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Research Article

The Role Pollution in Coastal Area to Effects on Quality of essential trace elements (Copper, Zinc, Selenium) and pH Levels of Ground Water of Nellore District, Andhra Pradesh, India

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Abstract: The Groundwater quality in the coastal of Nellore district, Andhra Pradesh, India, has been studied from August 2013 to December 2013 because the industrialization of the city has resulted in environmental pollution. The quality of groundwater from the soil-weathered zone and from the zones affected by industrial activities, urban activities and seawater activities has been assessed in terms of pollution. The increase in the concentrations of essential trace elements copper, zinc and Selenium and increased levels of pH in the groundwater were observed. The study infers that the industrial activity is more responsible for groundwater pollution, causing health problems. Measures on a groundwater-quality monitoring program are suggested for the sustainable development of the urban area.

Keywords: Trace elements, Pollution, Costal area, Ground Pollution

INTRODUCTION

India has 2.45 percent of the world's land resources and roughly 4 percent of the world's fresh water resources, while 16 percent of the world's population resides in the country [1]. Andhra Pradesh is endowed with numerous rivers such as the Godavari, Krishna, Pennar, and Vamsadhara, as well as other minor river basins. Groundwater quality in the coastal of Nellore district, Andhra Pradesh, India, has been studied from August 2013 to December 2013 because the industrialization of the city has resulted in environmental pollution.

Problems due to pollution have been growing, posing a serious threat to water use availability. Pollution of both surface and ground waters occurs due to Municipal sewage (often untreated), urban and rural wastes, industrial effluents, chemical fertilizers, and pesticides [1].

Health burden of poor water quality is dangerous [2]. It has been estimated that around 37.5 million Indian populations is affected by waterborne diseases per year and around 1.5 million children die due to diarrhoea alone and around 73 million working days are lost due to waterborne disease each year [3]. The nutrients as phosphate, nitrate, dissolved silica and trace metals that are either needed formetabolic pathways or taken "by mistake" (e.g. Cd, Zn,) are deplete from surface water [4]. 90% ofthe organic matter produced is recycled in the photic zone but the remaining 10% (of deadorganisms and fecal matter) sinks into the deeper ocean, gets remineralized (bacterial oxidation or dissolution) and returns to the water column as dissolved inorganic compounds. The result is depletion of the dissolved "recycled elements" in surface waters and enrichment at depth. The problems of chemical contamination is also prevalent in India with 1, 95,813 habitations, affected by poor water quality [5]. The chemical parameters increase in the concentrations of copper, zinc, selenium, pH, alkalinity leads to a change from carbonate hardness to noncarbonate hardness in the groundwater [6]. The study infers that the industrial activity is more responsible for groundwater polluted, which causes health disorders [7]. Groundwater-quality monitoring program is suggested for the sustainable development of the urban area [8]. The state that for metals such as Cu, Zn, Fe and Sn the bulk of the dissolved concentration in seawater is present in the nonreactive (nontoxic) form at the ocean surface [9]. The working theory is that this is due to the metals being bound to some strong unknown ligands (or binding molecule) with a small fraction of the metals being colloidal [10]. These putative ligands and chelators, some of which may be proved to be from biogenic sources are presumed to detoxify the metals and possibly assist with metal transport and sequestration [11]. The practice has nearly been stopped in recent years as it is realized that many trace elements are naturally present in low quantities in the major Chemical compounds like sodium chloride. Sodium sulfate and magnesium chloride that are used to make synthetic sea salts [12]. Heavy metals pollution causes serious problems, leach into ground water or soil, which is a threat to human health. Ground water pollution occurs due to several activities like chemical manufacturing, painting and coating and mining etc. [13, 14].

MATERIALS AND METHODS

Study area

The climate of Nellore region is humid and tropical. The mean monthly temperature ranges between 22 and 40 degree Celsius. It receives an annual rainfall of 1379 mm. The position of groundwater table varies from 1.8 to 26 meters. The Nellore region is basically an agriculture area and the land used for crop production is around 41.3 %. The study area is covered of the present investigation is located along the coast of the Nellore district, Andhra Pradesh, India.

Fig. 1: Figure shows Study Area: Sample collection at Nellore region, Andhra Pradesh, India (Geography)

Thirty representative groundwater samples, in total, were collected from the aquifers of Nellore region covering urban, rural and industrial areas. Collection, preservation and analyses of water samples were done. The study area consists of coastal region covered more than 30 villages and it is extended from Iskapalli village of Allur Mandal, Nellore district to Krishnapatnam village of Muthukuru Mandal of Nellore District. The length of the study area along the Buckingham Canal is about 52 km, which is running from Vijayawada to Madras along the east coast of Andhrapradesh (Figure 3). This canal carries only saline water and many of the major and minor aqua farms are located along this canal. Most of these aqua farms are using this Buckingham canal as a source of water to their grow out farms and discharge of their pond exchange water in to the canal. The study area ground water quality was monitored within and around the aqua farms, consists of both open and bore wells. The depth of the ground water in the study area ranges from 1.8 to 26 m. approximately, 41.3% of the area is covered by agriculture and the rest is covered by aquaculture, residential and barren lands. 10 wells were chosen for ground water quality monitoring. Coastal (Sea) water collected at different zones of the outer area of the Bay of Bengal along Nellore district.

Study setting

It was carried out in Advanced Research Centre, Narayana Medical College, Nellore-520057, Andhra Pradesh, India.

Sample collection

The water samples were collected at selected points; great care was taken during collection of the sample. The samples were brought to the laboratory and analyzed. The clean plastic bottles of one liter capacity were rinsed three times with the element free water before filling it, after the samples was collected, the stopper was placed tightly (Fig. 2).

