Biolife
AN INTERNATIONAL QUARTERLY JOURNAL OF BIOLOGY & LIFE SCIENCES
3(1):72-76
ISSN (online): 2320-4257
www.biolifejournal.com
BIOLIFE RESEARCH ARTICLE

Nutrients and heavy metal status of some dug wells water from Gadhinglaj Tahsil, Maharashtra

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ABSTRACT

The assessment of water quality from dug well for drinking and domestic purposes was carried out from Gadhinglaj Tahsil, Maharashtra. The dug well water quality was assessed by examining various nutrients and heavy metals. Dug well water samples were collected from five villages from Gadhinglaj Tahsil during November 2014. Nutrients and heavy metals like sodium, potassium, nitrate, phosphate, sulphate, fluoride, zinc, manganese, copper, iron, chloride along with Physico-chemical parameters like air temperature, water temperature, pH, EC, total alkalinity, total hardness, Ca & Mg hardness have been analyzed . The results were compared with WHO, BIS & ICMR water standards. On the basis of results obtained for water from all dug wells are within the permissible limit while total hardness of four samples was above the permissible limit.

Keywords: Nutrients, Heavy Metals, Physico-chemical Parameters, Water Quality.

INTRODUCTION

First life was originated in water and it is essential for the survival of any form of life. The poorer segments of the population both in urban and rural areas generally use dug well water as a main source of drinking water. The usefulness of water for a particular purpose is determined by its quality. If human activity alters the natural water quality so that it is no longer fit to use for which it had previously been suited, the water is said to be polluted or contaminated. Studies on water quality are therefore necessary to determine the extent of pollution so as to monitor likely danger to the human population. The tremendous organic loads imposed by urban sewage and other waste constitute a major cause of pollution of natural water bodies (Hynes 1960). The test results allow us to find out whether the water we drink and use for household activities is reliable and safe or not. In light of this information, present study is carried out to estimate quality of dug well water collected from various areas of Gadhinglaj tahsil to analyze whether the water samples are fit for human consumption or not (.Subin & Aneesha, 2011).

Gadhinglaj is an important tahsil of Kolhapur district of Maharashtra at latitude 16 013’26’’ N and longitude 740 26’ 9’’ E. Gadhinglaj tahsil comprises 90 villages. The population of Gadhinglaj is 2, 16,257. An area of Tahsil is about 48094 hectares.

MATERIAL AND METHODS

Collection of samples:
Dug well water samples were collected from five villages of Gadhinglaj tahsil during

November 2014 in plastic container and brought to the laboratory for further analysis.

Analysis of Physico-chemical Parameters:
Physico-chemical parameters were analyzed by using standard methods as suggested in APHA (2005), Trivedi and Goel (1984). Parameters like pH, E.C., were analyzed at the sampling site only. The DO was fixed in the BOD bottle at the site and brought to the laboratory for analysis by Wrinklers method. All the physico-chemical parameters were analyzed within 24 hours and compared with WHO (1963), BIS (1991) and ICMR (1975) drinking water standards.

RESULTS AND DISCUSSION

The results obtained through analysis of water samples from dug wells of five villages of Gadhinglaj tahsil are given in Table 1. Comparative physico-chemical parameters of dug well water samples has been made with WHO (1963), BIS (1991) & ICMR (1975) drinking water standard in Table 2. During the study period, all the water samples were clear, colorless & odorless. There was spatial variation in air and water temperatures. However, values of air and water temperatures ranged from 22^0 to 24^0 C and 19^0 to 22^0 C respectively. Both the air and water temperature were maximum at S4 and minimum at S3.

The pH values ranged from 7.75 to 8. All samples were within the permissible limit. However, higher values of pH hasten the scale formation on water heater and reduce the germicidal potential of Chlorine (Mahapathra and Purohit, 2000). There was decline of pH at S3 and inclined at S4.

Electric conductance of water is due to the presence of soluble salts and other ionic species which acts as conducting substance. The conductance values for the samples were ranged from 1.22 mmho/cm to 1.673 mmho/cm. Minimum EC was recorded at S2 while maximum at S5.

Carbonates and bicarbonates are main constituents which form alkalinity in water. In

Parameters/ Sites	Madyal (S_1)	Shippur (S_2)	Halkarni (S_3)	Nool (S_4)	Beknaal (S_5)
pH	7.79	7.89	7.75	8	7.91
E.C.	1.598	1.220	1.651	1.330	1.673
Air Temp.	23	21	20	24	21
Water Temp.	21	20	19	22	19
Alkalinity	110	96	126	82	86
TH	776	456	900	544	716
Ca Hardness	109.07	128.32	253.45	148.76	174.53
Mg Hardness	162.06	70.63	156.63	96.04	131.57
D.O.	4.4	9.2	6.4	6.4	7.6
Chloride	207.32	149.67	198.6	221.52	406.10
Fluoride	0.06	0.05	0.07	0.08	0.048
Sodium	83	71	88	82	82
Potassium	3	49	29	58	48
Nitrate	0.16	0.054	0.156	0.052	0.24
Phosphate	0.0765	3.67	0.153	0.28	4.3
Sulphate	146	56	72	68	82
Zinc	BDL	BDL	BDL	BDL	BDL
Manganese	0.371	0.371	0.371	0.371	0.371
Copper	0.014	0.012	0.014	0.010	0.011
Iron	2.175	BDL	BDL	BDL	BDL

Table 1: Nutrient status and physico-chemical parameters from study sites.
Note: All values are in mg/l except temperature (^{0}C), pH and EC (mmhos)

the present study, alkalinity of water samples ranged between 82 mg/l to 126 mg/l, which were within the permissible limit. During study period, highest alkalinity was noted at S3 while lowest alkalinity was recorded at S4.

