy access to potable water through pipe borne supply systems, the quality of such water is not satisfactory in most cases, particularly in developing countries. For disinfection, chlorine and chloramine are used very commonly. Due to low cost, stability, and effectiveness, free chlorine is the most commonly used disinfectant worldwide. Since most of the old water distribution systems in cities particularly in developing countries are made up of iron pipelines, this has to be considered very seriously. Such old, unlined cast iron pipe lines add iron oxides to water due to internal corrosions that drastically affect the water quality (Munasinghe *et al.*, 2017) [5]. The iron rust mixes with water in distribution and could react with chlorine, chloramines and chlorine dioxide adversely affects the disinfection processes and reduces the quality of drinking water. Chlorine and related disinfection compounds also increase the corrosion of metallic distribution systems since they are strong oxidizers, releasing dissolved iron into the water. Usually, free chlorine quickly converts to an equilibrium mixture of chlorine, hypochlorous acid (HOCl) and hydrochloric acid (HCl), in such a system in which the speciation depends on the pH of water.



The consumption of free chlorine in water reduces the effectiveness of the disinfection process. Therefore, the main objective of the current study was to evaluate the impact of iron corrosion in the disinfection process of a cast iron water distribution system.

Materials and methods

Data collection

As we know Data is of two types Primary and secondary data. During the course of data collection, I did some preliminary collection of data by enquiring about the quality of water. Some issues were raised with the Officials and several data was collected. Questionnaire was also made in consultation with the Jal Shakti department officials to find

the amicable response to the various issues. The different water supply plants of the South Kashmir were taken up during the course of study. 6 water samples were collected from six different sites from water supply systems from South Kashmir. During the recent survey it was found that most of the supply plants were very old and literally speaking their service time had got expired long ago but still they were not renovated by the authorities. It was also found that old rusty cast iron pipes were used for receiving the water from primary sources and also same Cast Iron pipes were used to supply water to the consumers. So, regarding that some physicochemical parameters were done i.e pH and Chloride (Adoni *et al.*, 1985) [1]. For this work water samples were taken from two water plants (Table- 1).

Table 1: List of Distribution Plants that have been studied.

S. No	Plant Name	Year of operation	Supply pipes	No. of beneficiary areas
01	Bumzoo Anantnag Old Distribution System	1953	Cast iron	8
02	Pampore New Distribution System	2011	Steel pipes	4

Results And Discussion

pH

It is an important test that tells about the quality of Water. pH simply signifies how acidic or basic water is. Normal pH of water lies in between 6.5-8.5. First of all water samples were collected from the various location like from the main source, water plant and also from different households. A portable electronic pH meter was used to measure the pH of

all the collected sample. The normal drinking water pH range mentioned in (WHO, 2011 and APHA, 1995) [2, 3]. The pH values of all the drinking water samples are found to be in between 6.6 to 7.3 units (Table-2), where the lowest and highest values are from samples 4, 6 (House No. 6, Railway Station Wanpoh, Anantnag) and sample 1 (Bumzoo Plant) (Table-2 and Fig.2).

Table 2: Shows pH value recorded during study period.

Sample No.	Collected from Old Plant with Cast Iron pipes	Collected from New Plant with Steel Pipes	pH value of Sample from Old Plant	pH value of Sample from New Plant
01	Bumzoo Plant	Bumzoo Plant	7.1	7.3
02	Bumzoo Treatment Plant	Bumzoo Treatment Plant	7.1	7.2
03	Public Water Post	GDC K.P Road	7.0	7
04	House No. 6	MCCH Sherbagh	6.6	7.1
05	GMC Anantnag	House No. 5	6.7	7.1
06	Railway Station Wanpoh Anantnag	Public Water Post	6.6	7.2

