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Appraisal of heavy metals concentration in ground water used for drinking purpose in Olpad Taluka, Surat, Gujarat, India

Patel Monali S.* **and Kapila Manoj**
Department of Aquatic Biology V.N.S.G.Uni, Surat. Gujarat, India
monapatel8692@gmil.com

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Abstract

Safe drinking water is as major requirement as air for humans. Ground water is one of the most valuable source of drinking water on the earth. From last few decades, the major problem of environment pollution increases because of human activities. Because of rapid industrialization and agricultural practices the groundwater quality is declining. It is also cause a root entry of heavy metals into ground water. The study was undertaken to assess the ground water status of Olpad taluka with respect to heavy metals like, Cu, Ni, Zn and Co. seven samples from four villages were collected with different sources. The heavy metals were analysed by Atomic Absorption Spectrophotometer. The values of Cu, Zn and Co were found under permissible limit but Ni recorded higher than limits specified by Indian Standards for drinking water. Toxic effects in respiratory tract and immune systems found with higher concentration of nickel. Deficiency of vital metals like Zn and Cu also affect the human health.

Keywords: Heavy metals, AAS, Pollution, Olpad, Surat.

Introduction

Water is most precise and important natural resources on the earth. It is used in day by day activities like drinking, bathing, washing; recreation, irrigation and industrial purposes[1]. It is considered as "Gift of God", as something that human beings are as naturally entitled to as the air they breathe[2]. Mainly two basic sources of drinking water; surface and ground water. Over 98% of available global fresh water is stored as ground water in saturated zone within pores and fractions in rocks beneath the earth's surface[1]. 30 % of available fresh water comes from ground water which supplies a significant amount of water to community by water systems and private wells[3,4]. The value of ground water is not only depends upon the wide occurrence and availability but it also consist a good quality that can be used for drinking purpose. Daily increasing the urbanization, industrialization, agricultural practices and human activities increase the pollution at an alarming rate. Naturally metals are dissolved in the water when it contact with rock and soil and at some level it required for our body. But when excess amount of metals are entered in the body it became toxic to human health. The reason behind heavy metal found in water sources are, contaminated drinking water source, leach the metal in source by corroded pipes and unhygienic practices for drinking water[5].Drinking water that contains heavy metals higher than permissible limits, it causes potential risk to health of humans.

The study was conducted to determine the suitability of ground water of Olpad taluka Surat, Gujarat that used for drinking purpose with respect to heavy metals and associated with human health. For the present study four villages were selected with different water sources i.e. hand pump, bore well, open well and tube well. The metals like Cu, Ni, Zn and Co were analysed by using Atomic Absorption Spectrophotometer.

The metals like Zn and Co are essential for body growth and development also. Co is the main constituent of vitamin B12 but it is toxic at high level. Deficiency of the trace metals can also cause anaemia, growth inhibition and blood circulation problems. The long term exposure with drinking water contain heavy metals can cause ill effect on body like kidney and heart damage, vomiting, diarrhoea, stomach cramps, liver damage etc. Heavy metals are having a tendency to bio accumulate into the body so minute quantity also create health hazard. Sources of these metals were normally fertilisers, septic systems, animal's feedlots and household plumbing materials, waste water effluent, sewage sludge, it can leach from Nickel or Chromium plated taps or borehole equipments[6]. Some metals were found by naturally erosion of soil and rock minerals.

Materials and methods

Sampling of water: Water samples were collected from four villages: i. Jothan (Hand pump), ii. Talad (Open well), iii. Atodara (Tube well) and iv. Sithan (Bore well) of Olpad taluka, Surat, Gujarat.

The samples were collected monthly From Aug'2015 to Jan' 2016, early in the morning. Two samples from each source were collected respectively (except open well). The samples were collected in properly washed double capped polythene bottles (Washing with detergent followed by dilute HNO_3 and double

distilled water). The samples were preserved in acid medium (1.5-2 pH). Samples were digested by methods that specified in APHA[7]. These digested samples were directly measured on Atomic Absorption Spectrophotometer.

Results and discussion

Graphical representation of all results given in Figure 1 to 8.

