

Study of Drinking Water Quality of the Kirtipur Municipality by Using Different Physico-chemical Method

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Abstract

Water quality should be determined before consuming it because of several water related problems. Hence water samples were collected from different sources and were analyzed for the determination of various physical parameters like pH, conductivity and temperature and chemical parameter such as iron of water samples. Concentration of iron in different water samples was determined by spectrophotometric method.

Introduction

Water is one of the most important and abundant compound of the ecosystem. All living organisms on the earth need water for their survival and growth¹. Two principal natural sources of water are; surface water (lakes, rivers, streams, etc.) and ground water (borehole water and well water etc). More than one billion people in the world do not have suitable drinking water, and two to three billions lack access to basic sanitation services. Deterioration of water quality rendering serious environmental problems posing the threat on human beings and sustaining⁵. It is reported that about three to five millions people die annually from water-related diseases².

Hence water can be taken as a key component in determining the quality of our lives. Although water covers about 70 percent of the earth's total surface, only 0.3 % of it can be used by human beings. Notwithstanding the small quantity of water available as a usable source, the society continues to contaminate this precious resource by different means. In the past, most people especially the rural folks depended mostly on surface water as their drinking source. In recent years however, groundwater sources such as boreholes (groundwater) are being given preference due to exhaust as well as increasing rate contamination of surface water resources.

Not only surface water but ground water sources are also being highly polluted with different harmful contaminants due to increased human population, industrialization, use of different kinds of fertilizers in the agriculture and man-made activity. To prevent disease incidence and other negative effect of consuming substandard water, it is imperative to systematically and regularly monitor the quality of the groundwater consumed by people. This may help in adopting recommended safe use strategies for drinking, industrial and domestic purposes when necessary³.

In this study various physical parameters such as pH, conductivity and temperature and chemical parameter such as concentration of iron in different water samples was determined by spectrophotometric method.

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Experimental Methods

Different water samples were taken from Panga, Nagaun, Bhatkepati, Kirtipur hospital, Sagal chok, Dhodpokhari of Kirtipur municipality randomly during mid April of 2016. Samplings were carried out according to standard method described in the literature^{4,16}. All reagents used in this study were AR grade chemicals that were purchased from local supplier of Kathmandu.

For determination of temperature, pH and conductance of the water sample were carried out by dipping thermometer, glass electrode and conductivity cell with conductivity bridge in 50 mL water sample containing in 100 mL beaker respectively.

Trace amount of iron present in water sample were determined by spectrophotometric method. In this method all the iron is converted into ferrous state by boiling with hydrochloric acid and hydroxylamine. The reduced iron chelate with 1, 10- Phenanthroline at pH of 3.2 to 3.3 to form a complex of orange red color which has absorption maximum at 510 nm. The intensity of this color is proportional to the concentration of iron and follows Beer's law and therefore, can be measured iron concentration in the water samples. In this study calibration curve for iron determination is carried out first (Fig 3) and the concentration of iron in water was calculated directly from the standard calibration curve¹².

Results and Discussion

Physical parameters (Temperature, pH, and Conductance)

Sample collected from different area of Kirtipur, temperature of water samples were found on the ranges from 28-30 °C.

The pH is the measure of acidity and alkalinity of any solution that depends upon the presence of H⁺ or OH⁻ ions in water. If free H⁺ ions are more than OH⁻ ions than water is said to be acidic. Similarly if free OH⁻ ions are more, than water is said to be alkaline. Further the hydrogen ion concentration (pH) of water is considered as an index of environmental conditions. According to literature the better fish production could be possible in pond water with pH value ranging between 6.5 - 9.0.

Maximum pH (pH 7.90) was measured in the samples collected from the Bhatkepati well and minimum pH (pH 6.61) was measured in the samples collected from the well of Sagal chok. According to WHO standard value acceptable pH range for drinking water is 6.5-8.5. The pH of different water samples are shown in Figure 1.

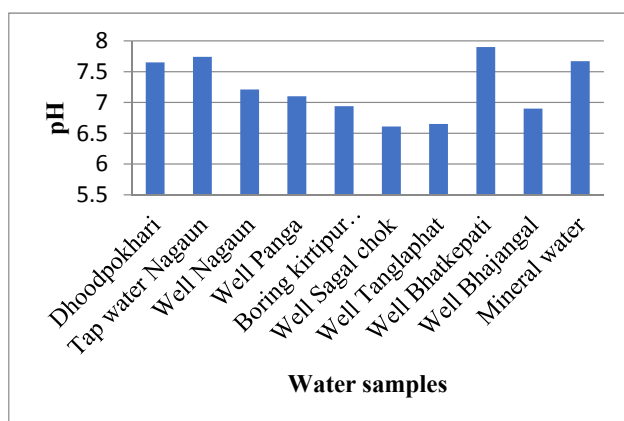


Figure 1: The pH of different water samples

Conductivity depends upon the presence of ionic substances. Conductivity of distilled water ranges from 1-5 $\mu\text{s}/\text{cm}$. Presence of salt and contamination of water increases the conductivity. Maximum conductivity was measured in the sample collected from the Bhajangal well (1560 $\mu\text{s}/\text{cm}$). This value is above the recommendation of WHO (500 $\mu\text{s}/\text{cm}$) and Nepal (1500 $\mu\text{s}/\text{cm}$) drinking-water quality guidelines. Sample collected from wells of Panga, Sagal chok, Tanglaphat and Bhajangal exceed the conductivity value recommendation of WHO drinking water quality guidelines. Conductivity of different water sample are shown in Figure 2.

