

Assessment of Heavy Metals in Water samples of Singanamala Tank, Singanamala, Anantapuramu District, Andhra Pradesh, India

Venkataramanaiah Kolala¹, Jayaram Naik V N², Philip G. H^{3*}

^{1,2,3} Dept. of Zoology, Sri Krishnadevaraya University, Anantapuramu, Andhra Pradesh, India.

Abstract - Aquatic ecosystem is the ultimate recipient of almost everything including Heavy metals. This paper deals with the analysis of heavy metals concentration of like Li, Al, V, Fe, Co, Ni, Cu, Zn, As, Ag, Cd, Cs, Ba, Ti, Pb, U etc., in the water samples collected from Singanamala tank, Anantapur district AP, during May, 2011 to April, 2013. They were measured by A Perkin Elmer SCIEX®, Model ELAN 5000 Inductively Coupled Plasma-Mass Spectrometer (ICP-MS), is most advanced technique for the determination of trace metals concentrations up to 1 part per billion (ppb). The concentration of these metals in the study area was above desirable limits given by the Indian Standard Specification for Drinking Water IS 10500: 2012.

Key words: Heavy metals- ICP-MS- Singanamala.

1. INTRODUCTION

Environmental pollution is a worldwide problem, heavy metals belonging to the most important pollutants. Aquatic ecosystem is the ultimate receipt of almost everything including heavy metals. This has long been recognized as a serious pollution problem (1). By the term "heavy metals" we usually refer to any metallic element that contain a relative high density and applies to the group of metals and metalloids with atomic density greater than 4 g/cm³. There are about fifty heavy metals that are of special concern for their toxicological importance to human health and many of them, like Zn, Cu, Ni and Mn are also essential trace elements for living organisms. However, if these accumulated at high levels, or ingested in greater amounts than the required concentration, then they cause health problems (2).

Heavy metals enter the environment by natural and anthropogenic means. Such sources include: natural weathering of the earth's crust, mining, soil erosion, industrial discharge, urban runoff, sewage effluents and pest or disease control agents applied to plants, air pollution fallout (3). For the past few decades the concern over the studies on different pollutants such as trace metals, pesticides, oil and fertilizers and their impacts on environmental compartments such as soil, plants and water have attained a great importance (4). In recent years, the contamination of aquatic systems has become a problem of great concern throughout the world (5). The main purpose of the study was to obtain basic and simple information for a better understanding of environmental impact of some of the heavy metals contaminates the aquatic life. Monthly variations and year wise variations of metals like Li, Al, V, Fe,

Co, Ni, Cu, Zn, As, Ag, Cd, Cs, Ba, Ti, Pb, U etc., and assess the level of concentrations.

In India much research has been carried out with regards to assessment of Heavy metal concentrations in different tanks like Ureje water Reservoir (6), Hussainsagar lake water (7), River Noyyal (8), Ground water of Goa mining region (9), Drinking water contaminated with Heavy Metals (10). Andhra Pradesh has good number of Reservoirs, Ponds and Tanks. Qualitative and quantitative heavy metal investigations had been carried out in water bodies like Kolleru lake (11), water samples of Tirupathi region (12), In ground water of SPSR Nellore district (13), Surface and ground water of rural and urban areas of Kakinada, East Godavari district (14), Fish pond in around Bhimavaram, West Godavari district (15), Surface and Ground water in and around Tirupati (16).

2. METHODOLOGY

Study area: Singanamala Tank (Sri Rangarayalu Cheruvu) located at Singanamala, Anantapuramu District of Andhra Pradesh. It is about 3 km from Singanamala village and 20 km from Anantapuramu Town. It is largest tank in the district and geographically is located at 14°48'00" N Latitude and 77°43'00" E longitude. Elevation of this tank is 287 meters (944 fts) the Catchment area is 3436.00 acres and existing ayakut is about 5000 acres. The storage capacity of this tank is 0.5 TMC with the depth of 5-9 fts. The main source of water for this tank is rain fall and receives through surface run off during monsoon from Tadakaleruvagu, Erravanka, Vadiyampeta canal and Narasapuramvanka.

