Determination of Drinking Quality of Water near the Coastal Areas of Jaffna Lagoon

Article · August 2015

CITATIONS
4

READS
319

1 author:

Ranganathan Kapilan
University of Jaffna
88 PUBLICATIONS **458** CITATIONS

SEE PROFILE

ISSN 2454-1672

SCITECH
RESEARCH ORGANISATION

Volume 2, Issue 1
Published online on July 05, 2015

Journal of Progressive Research in Biology
www.scitecresearch.com/journals

Determination of Drinking Quality of Water near the Coastal Areas of Jaffna Lagoon

Ranganathan Kapilan
Department of Botany, University of Jaffna, Sri Lanka. T.P - +94 (0) 768 450010 (Mobile)

Abstract

Ground water pollution by human activities is one of the areas of major concern to the world. Water quality is one of the principle health index of a country. Industrialization, urbanization and modern agriculture practices have direct impact on water resources. These factors influence both fresh and salt water bodies quantitatively and qualitatively. This paper presents ground water quality of an urbanized area in the marine coast of Jaffna. Twelve different locations were randomly selected for this comparative study and the following parameters were studied, temperature, pH, turbidity, total hardness, total alkalinity, sulphate, chloride, fluoride, conductivity, total dissolved solids, coliform bacterial count. A slight fluctuation in the physico-chemical parameters of the water samples analysed confirms the pollution of the ground water and it is not up to the quality of drinking.

Keywords: Coliform; Drinking Quality; Ground Water; Jaffna Lagoon.

Introduction

Water is one of the most common and the most precious resources on earth without which there would be no life on earth. It is the most abundant and useful compound on the earth. Water is the most widely used chemical compound on earth. Among the three essentials of life, i.e Air, water and food, water occupies the second position in the order of priority. Human beings, but also for plants and animals. Safe drinking water is the primary need of every human being (WHO, 2004, Gulta et al., 2009). Ground water is the most important source of Ground water supply for drinking, irrigation and industrial purposes. Increasing population and its necessities have lead to the deterioration of surface and sub surface water (Dhivyaa, 2009). Water is polluted on all the surfaces of earth. All metabolic and physiological activities and life processes of aquatic organisms are generally influenced by such polluted waste and hence, it is essential to analyze the physico-chemical characteristics of the drinking water (LMWA, 1991).

Materials and Methods

Study Area

Jaffna lagoon is a large lagoon off Jaffna District and Kilinochchi District, of the northern Sri Lanka. The lagoon is surrounded by the densely populated Jaffna peninsula containing palmyrah palms, coconut plantations, and rice paddies. There are numerous fishing villages and some salt pans. The lagoon is shallow water body and has extensive mudflats, sea grass beds and some mangroves. The lagoon attracts a wide variety of aquatic birds including American flamingoes, ducks, gulls, terns and other shore birds. Underground water quality of the coastal area of the lagoon is continuously degrading due to fishing related activities and dumping of garbage without proper management. The coastal area is widely used for the fishing purposes and for small scale production of salt. Majority of this land is covered by the patches of improperly dumped garbage that includes plant and animal debris, decays, metals wastes and unwanted household stuffs. Most of the wells that are closer to sea are not used for public consumption because of the salty nature. It was decided to analyze its ground water so that some remedies for improvement could be possible and sampling locations.

ISSN 2454-1672

Water Sampling:

A total of 15 Ground water samples collected from 12 different locations of the coastal area (Fresh water wells within 500 meters from the sea water) during the period between February to May 2015. Water samples were collected in sterilized (at 121^{o}C, 15Lb/inch^{2} for 15 minutes) screw-capped bottle of one liter capacity and analyzed in laboratory for their biological and physico-chemical parameters (Karunakaran et al., 2009).

Methodology

The following parameters were measured to determine the quality of the drinking water. Temperature of the water was recorded in the field using mercury thermometers. The pH of the samples was determined by using digital PH meter (Yadav and Kumar Rajesh, 2010). Turbidity was determined by Naphelo turbidity meter (Parashar charu et al., 2008). Total alkalinity was determined by tetrimetrically method. Total hardness was determined tetrimetrically using EDTA method (Yadav and Kumar Rajesh, 2011). Chlorides were determined by Mohrs' argentometry. Flouride content is determined using ELICO-52 UV spectro photometer (Kameswara Rao and Venkateswarlu, 2011 and De, 2002). Sulphate content is determined using turbid metric method. Conductivity was determined by conductometry. Total dissolved solids were determined by conductivity meter.