Procedure

The water samples were analyzed for various parameters such as temperature, pH, alkalinity and salinity according to standard methods for examination of water. Cooper, zinc, selenium were estimated by using AA-7000Fatomic absorption spectrophotometer (SHIMADZU, Japan).

WHO Guideline for drinking water quality-ground-(2011): Cu =2 mg/L; Zn=0.05 mg/L and Selenium= 0.001 – 0.002 mg/L.

Statistical analysis

Values are expressed in Mean and analysis done using SPSS version 16.0. Chi square analysis was carried out to analyze each element with their comparison. A p value less than 0.05 will be considered as significant.

RESULTS

The present study Groundwater is the prime source of drinking water and quality is getting degraded due to increasing environment pollution. Ground water is one of the major important drinking water sources in throughout the world. Especially in most of the village areas the public are using ground water for drinking purpose. Heavy metals like Hg,Pb and others are considerable contaminants in drinking water. Excess levels of heavy metals may cause several acute and chronic health disorders to the human beings and other animals also. Determination of these metals with high accuracy and precision at trace levels is one of the major challenges in analytical chemistry. The pollutants that enter the inshore water and estuaries create serious problems causing extensive damage to the life and activities of the living aquatic organisms [15]. The geological formations present in the study area are of marine origin and hence there is every possibility for the presence of trace metal in groundwater. The excessive pumping of groundwater leading to sea water intrusion and spurt in industrial activity further enhance the scope for higher concentrations of trace metals. The chief mechanism controlling chemistry of ground water of Nellore region is rock water interaction. The Trace elements accumulation in aquatic consumers is of interest to ecologist and environmentalists so as to understand the fate and effects of contaminants in the food web dynamics as well as in the biogeochemical cycle of trace elements [16] (Table 1). Therefore we suspect that there may be metals contamination in the selected samples of ground water and surface water. The concentrations of elements like Cooper, Zinc and Selenium are found to be high in coastal than ground water samples.

The observed copper levels in costal surface water ranged from 1.8 to 2.4 (2.0 ± 0.2), where as in ground water 1.1 to 1.5 (1.3 ± 0.1) in comparison to normal range (Cu =2 mg/L) with significant of *p*-value <0.0001.

The observed selenium levels in costal surface water ranged from 0.26 to 0.30 (0.28 ±0. 02), where as in ground water 0.12 to 0.16 (0.14 ± 0.01) in comparison to normal range (0.001 – 0.002 mg/L) with significant of *p*-value <0.0001.

The observed zinc levels in costal surface water ranged from 2.7 to 3.1 (2.9 ± 0.2), where as in ground water 1.6 to 2.0 (1.8 ± 0.1) in comparison to normal range (0.05) with significant of *p*-value <0.0001.

Table 1: Trace element parameter in costal water and ground water

	Ground water Mean ± SD	Costal surface water Mean ± SD	*p*-value
Copper (mg/L)	1.3 ± 0.1	2.0 ± 0.2	<0.0001
Selenium (mg/L)	0.14 ± 0.01	0.28 ± 0.02	<0.0001
Zinc (mg/L)	0.18 ± 0.01	0.29 ± 0.02	< 0.0001
pH	6.9 ± 0.4	7.5 ± 0.4	< 0.0001

pH of water

The observed pH value ranging from 6.4 to 8.5 has shown that the water samples have mild acidic to alkaline nature [1]7. The increased pH value than the permissible level may cause corrosion of plumbing systems or fixtures. The observed pH levels in costal surface water ranged from 7.1 to 7.9 (7.5 ± 0.4), where as in ground water 6.5 to 7.3 (6.9 ± 0.4) in comparison to normal range pH and (6.4 to 8.5) with significant of *p*-value <0.0001 (Fig. 1).

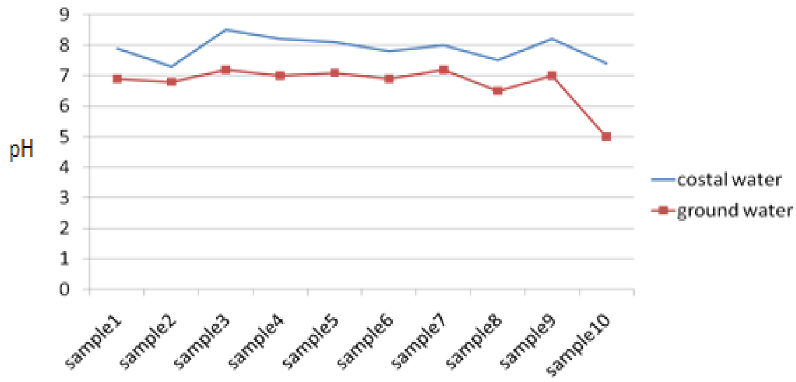

Fig. 1: pH role levels in costal water and ground water

Fig. 2: Collection of water samples from Buckingham Canal and coastal region

CONCLUSION

This study emphasizes the need for regular ground water quality monitoring to assess harmful elements activity from time to time for taking appropriate management measures in time to mitigate the intensity of chemical parameters activity. All living organisms on the earth need water for their survival and growth. Increased human population, industrialization, use of fertilizers and man-made activity has resulted in contamination of water with different harmful contaminants. Thus, quality of drinking water should be checked at regular time interval, as use of contaminated drinking water is responsible water borne diseases. Most of the groundwater is not due to the influence of sea water but it is caused by the hydro-geochemical process. Minimal influence of sea water on the groundwater quality is observed along the rock fractures. The role copper, zinc found < 0.001 were more significant in costal water compare to ground water, where as selenium < 0.001were significant in costal water higher concentration compare to ground water. The combined effect of sea water and urban waste waters is due to the inferior quality of groundwater in a few wells, where they are at minute low close to the coast.

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