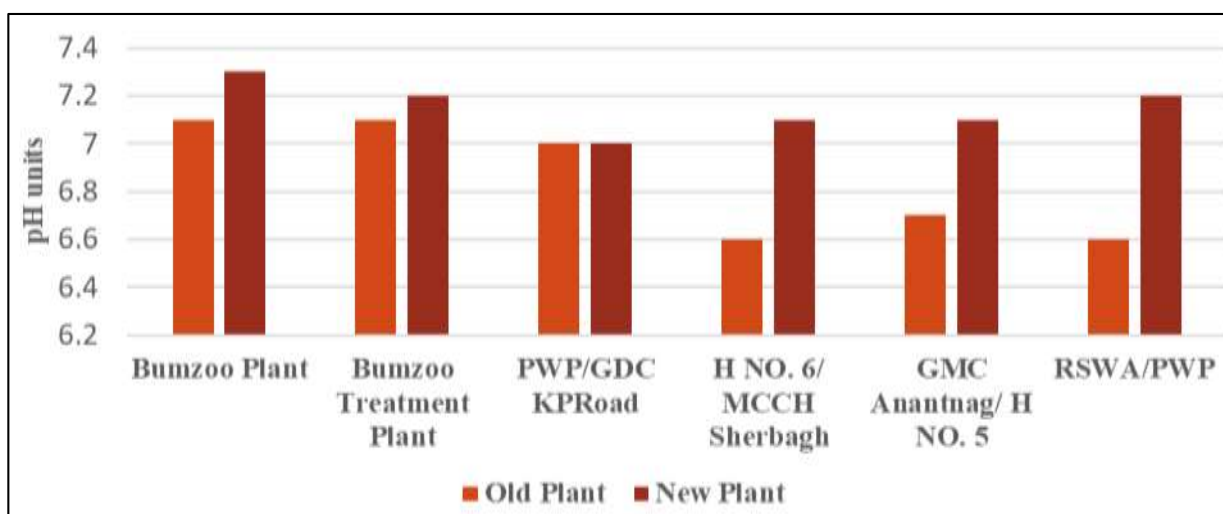


Fig 1: Shows pH recorded during study period

Chloride

Chloride occurs naturally in groundwater. It is found in less amount in drinking water and usually more in Salty/Sea water. It may be noted that at low levels it does not possess

any harm to the living organisms but higher amount of chlorine may pose health issues Interestingly, there is no legal standard for chlorides in drinking water but EPA

recommends Chloride level in water should not be more than 250 mg/L.

However, from the data one can easily see that there is slight increase in the amount of chlorides from the Bumzoo site to the consumers which is supplied by using old rusty cast iron pipes. The amount of chlorides increased with the increase

in the distance from the site. But in case of the water supplied with the new steel pipes the result was altogether different. There was a negligible increase in the amount of chlorides which is a good sign. Chlorine reacts with water and Iron pipes and causes corrosion of the pipes. (Table-3 and Fig.3).

Table 3: Shows Chloride results during study period.

Sample No.	Collected from Old Plant with Cast Iron Pipes	Collected from New Plant with Steel Pipes	Chloride Value of Sample from Old Plant in (mg/L)	Chloride Value of Sample from New Plant in (mg/L)
01	Bumzoo Plant	Bumzoo Plant	4	4.1
02	Bumzoo Treatment Plant	Bumzoo Treatment Plant	4.1	3.8
03	Public Water Post	GDC K.P Road	4.6	3.9
04	House No. 6	MCCH Sherbagh	4.2	4
05	GMC Anantnag	House No. 5	5.5	4.1
06	Railway Station Wanpoh Anantnag	Public Water Post	5.3	4.1

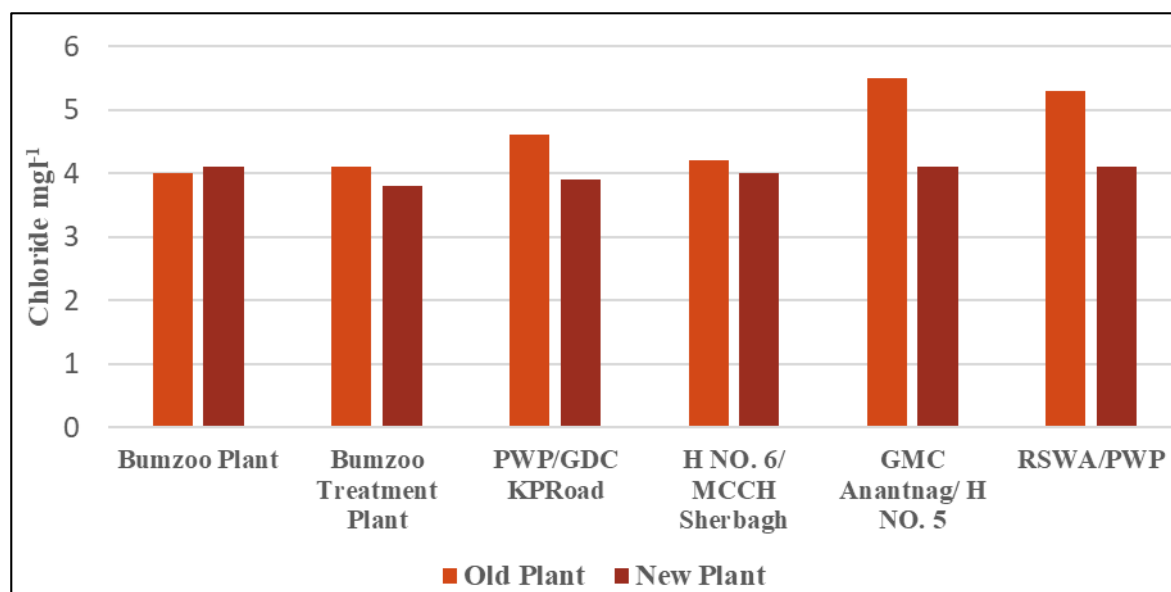


Fig 2: Shows Chloride mgL^{-1} recorded during study period

Conclusion

The present study was conducted to assess the water quality of two water supply systems Bumzoo Anantnag (Old Distribution System) and Pampore (New Distribution System) from South Kashmir. The water samples were analysed for physicochemical parameters *viz.*, pH and Chloride. The results obtained through this analysis showed that water is fit for drinking. Chlorine added to water for disinfection could react with iron that leaches from these iron pipelines, thereby reducing available free chlorine for disinfection. Hence, from this study old water pipes should be replaced with new ones.

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