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ORIGINAL RESEARCH ARTICLE

A Study on Chemical and Bacteriological Analysis of Bore Water from Some Communities in Tirupathi Rural Areas of Chittoor District, Andhra Pradesh, India

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ABSTRACT

This study consisted the determination of trace metal ions, bacteriological analyses and some physiochemical properties in bore water samples from some communities in Tirupathi rural areas of Chittoor District, where bore water samples are not treated before it is consumed. The purpose was to ascertain the quality of water from these sources. Samples were taken from four sampling points and analyzed for the following parameters Fluorides, Chlorides, Calcium carbonate and Nitrites. The presence of pathogens in water for drinking purposes is of public health significance considering the possibility of the presence of other bacteria, protozoa and enteric viruses that are implicated in gastro-intestinal water borne diseases and the low infectious dose for these water borne pathogens.

Key words: bore water, Tirupathi Rural region areas, bacteria, Trace metals, physiochemical Properties.

1. INTRODUCTION

Good drinking water quality is essential for the well being of all people. Unfortunately in many countries around the world, including India, some drinking water supplies have become contaminated, which has impacted on the health and economic status of the populations Contaminants such as bacteria, viruses, nitrates and salt have found their way into water supplies as a result of in adequate treatment and disposal of waste industrial discharges, and over-use of limited water resources Even other Chemicals to be harmful to human health. Unfortunately, this problem arose because the bore water was extracted for drinking without a detailed chemical investigation. The natural water analyses for physical and chemical properties including trace element contents are very important for public health studies. The bacterial qualities of bore water, pipe borne water and other natural water supplies in Tirupathi, have been reported to be unsatisfactory, with coli form counts far exceeding the level recommendation by W.H.O (Dada *et al*., 1999a, 1999b, Edema *et al*., 2001). The reason for elucidation of important parameters in water quality assessment may be attributed to the fact that in the overall potability of water, such parameters should not be ignored (Osuinde and Enuezie 1999). According to our literature review some physical and chemical properties of the samples were determined by using standard analytical methods. The probability of ingesting infective dose of disease causing microorganism is very high considering the fact that water borne pathogens generally have low infective dose. The objective of this work is to evaluate the general bacteriological and physico chemical parameters of the sources of water used for drinking purposes from bore.

2. MATERIALS AND METHODS

2.1 Sample collection

The bore water samples were collected in prewashed (with detergent, diluted HNO_3 and doubly deionized distilled water, respectively) polyethylene bottles. pH and conductivity of the samples were measured while collecting the samples. Water samples from four different areas located in and around tirupathi territory were collected in brown glass bottles with necessary precautions. Samples were collected in July 2013.The determinations of the physicochemical and Bacteriological properties of the water samples were performed on the same day of sampling. The water samples were obtained

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directly from the bore after allowing the water to run for at least five minutes and each sample bottle and its cap rinsed three times. These samples were subsequently stored at 4°C for as short a time as possible before analysis to minimize physicochemical changes (Anonymous, 1996). Because very little particulate matter was present in the sample, filtration was not considered necessary.

2.2 Physicochemical Analysis

The physicochemical tests included the determination of temperature, turbidity, odour, colour, pH, conductivity, nitrites content, alkalinity, total hardness, fluorides and chloride content using the methods of FAO (1997a).

2.3 Bacteriological Analysis

Bacteriological characteristics were determined as described by Bezuidenhout *et al*., (2002). The
Most Probable Number multiple tube technique was used for coliform enumeration. All plates were incubated at 37^{o}C for 24hrs. Presumptive colonies were confirmed by gram staining and biochemical reactions and each plate was given a positive or negative score. Isolates were confirmed by some conventional biochemical test SCA, (2002).

3.0 RESULTS

The physicochemical data of the bore water samples collected in July 2013. The results of the samples vary with different collecting places because of the different nature of the soil. The physicochemical analysis (Color, odour, Turbidity, conductivity, total hardness, chlorides, fluorides, nitrites and alkalinity) is presented in (**Table 1**).

The pH of the water samples ranged from 7.7 to 7.9. while the turbidity of water samples also ranged from 1.0-2.0, total hardness of water samples ranges from 200-280 (mg/l) while With the exception of alkalinity of water samples ranges from 550-800, electrical conductivity of water samples ranges from 1400-2800 at 28°C (mmhos/cm). The chlorides in four water samples ranges from 220-820 (mg/l) fluorides present in water samples ranges from 0.6-1.0. The colour of the water samples was colorless and odour is unobjectionable. Finally nitrites present in three samples A, B, C and absence of nitrites is seen in sample D collected from bore water tiruchanoor area (Table 1).

Results of the bacteriological analysis of the water sample are presented in (**Table 2**). The total viable counts for all water samples were quite high ranging from 6.3 x 106 cfu/ml to 2.01 x 107cfu/ml. The most probable number (MPN) for presumptive total Coliform count of the water samples ranged from 1,600 to >1,800 MPN per 100ml. Water samples B, and C had total Coliform count greater than 1,800 MPN per 100ml while sample D had the lowest total Coliform count of 180MPN per 100ml.