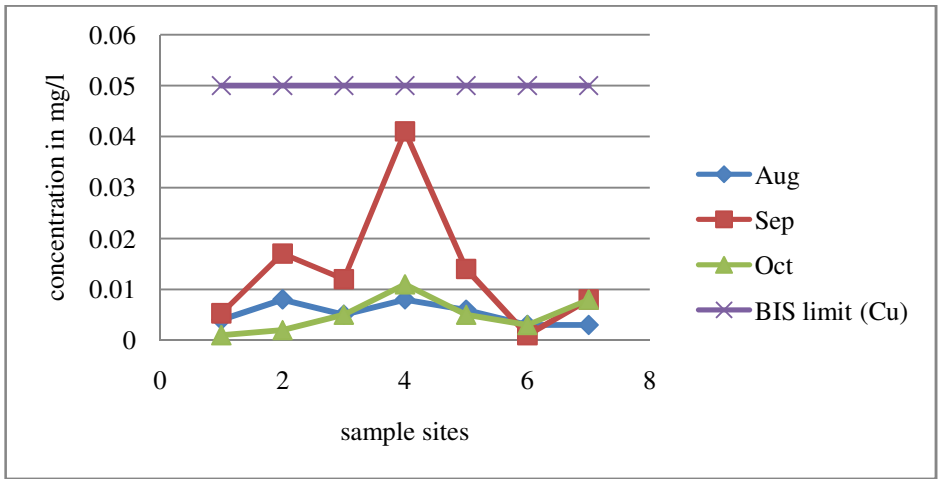

Figure-1: Cu concentration (mg/l) from Aug'2015 to Oct' 2015.

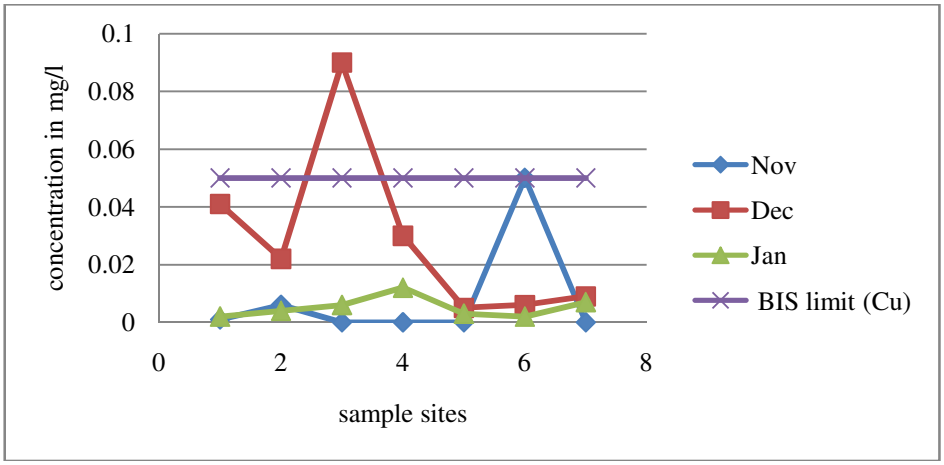

Figure-2: Cu concentration (mg/l) from Nov'2015 to Jan' 2016.

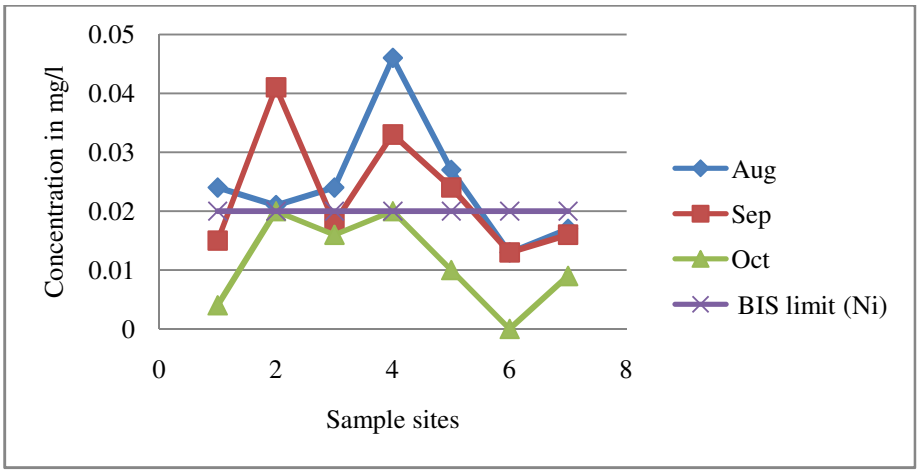

Figure-3: Ni concentration (mg/l) from Aug'2015 to Oct' 2015.