Methodology: The water samples were collected and stored in 1liter capacity clean plastic bottles. Before collection of samples, the bottles were washed with double distilled water. All the samples were filtered using Whatman 42 filter paper and were diluted to bring down the TDS 200 ppm for further analysis by ICP-MS. The trace element samples were treated with 0.6N HNO₃. The elements were analyzed by Inductive Coupled Plasma-Maas Spectrophotometer (ICP-MS). A Perkin Elmer SCIEX®, Model ELAN 5000 Inductively Coupled Plasma-Mass Spectrometer (ICP-MS) (Concord, Ontario, Canada) was used throughout. Acidified water samples were directly fed into the instrument nebulizer after proper dilution and filtration. Calibration was performed using the certified reference material NIST 1640a (National Institute of Standards and Technology, USA) to minimize matrix and other associated interference effects and

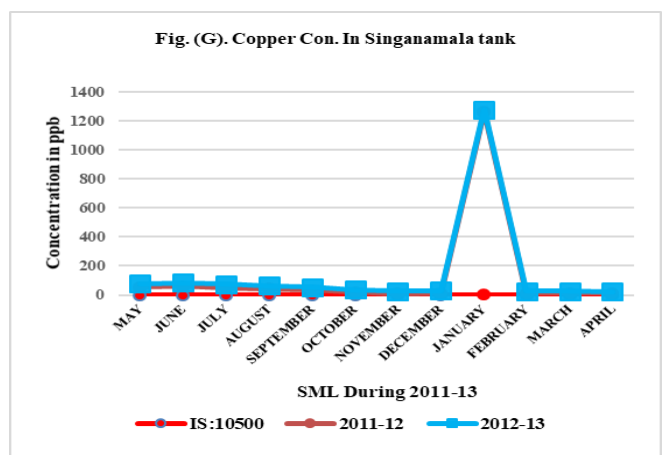
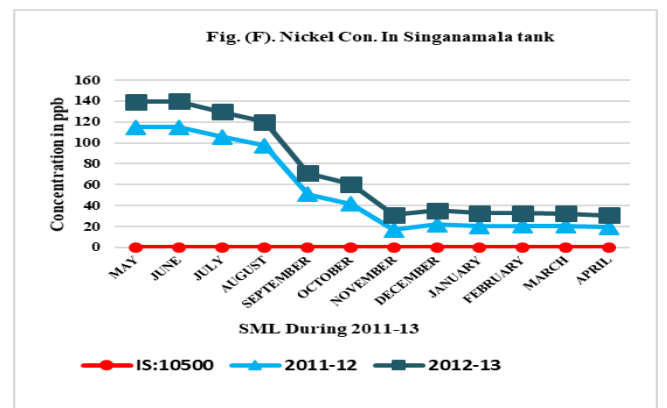
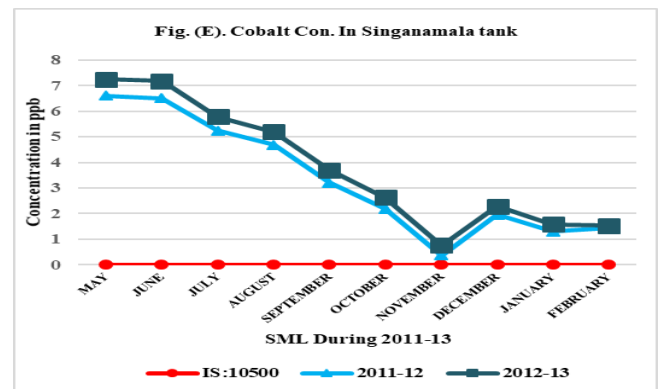
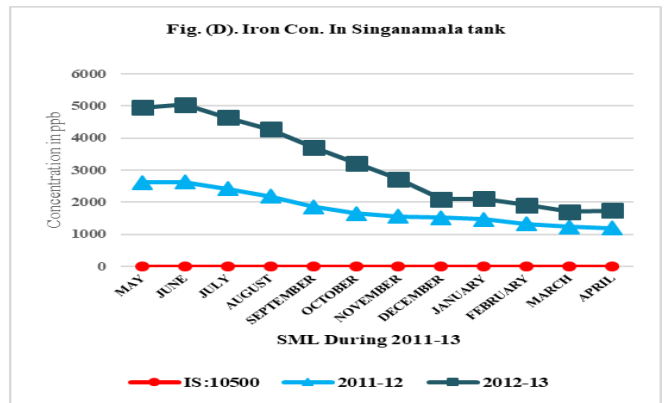
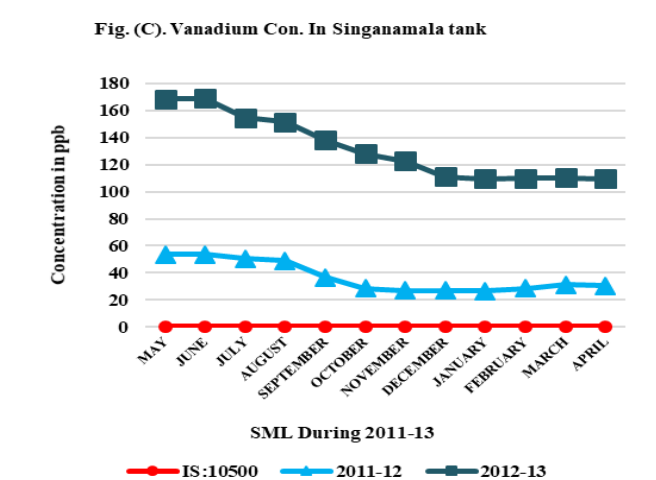
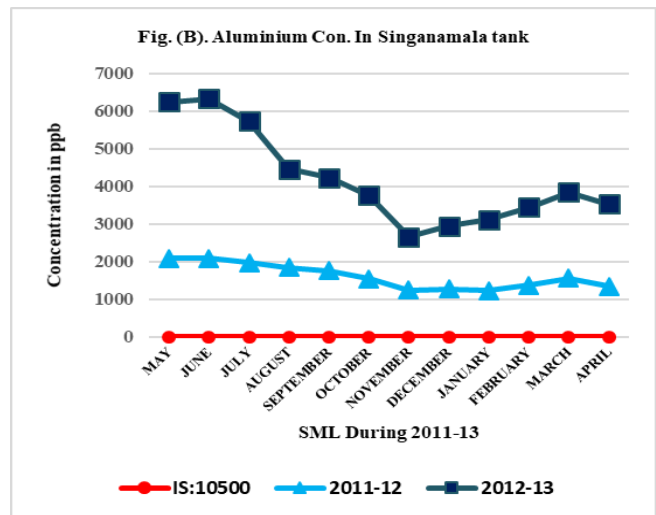
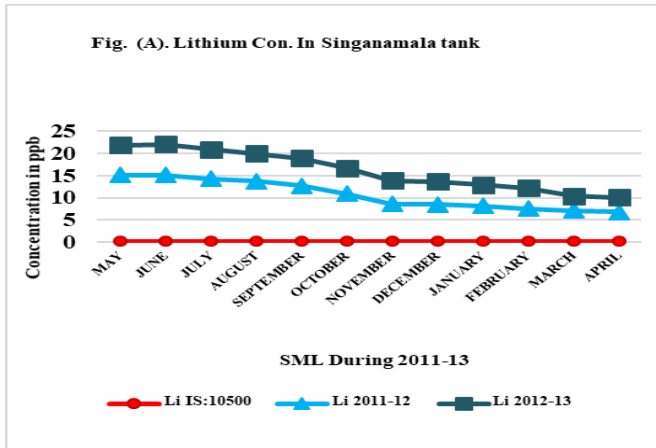
accuracy was better than 6% RSD. Relative standard deviation (RSD) was found to be better than 6% in the majority of the cases, which indicates that the precision of the analysis is reasonably good. Trace elements analyses were carried out at Department of Geophysics, Andhra University, Vishakapatnam, AP, India.