Table 1: Physicochemical Analysis of Bore Water Samples from Water Sources present in Tirupathi Rural Areas

Parameters	Sample A Bore water (Renigunta north side)	Sample B Bore water (Renigunta south side)	Sample C Bore water (Tirupathi R.T.C bus stand)	Sample D Bore water (Tiruchanoor temple)	WHO Standard	EPA Standard
pH	7.7	7.9	7.8	7.9	6.5	6.5-8.5
Conductivity (mmhos/cm)	2800	1900	1400	1800	1500	1500
Color (HU)	Colourless 5	Colourless 5	Colourless 5	Colourless 5	Colourless 5-6	Colourless 5-6
Odour	Un-objectionable	Un-objectionable	Un-objectionable	Un-objectionable	Un-objectionable	Un-objectionable
Turbidity (NTU)	1.0	1.0	1.0	1.0	6.0	0-5
Alkalinity (600mg/l)	800	550	650	800	600	600
Total Hardness (mg/l)	280	240	200	250	500	500
Carbonate Hardness (mg/l)	280	240	200	250	400	600
Chlorides (mg/l)	820	500	220	460	200	250
Fluorides (mg/l)	0.8	0.8	0.6	1.0	0.6	1.0-1.5
Nitrites	Present	Present	Present	Present	NS	NS

U = Unobjectionable; NS- No Standard

Table 2: Bacteriological Analysis of Water

Sample Code	Bore water Samples	Total Coliform count
A	Bore water 1	1,600
B	Bore water 2	>1,800
C	Bore water 3	>1,800
D	Bore water 4	180
	WHO Standard	Zero per 100ml
	EPA standard	Zero

4.0 DISCUSSION AND COLCLUSION

4.1 Anions in Studied Water

4.1.1 Fluorides

The fluorides in water represent the bacteria and fungi formation in drinking water pipe lines. The

value allowed by the USEPA is 1.5 mg/l. For in this study water samples of the values of fluorides were between 0.6- 1.0 mg/l

4.1.2 Chlorides

The chlorides in water are known to come from rainwater. The accepted values are between 200 and 600 mg/l. In this study of bore water samples shows values obtained were between 500 -820 mg/l. This water is thus high in chlorides and thus not good quality with respect to chlorides.

4.1.3 Bicarbonates

Total alkalinity is the sum of carbonates and bicarbonates. The values of bicarbonates are also used to express alkalinity, in the absence of carbonates. All samples showed the presence of carbonates (550-800 mg/l) in the bore water. The acceptable values of alkalinity are 400 mg/l. Water of strong alkalinity has a bad taste.

4.2 Microbiological Parameters in Studied Water

Studied water average microbiological density is represented in Table 2. The total coliforms are observed in all water, except the sample D bore water collected from thiruchanoor. The pathogenic bacteria here are coliforms. They result from the contamination of water by soil pollution. One found them in great quantity sample A collected from renigunta. Accordingly, the total coliform count for all samples were exceedingly high the EPA maximum contamination level (MCL) for coliform bacteria in drinking water of zero total coliform per 100ml of water (EPA, 2003). The high coliform count obtained in the samples may be an indication that the water sources are faecally contaminated (EPA, 2003; Osuinde and Enuezie, 1999). None of the water samples complies with EPA standard for coliform in water except sample D (absence of coli form bacteria). The pH of all the water samples were in agreement with pH assigned by EPA as the standard pH of water which ranges from 7.7 – 7.9 (EPA, 2002). The colours of all the four water samples were also in agreement with the standard limit for colour of drinking water recommended by EPA. The standard colour limit recommended by EPA is 15 (colour unit) (EPA, 2002) while the colour of the water samples in this work ranged from 5-10 (colour units). The turbidity observed in this bore water samples agreed with EPA standards on turbidity. High turbidity is often associated with higher levels of disease causing microorganism such as bacteria and other parasites. Fewer number of disease causing microorganisms may be an indication of lower turbidity value experienced with well samples. At no time can turbidity (Cloudiness of water) go above 5 nephelometric units (NTU) (EPA, 2002). All parameters of physicochemical analysis have been documented as National Secondary Drinking Water Regulation (NSDWR), they are not enforceable guidelines regulating contaminants that may cause cosmetic effect (such as taste, odour, or colour) in drinking water (EPA, 2002).

In conclusion, the concentrations of the investigated major salts, carbonates and bacteria in the bore water samples from these communities in the tirupathi rural areas were found high the guidelines for drinking waters given by the World Health Organization (WHO). Further research on other communities in this region for drinking water analyses is required as levels of contaminants may vary due to different soil types, water chemistry and different human activities. No correlations were found between metal concentrations in the drinking water samples.

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