Coliform Test

50 ml of water sample was aseptically transferred into 50ml double strength medium. Five 10ml samples into five 10ml medium, five 1ml samples into five 5ml single strength medium were also transferred. All the tubes were incubated at 37^{o}C for 24 - 48 hours. Two loops of sample from tubes showing acid and gas were transferred into Brilliant Green Lactose bile broth. One set of tubes were incubated at 44^{o}C for 24 hours with control tube for faecal coil-form count and the other set of tubes were incubated at 37^{o}C for 24 - 48 hours for normal coli-form count. From the MPN table, the number of coliforms and faecal coliforms in the sample were counted with the positive tubes.

Table 1: Physical, chemical and biological properties and their allowable values.

Parameters	BIS values maximum allowable	Potential health issue	References
Temperature			
pH	6.5 – 8.5	Affect the mucous, corrosion	(World Health Organization, 1984)
Total alkalinity	600 mg/l	Boiled rice will turn into yellow	
Turbidity	-		
Total hardness	600 mg/l	Poor quality cloths, poor lethering of soap	
Chloride	1000 mg/l	Corrosion	
Fluoride	1.5 g/l	Dental & skeletal fluorosis	
Sulphate	400 mg/l	Gastro intestinal issues	
Electrical conductivity	750		
Total dissolved solids	500 mg/ l	Gastro intestinal issues	
Total Coliforms/ 100ml	10		
E.coli / 100 ml	0		

ISSN 2454-1672

Results

The sample collected from fresh water wells close to the lagoon was analyzed. The analysis of ground water samples includes the determination of concentration of inorganic constituents. The physico-chemical and biological parameters, which, were analyzed immediately after the collection are presented in the tables.

Temperature

The maximum water temperature was 33^{o}C and the minimum was 27^{o}C. The variation in water temperature may be due to different places and timing of collections. Temperature controls behavioral characteristics of organisms, solubility of gases and salts in water. Other biochemical factors do not influence on fluctuation of the temperature [12].

PH

The desirable PH range necessary for drinking water should be 7.0 – 8.5. The PH value of water sample in the study area ranged from 6.9 – 8.6. This shows that PH of water sample was slightly alkaline [13]. On an average, PH of all samples was in desirable limit as prescribed for drinking water standards. Lime deposits below the soil, decaying plant and animal wastes, seasonal rain, influence of the salt water from lagoon, fishing related activities in the study area might have influenced in the observed pH values. Lacking of uniformity in the distribution of the above factors, might be a reason for the fluctuation in the pH throughout the area.

Total Alkalinity

Total alkalinity of water in terms of $CaCO_3$ varied place to place and the water was moderately alkaline. Having alkalinity less than 100 mg/lit in the drinking water is safe. The reason for the high content of alkalinity obtained in all the study area may be explained by the lime deposition below the soil surface.

Turbidity

The present study shows the turbidity in the range of 5.5 – 27 NTU. World health organization prescribed the highest desirable limit is 5 NTU and maximum permissible limit is 25 NTU. In most of the areas the water was very clear and the values of turbidity present were in the permissible limit. As all the fresh water wells that were used for drinking were kept covered all the time there was very less chance of substances reaching the water.

Total Hardness

Total hardness of the sample water, ranges from 210-350 mg/lit. This shows that water is safe for drinking purpose. Hardness has unknown adverse effects on health. However maximum permissible level prescribed by WHO for drinking water is 500 mg/ lit and all the water samples tested were up to the standard.

Chlorides

Presence of chlorine is common in all the natural waters in widely varying concentrations. The chloride contents normally increases as the mineral content increases. As Chloride chemicals are applied to the well water time to time for the purpose of sterilization and the whole water is pumped out completely to get the pure water from the base of the well, the amount of chloride contamination in the water samples are very less. According to WHO, maximum permissible chloride limit in the drinking water is 500 mg/lit. The value observed in present study is in the range of permissible limit determined by WHO (2004).

Fluoride: The range of fluoride content in water was 0.7- 1.8 ppm. It was in the limits in most of the sample collection spots. Higher concentration of fluoride situation might lead to health issues such as dental and skeletal problem.

Sulphate

The sulphate content varies between 140-230 mg/lit. The value observed in present study is in the range of permissible limit determined by WHO.