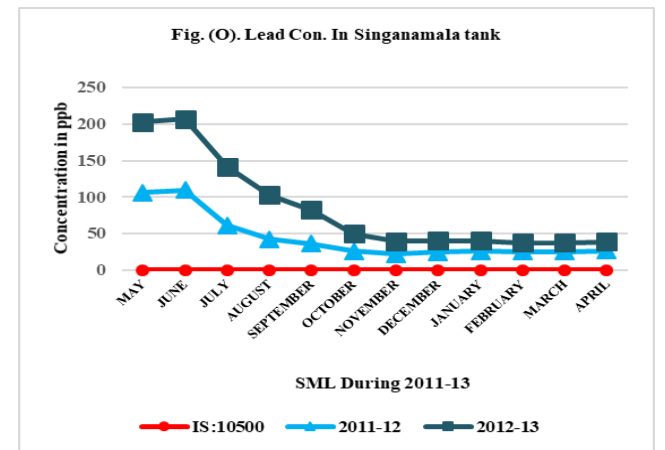
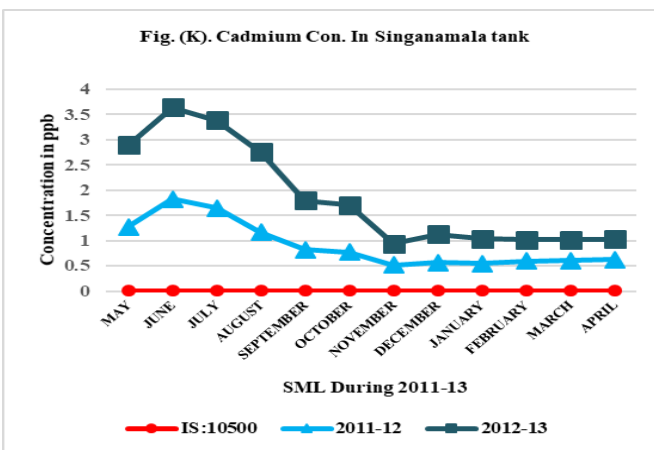
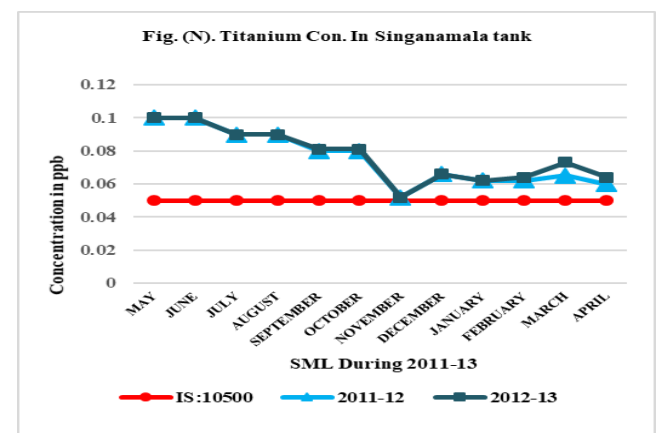
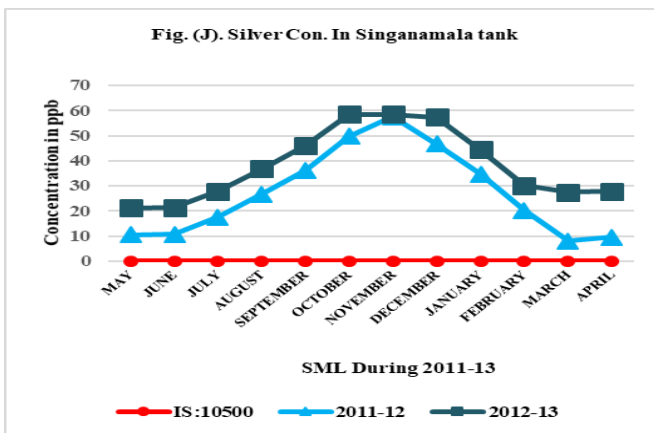
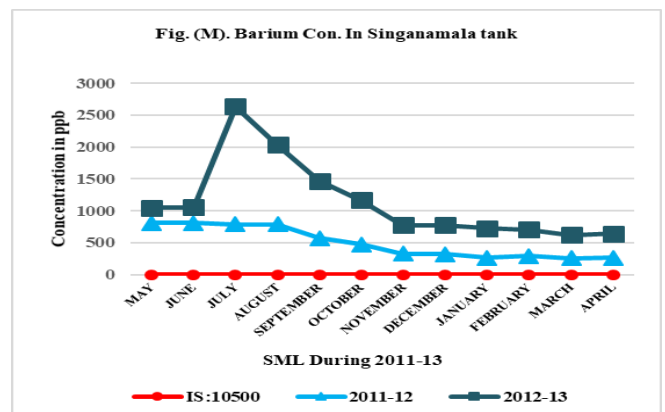
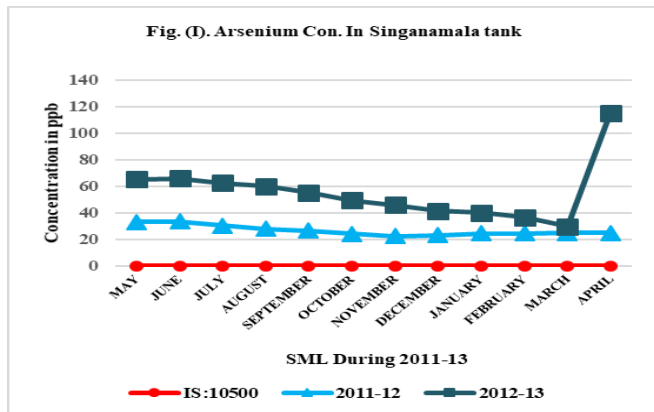
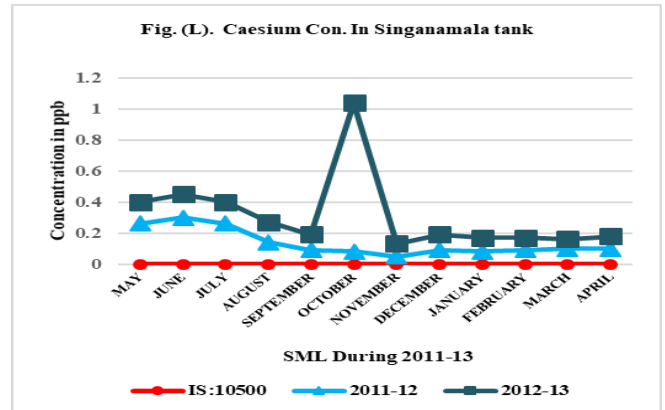
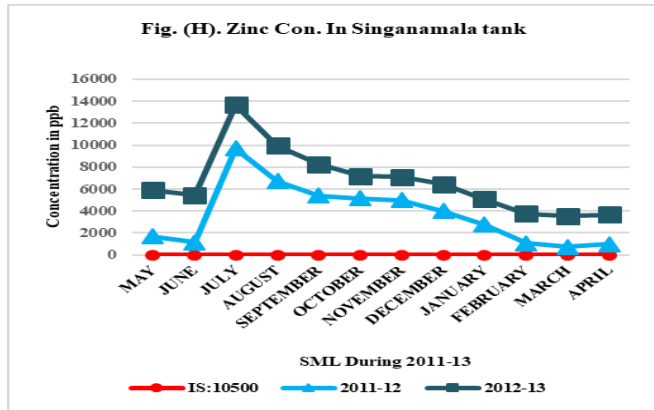
3. RESULTS AND DISCUSSION:

The mean Lithium levels in water sample were ranged from maximum 14.87 ppb in the month of June, 2011 and minimum 3.26 ppb in the month of April, 2013 (Fig A). The concentration of Lithium was above desirable limit i.e., 0.2 mg/L according to the Drinking water specifications IS 10500:2012. The mean Aluminium ranged from the maximum value of 4245.3 ppb in the month of June, 2012 and a minimum of 1234.4 ppb in the month January, 2011 (Fig B). The concentration of Aluminium was above desirable limit i.e., 0.3 mg/L according to the Drinking water specifications IS 10500:2012. The range of Aluminium in the present study was also observed by (17 2008) in the study of Impact of metals on Aquatic Ecosystems. On the observation of the results of Vanadium were ranged from the maximum 115.3 ppb in the month of June, 2012 and minimum 26.31 ppb in the month of January, 2012 (Fig 6 C). The concentration of Vanadium was above desirable limit i.e., 0.3 mg/L according to the Drinking water specifications IS 10500:2012. Iron (Fe) is an essential metal for most living organisms and humans. It is a constituent of proteins and many enzymes, including haemoglobin and myoglobin (18, 19). The mean value of Fe ranged from a maximum value 2636 ppb in the month of June, 2011 and a minimum 471.7 ppb in the month of March, 2013 (Fig D). The concentration of Iron was above desirable limit i.e., 0.3 mg/L according to the Drinking water specifications IS 10500:2012. The high concentration of Iron in the study area is due to the presence of Iron by washing vehicles, which was also mentioned by (14). Cobalt is beneficial for humans because it is a part of vitamin B12 which is essential for human health. Cobalt is used to treat anaemia with pregnant women, because it stimulates the production of red blood cells. The concentration of Cobalt tank ranged from 6.61 ppb in the month of May, 2011 and BDL (below detective level) in the months of March and April, 2013 (Fig E). The desirable limit of Cobalt was not mentioned according to the Drinking water specifications IS 10500:2012. In fresh waters it is generally low and higher concentrations are generally associated with industrialized or mining areas. The concentration range of Nickel was found between 115.1 ppb in the month of June, 2011 and 11.26 ppb in the month of April, 2013 (Fig F). The concentration of Nickel was above desirable limit i.e., 0.05 mg/L according to the Drinking water specifications IS 10500:2012. It was found maximum in rainy season. It can be deposited in the sediment by such process as precipitation, complexation and adsorption on clay particles (20). Copper is one of the earliest known metals. The range of Copper was found from 59.46 ppb in the month of June, 2011 and 10.6 ppb in the month of November 2011 (Fig G). It was noticed that the desirable limit of Copper in water is