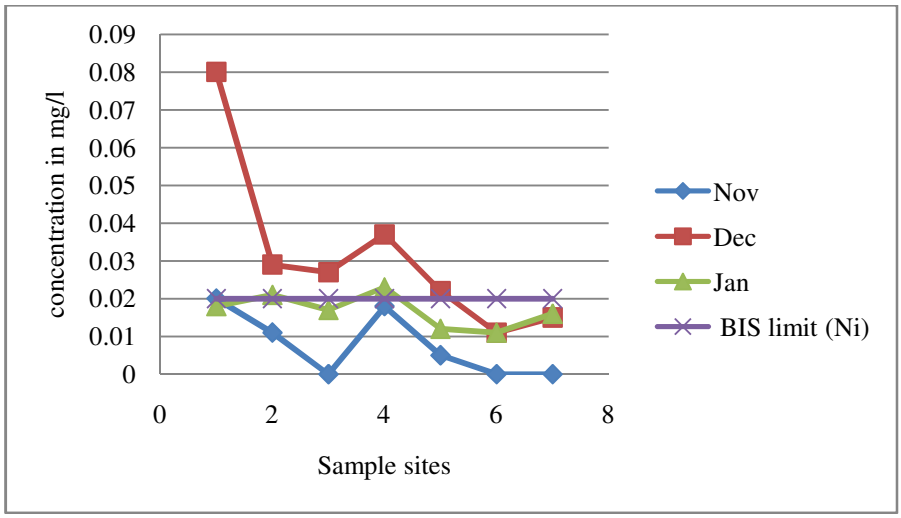

Figure-4: Ni concentration (mg/l) from Nov'2015 to Jan' 2016.

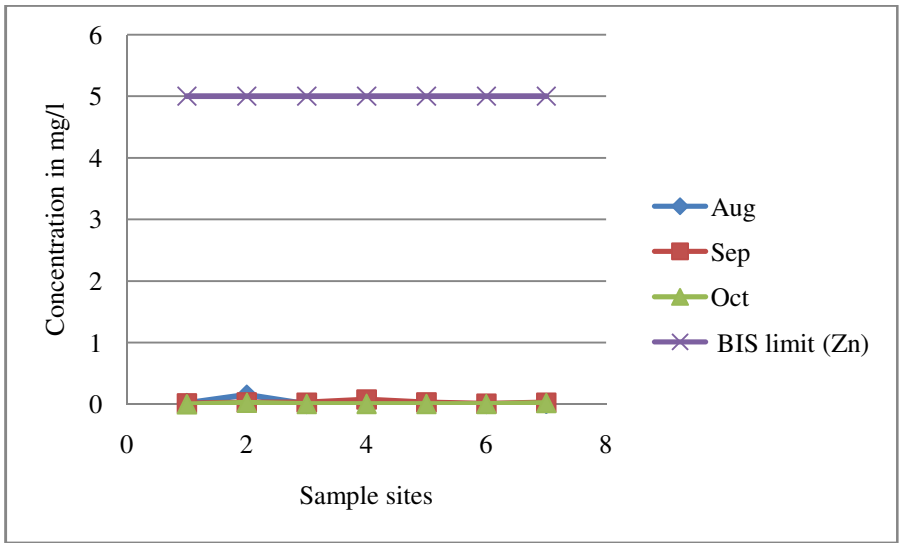

Figure-5: Zn concentration (mg/l) from Aug'2015 to Oct' 2015.

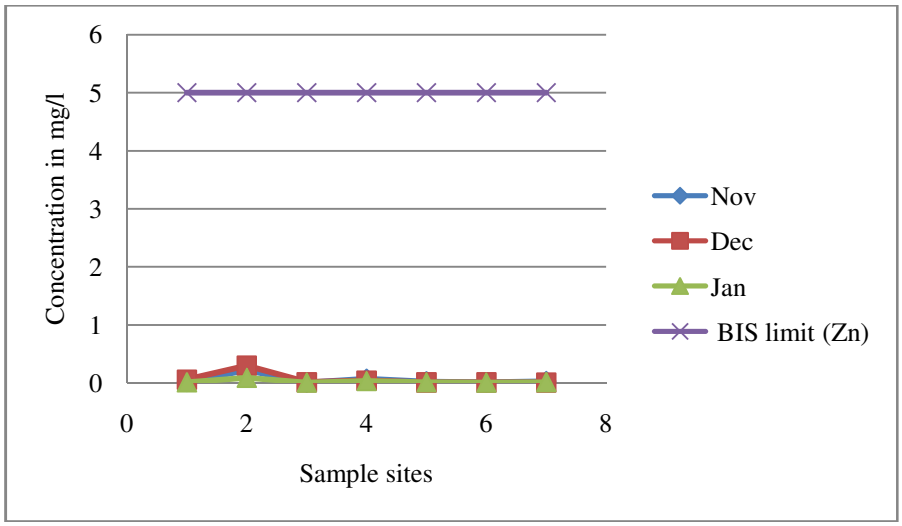

Figure-6: Zn concentration (mg/l) from Nov'2015 to Jan' 2016.