Conductivity

The specific conductivity of water samples in this study varies between 700-950 µ mho /cm. The maximum permissible limit of specific conductivity for drinking water is 300µ mho/cm. However, the average specific conductivity exceeds the permissible limit because of its high values during rainy season. In rainy season due to floods and rains, water level in the well will increase and this will lead to increase in the amount of electrolytes.

ISSN 2454-1672

Total Dissolved Solids (TDS)

TDS in a measure of the combined content of all inorganic and organic substances found in any form (liquid in molecular, ionized (or) micro granular suspended form) The permissible limit of TDS of drinking water is 500mg/lit (WHO, 2004). The observation shows that the TDS is within the permissible range as prescribed.

Coliform Count

The number of coliforms and the faecal coliforms are obtained in the original sample by referring the MPN table after the coliform test. Results were compared with the Sri lankan standard and confirm the bacteriological quality of the water sample for various purposes like human consumption for drinking, washing and bathing purpose, recreational activities and others. Except well 11, all the water samples met the requirement determined for Sri-Lanka. The well that reported positive to faecal coliforms might have been infected by the faecal matter during water flow with the heavy rain experienced in this area couple of weeks before the sampling was done.

Conclusion

There has been a slight fluctuation in the physico-chemical parameters of the water samples analysed. This study confirms the presence of pollutants in the fresh water wells in the study area and the water is not up to the quality of drinking. Therefore appropriate action needs to be taken immediately to improve the quality of drinking water and maintain the water quality standard for ever.

Table 2: Physical, chemical and biological parameters and the values obtained for each sample.

Parameters	Sampling point											
	1	2	3	4	5	6	7	8	9	10	11	12
Coliform	1		2	1	3	1	0	0	2	5	14	3
Faecal coliform	0	0	0	0	0	0	0	0	0	0	3	0
Temperature	27	28	30	29	33	30	27	28	29	29	33	28
pH	7.4	7.2	7.8	7.7	7.7	7.8	7.3	8	7.9	8.1	6.9	8.2
Total Alkalinity	310	315	300	310	270	300	310	320	320	300	290	265
Turbidity	285	268	237	215	160	190	180	185	190	175	180	250
Total hardness	220	270	230	290	310	270	220	240	240	270	250	260
Chlorides	330	370	380	345	360	370	330	350	355	345	340	345
Fluoride	1.1	0.9	1	1.2	1.3	1.1	1	0.9	1.3	1.1	1.1	1.2
Sulphate	190	220	210	190	200	190	190	190	190	170	190	210
Conductivity	880	890	8E+05	785	810	820	790	810	770	800	790	820
Dis solids (Total)	520	685	850	850	880	910	750	810	790	785	810	820

Acknowledgement

The author thanks the funding and physical support provided by Dr. Senthil and his wife.

ISSN 2454-1672

References

[1] American public Health Association water Pollution Control board (1965). APHA, AWWA-WPCF, standard methods for examination of water and waste water,New York (USA), 6:74-92.

[2] De, A.K. Environmental chemistry (4th edition), (2002) New age International Publishers, New Delhi.

[3] Dhivyaa Pranava, TS, venkatesa Rao, T, punithavathi L, karumanithi, S and Bhaskaran, A. (2009). Ground water pollution in the polar rever bed near vellore tamilnadu, India, *Indian J, Sci technol.* 4(11):19-21.

[4] Gulta, DP, Sunita, and Saharan, JP. (2009). Physico chemical analysis of ground water of selected area of kaithal city (Haryana) India. Researcher, 1(2):1-5.

[5] Karunakaram K, Thamilarasu P, Sharmita R. (2009). *E-J. Chueu*, 6(3): 909.

[6] Kameswara Rao, O. and Venkateswarlu, P. (2011). Concentration of Fluoride in ground water and its distribution between coastal and central areas in S.P.S.R. Nellore district, *Rasayan.j.chem.,* 4(2).

[7] Laboratory Manual on water analysis, National Environmental Engineering Reaserch Institute, NEERS, Nagpur. (1991).

[8] Parashar charu, Verma N, Dixit, S, Shrivastav R. (2008). *Environ moinit Assess*, 140:119-122.

[9] American Physic Health Association Washington 'DC'.10 editions (1985).

[10] WHO, International standards of drinking water, world health organization, Geneva, (2004). 55-79.

[11] Yadav, SS., and Kumar Rajesh. (2011). *Ultra Chemistry*, Pelagia Research Library Advances in Applied Science Research, 2 (2):197-201.

[12] Yadav S.S, Kumar Rajesh, SSMRAE (2010), 10:146-151.