Total Hardness values ranged from 456 mg/l to 900 mg/l. Hardness of water is due to the presence of certain salts of Calcium, Magnesium and other heavy metals (Jain 1998). If hard water is used for drinking it causes undesirable effect on digestive system (Pitchammel et al., 2009). The adverse effects of total hardness are formation of kidney stones and heart diseases (Freeda Grana Rani et. al., 2003, Sastry and Rathee, 1998).The value of total hardness was minimum at S2 while maximum at S3. The total hardness was exceeding acceptable limit at all sites except S2. The value of total hardness at S2 is also close to cross the permissible limit.

Calcium Hardness values varied from 109.07 mg/l to 253.45 mg/l. All values were within the permissible limit except sample from S3. Higher value of calcium was observed at S3 while lower at S4. Magnesium hardness values ranged from 70.63 mg/l to 162.06 mg/l. Samples from S2, S4 & S5 were within the permissible limit whereas S1 and S3 were exceeding the permissible limit. Higher value of magnesium was noted at S1 and lower at S2.

The concentration of dissolved oxygen fluctuated from 4.4 mg/l to 9.2 mg/l. Dissolved Oxygen decreases in summer due to increases in temperature which increases catabolic activity leading to utilization of oxygen. Similar observation was made by Gonzalves and Joshi (1996). Based on WHO (1963) criteria, out of five samples only sample from S1 was within the permissible limit.

Chloride values varied between 149.68 mg/l and 406.10 mg/l. The presence of higher value of chloride is due to the human interference. Maximum chloride was reported from S5 while minimum at S2. Except S2, all samples were crossing acceptable limits. Excess chloride in drinking water may induce heart failure (Brooker and Johnson, 1984) and hypertension (Hussain and Ikbal, 2003).

Fluoride is one of the main trace elements in ground water which generally occurs as a natural constituent. Bedrock containing fluoride minerals are generally responsible for high concentration of this ion in groundwater (Handa, 1975; Wenzel and Blum 1992; Barden et al. 1996). Fluoride values ranges from 0.05 to 0.07 mg/l & were within permissible limit for human consumption and agriculture use as per the International standards. Spatial variation was observed negligible for fluoride values. According to Tailor and Chande (2010), excess amount of fluoride causes dental fluorosis, skeletal fluorosis and non-skeletal fluorosis.

The Sodium content in the water sample varied from 71 mg/l to 88 mg/l. All samples are within the permissible limit. Content of sodium was noted lower at S2 while higher at S3. The high concentration of Sodium is due to addition of municipal sewage under low flow conditions. Potassium content in the water samples ranged from 3 to 58 mg/l. Sample S4 has the highest Potassium content while lowest at S1.

According to Sylvester (1961), the domestic sewage is mainly responsible for greater concentration of nitrate in freshwater bodies (Hem 1959) and (Chaudhary et al., 2014) pointed out that the use of soil fertilizer in the agriculture farms around lakes may add large amounts of nitrates to the water. In the present study all water samples have nitrate content below permissible limit. Waste from human body and domestic cattle farmland, run off and leaching from soil are the important sources of ntrogen. Nitrate content in the water samples ranged from 0.052 mg/l to 0.156 mg/l. The value of nitrate was higher at S5 and lower at S4.

The highest value of phosphate was observed at S5 with 4.3 mg/l while lower value was at S1 with 0.0765 mg/l. All samples were found to be within the permissible limit. Zinc is an essential element for the effective function of various enzyme systems. The child required 0.3 mg/l of zinc per every Kilogram of Body weight. A deficiency of which might causes retardation of growth. Besides the growth retardation, zinc deficiency may also lead to immaturity and anemia (Kakati, 2012). In the present study, all samples were below detectable limit.

In the present investigation, content of copper at all the samples were found to below permissible limit of 1.5 mg/l (BIS 10500:1991), with maximum value of 0.014 mg/l and minimum value of 0.01 mg/l. Copper is an essential element in human metabolism. It is an integral part of number of enzymes and proteins which also cause staining of laundry and sanitary ware. (WHO 1984).

The present investigation shows all the samples were found below detectable limit for iron except S1 with 2.175 mg/l. Sulphate content ranges from 56 mg/l to 146 mg/l. All samples were within permissible limit. Higher value was observed at S1 while lower at S2. The weathering and pollution are the chief source of SO_4^{2-} in ground water. The content of manganese at all sites was 0.371 mg/l and found within the permissible limit.

CONCLUSION

Based on the present study, it can be concluded that water from all dug wells are undesirable for drinking purpose, especially with reference to total hardness and chlorides which may cause medical complications. However, all other parameters are comparatively within permissible limit and prior to domestic use, proper treatment is required so as to reduce total hardness and chloride values.

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