0.05mg/L. The higher values of Cu may be attributed to the huge amounts of raw sewage, agricultural discharge in to the water bodies (21). Zinc involved in the nucleic acid synthesis and participates in a variety of metabolic processes involving carbohydrates, lipids, proteins and nucleic acid (22). The fluctuations of Zinc were found maximum with the value 9674.6 ppb in the month of July, 2011 and the minimum value 732.45 ppb in the month of March, 2012 (Fig H). The concentration of Zinc was above desirable limit i.e., 5.0 mg/L according to the Drinking water specifications IS 10500:2012. The higher values of Zn may be attributed to the huge amounts of raw sewage, agricultural discharge into the water bodies (21). The high level of Arsenic was found in the month of June, 2011 (33.71 ppm) and the low level was found in the month of March, 2013 (5.01 ppm) (Fig I). The concentration of Arsenic was above desirable limit i.e., 0.05 mg/L according to the Drinking water specifications IS 10500:2012. High values of Arsenic are mainly due to discharge of effluents from industries like paints, pharmaceutical, fertilizers and pesticides (23). The presence of minimum range of Silver in our food is very much essential for human beings, but the higher presence causes many abnormalities, especially the salts of Silver like AgNO_3 causing bluish or black pigmentation. The variation in the concentration of Silver was ranged between 57.5 ppb in the month of November, 2011 and 0.88 ppb in the month of November, 2012 (Fig J). The range of Cadmium value was found between 1.89 ppb in the month of June, 2012 and 0.41 ppb in the months of March and April, 2013 (Fig K). The concentration of Cadmium was above desirable limit i.e., 0.01 mg/L according to the Drinking water specifications IS 10500:2012. The high levels of Cd in water were known to be attributed to the agricultural discharge (24). The concentration of Caesium was assessed in water sample ranged between 0.3 ppb in the month of June, 2011 and 0.05 ppb in the month of November, 2011 (Fig L). Barium is one of the 14 abundant element found in earth's crust. The fluctuations of Barium values were ranged between 1846.3 ppb in the month of July, 2012 and 241.2 ppb in the month of May, 2012 (Fig M). The concentration of Barium was above desirable limit i.e., 0.7 mg/L according to the Drinking water specifications IS 10500:2012. Titanium was detected in the water sample ranged between 0.05 ppb in the months of May and June, 2011 and BDL (below detectable level) in the months of May, 2012 to January, 2013 (Fig N). The concentration of Titanium was within desirable limit i.e., 0.05 mg/L according to the Drinking water specifications IS 10500:2012. The analysis of the concentration of Lead was found in the water sample varied from 109.3 ppb in the month of June, 2011 and 12.13 ppb in the month of April, 2013 (Fig O). The concentration of Lead was above desirable limit i.e., 0.1 mg/L according to the Drinking water specifications IS 10500:2012. The high levels of Pb in water can be attributed to the agricultural discharge (25). Uranium is the radioactive trace element occurring naturally in soil and rocks. The concentration of Uranium in water is typically very small, but varies from region to region. The variation in the concentration of Uranium in the water sample ranged between 34.74 ppb in the month of March, 2013 and 5.93

ppb in the month of November, 2011 (Fig P). The concentration of Uranium was above desirable limit i.e., 0.1 mg/L according to the Drinking water specifications IS 10500:2012 in both the tanks. Kidney injury is the most sensitive end point for Uranium, which means that the kidney is the organ that is most susceptible to the effect of Uranium.





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