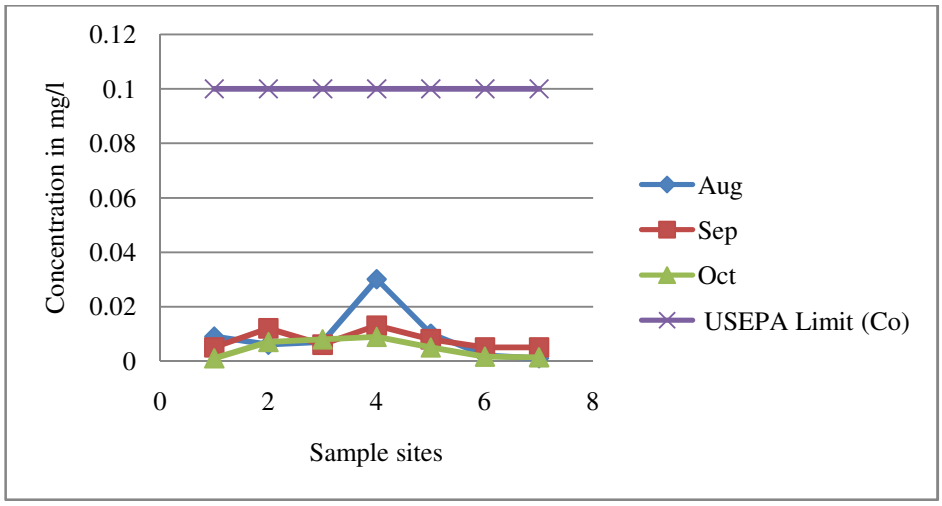

Figure-7: Co concentration (mg/l) from Aug'2015 to Oct' 2015.

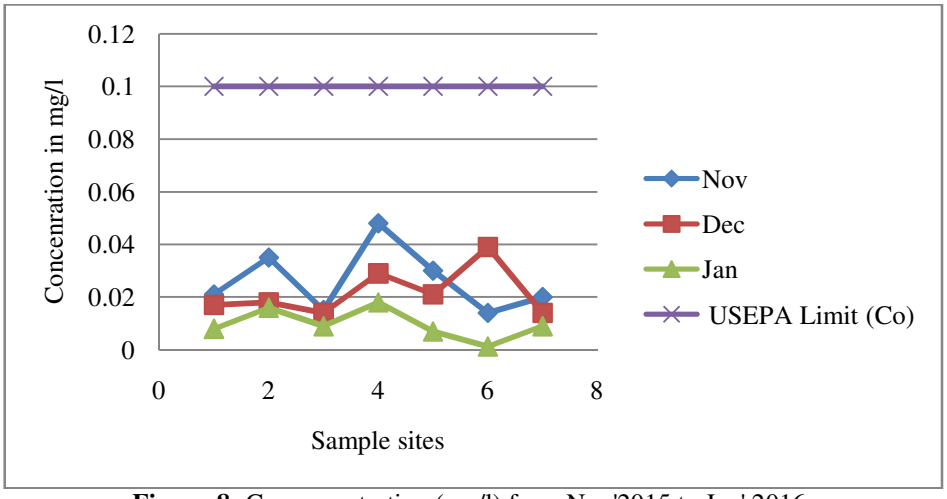

Figure-8: Co concentration (mg/l) from Nov'2015 to Jan' 2016.

Table-1: Metal concentrations and their impact on health.

Metals	Permissible limit (mg/l)	Within permissible limit (mg/l)	Above permissible limit (mg/l)	Site No	Impact on health
Cu	0.05 (BIS 2012)	-	0.09	Site – 3	vomiting, diarrhoea, stomach cramps, liver damage
		<0.05	-	All sites	Deficiency cause Anaemia
Ni	0.02 (BIS 2012)	-	0.08 0.046 0.041 0.027 0.027	Site 1-5	It damage heart and liver. Toxic effect in respiratory track and immune system.
		<0.02	-	Site 6 and 7	
Zn	5 (BIS 2012)	<5	-	All sites	Deficiency Retard growth and development, problem in DNA and protein synthesis, immune system
Co	0.1 USEPA 2008	<0.1	-	All sites	Problem in synthesis of vitamin B12 and enzyme activities has stopped.

Maximum concentration of Cu was found 0.09 mg/l in open well water. In other samples Cu concentration was found very low than the prescribed standard .Ni concentration were also varies between 0.027 to 0.08 mg/l in all sources instead of bore well water this indicate that the samples containing high Ni concentration not suitable for drinking purpose. Zn and Co also found in minute quantity as all samples containing less value than the standard prescribed.

Conclusion

From the study conducted for determination of heavy metal concentrations in ground water that used as drinking purpose, it is concluded that the water from site-1, site-2 and site-3 are not suitable for drinking purpose. It contains higher value of Nickel in water than the permissible limit. It can be removed by ion exchange, membrane filtration or reverse osmosis. But the procedures are cost effective so, users can not afford it. In that case the Gram Panchayat is advised to provide a good quality of water to the people after giving proper treatments. Water from site-4 can be used for drinking purpose but essential metals are below the permissible limit. In that case other sources of these metals can be added as food source.

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