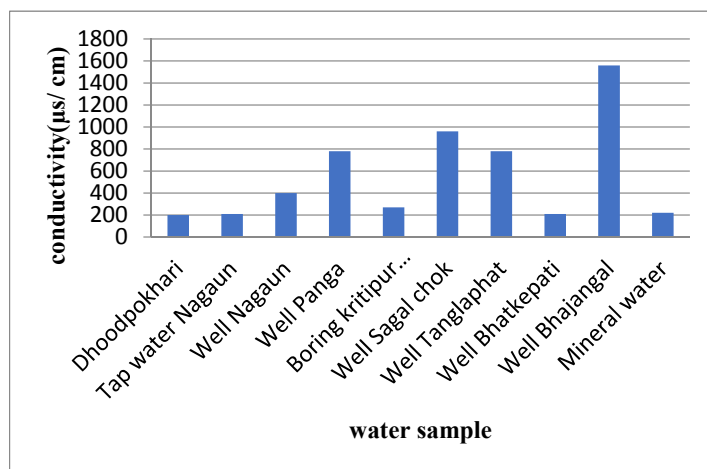


Figure 2: Conductivity of different water samples

Chemical parameter (iron)

Iron is an essential nutrient required in trace quantities for all living cells of plants and animals and human for their normal metabolism. Iron is commonly present in surface and drinking water. This occurs from dissolution processes of ironstones in nature and partially from the corrosion processes in pipes.

Presence of iron in water impacts a bitter and metallic characteristic taste and oxidized precipitate. Small amounts of Fe (II) can cause iron bacteria growth leading to the clogging of pipes and an offensive odor of water⁶. Water containing significant quantities of iron may appear clear but changes quickly upon exposure to air. This process is called oxidation and it involves the conversion of ferrous ion to ferric ion.

The concentration of iron in water sample vary with time of the year and also the depth of the water sample taken as iron can oxidize in presence of oxygen^{9, 13}. Concentration of iron in water samples collected from different area of Kirtipur was determined by spectrophotometric method. In this study the maximum amount of iron was found sample collected from the well of panga (0.54 ppm). Since iron may also present in drinking water as a result of the use of iron coagulants or the corrosion of steel and cast iron pipes during water distribution. This could be the reason for high iron concentration in Panga. Water sample collected from Dhoodpokhari and Panga well concentration of iron were found above the recommendation of WHO drinking-water quality guidelines (0.3 ppm) but within the range of Nepal government (0.3-3 ppm) drinking water quality guidelines. Concentration of iron in different water samples are shown in Figure 4.

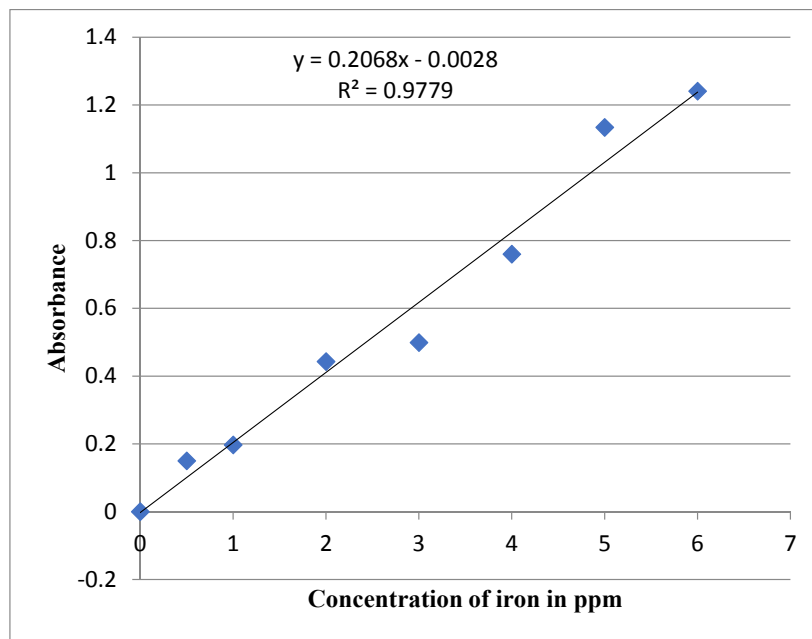


Figure 3: Calibration curve for iron

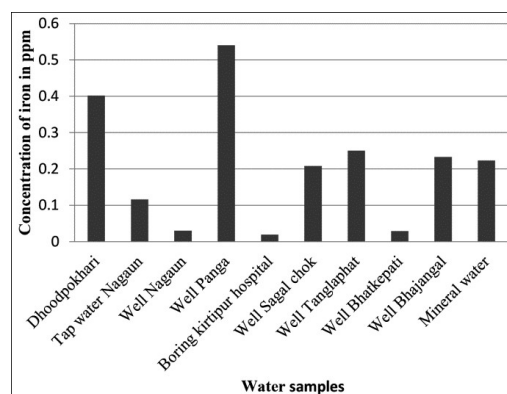


Figure 4: Concentration of iron in different water samples

Conclusions

Water quality of Kirtipur municipality was studied and assessed the contaminants level of water sample. The physico-chemical parameters of water such as pH, temperature, conductivity were determined along with the iron concentration in different water samples. Water quality parameters were compared with recommendation of WHO and Nepal's drinking-water quality guidelines as far as available.

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