

# Review of Metal Contamination in Groundwater in Different States of India

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**Abstract:** - Water is important sources of the minerals for the living beings. But it may become harmful for the living beings if it is contaminated by the pollutants. In this work literature review of water samples from different locations of India is carried out. Different types of techniques such as EDXRF (Energy Dispersive X-ray Fluorescence), PIXE (Proton Induced X-ray Emission), PIGE (Proton Induced Gamma ray Emission), AAS (Atomic Absorption Spectrophotometer) and ICP-OES (Inductively Coupled Plasma Optical Emission Spectroscopy) were used in elemental determination.

## I. INTRODUCTION

Water is a wonder of nature. It is a vital source for healthy growth and is a basic requirement for the survival of life. If the water is contaminated by any type of pollutants then it may become very harmful for the living beings. Groundwater is one of the sources of the water. More than the 50% of the world population is depending on the groundwater. The groundwater may be contaminated by the several types of pollutants like metals, fertilizers, industries, urbanization, degradation of plants and animal bodies etc. Different locations have different types of contamination of groundwater and at different levels. Different types of techniques have been used for determining the contamination in water samples.

## II. METHOD

Different types of techniques are used to detect the different types of metals in the groundwater samples such as EDXRF, PIXE, PIGE, AAS, ICP-OES etc. These techniques have different detection limits for the different elements. In the research paper (Atul Bhalla et. al., 2011) the EDXRF technique was used. PIXE and PIGE techniques were used by (Rajbir Kaur et. al., 2012). In the research papers (Akhilesh Jinwal et. al., 2009), (M. Arun Prasanth et. al., 2014), (Parul Virk et. al., 2010), (K. Mohan Kumar et. al., 2016), (A. Abdul Jameel et. al., 2012), (Dinore J. M. et. al., 2015), (Mohammed Ilyas Fazil et. al., 2012), (P. Susan Verghese et. al., 2015) and in (S. Dutta et. al., 2015) AAS technique is used. This technique is also called as Flame atomic absorption spectrophotometer. In the research paper (O. Venkata Subba

Raju et. al., 2014) ICP-OES technique is used while in the research papers (Sunaina Mittal et. al., 2014) and in (Shaik Rameeza et. al., 2012) the standard methods are used. In the research paper (Chanchal Verma et. al., 2016) two techniques EDXRF and AAS are used. All these techniques provide concentration of different elements in different samples of groundwater.

## III. RESULTS AND DISCUSSION

According to (Atul Bhalla et. al., 2011) the concentration of U is found to be very high (0- 212 µg/L) in some villages of Bathinda district but the highest concentration of U is observed in Balluana village (212 µg/L) of Bathinda district. The concentration of Fe is found to be very high (3036- 30443 µg/L) in the Buddah Nallah in Ludhiana but concentration of Fe is not very high in other locations. The concentration of Sr is also found to be very high (103- 6165 µg/L) in the villages of Bathinda district area. The highest value of the concentration of Sr is observed in Balluana village (6165 µg/L). The concentration of Cr, Pb, Zn, Cu and Mn has very high value in the Buddah nallah in Ludhiana. The concentration of Mo is found to be very high (227 µg/L) in the Ash slurry samples from Guru Nanak Thermal Power Plant, GNTPP in Bathinda. The concentration of Se is found to be very high (8- 175 µg/L) in the Barwa region of Nawanshahr. Other metals have lower value of concentration than the permissible values.

According to (Rajbir Kaur et. al., 2012) the U concentration is found to be very high ( $15.7 \pm 1.3$  ppb) in the Harraipur village of Bathinda district. The concentration of Se is found to be very large in the Goniana ( $15.3 \pm 1.3$  ppb) (Bathinda) and the concentration of As is found to be very high in the Kiratpur (10.9 ppb) (Bathinda) but the concentration of other metals is found to be within the permissible values.

According to (Sunaina Mittal et. al., 2014) the maximum value of the concentration of Al (0.094 mg/l), Fe (0.131 mg/l), K (195.30 mg/l), and Ca (76.11 mg/l) is found at Thermal colony, Goniana, National Fertilizers Limited, NFL and at Romana respectively. The maximum value of the concentration of Mg (59.09 mg/l) is also found at Romana.

The concentration of Cu (0.108 mg/l) and Na (529 mg/l) is found to be maximum at Nathana.

According to (Akhilesh Jinwal et. al., 2009) the concentration of Fe is found to be very high in the Islamnagar (1037 ppb) of Bhopal district and Bilkisganj (3330 ppb) of Sehore district. The concentration of Pb is found to be maximum in the Sehore (60 ppb) district. The concentration of Cr is found to be very high in the Islamnagar (69 ppb) and Ahmedpur (121 ppb) of Bhopal district. The concentration of other metals such as Cu, Mn and Zn is found to be within the permissible values.

According to (Chanchal Verma et. al., 2016) the concentration of Pb, Ni, Fe, Cr and Mn is found to be exceeds the permissible values in coal and in fly ash of coal fired thermal power plant in Paricha (Jhansi). The concentration of Pb and Ni in all the groundwater samples have exceeds the permissible values. The concentration of Fe, Cr and Mn is found to be very high value at some locations but at other locations the values of the concentration of these metals are low.

According to (M. Arun Prasanth et. al., 2014) the concentration of the metals such as Fe, Cr, Pb, Mn and As is found to be lower value than the permissible values at all sites. The Enrichment factor (Ef) for all metals is found to be less than 2 so this area falls under low enrichment. The MPI (Metal Pollution Index) is found to be low value than 1 at all sites. So this area is unpolluted. The ( $I_{geo}$ ) Geo Accumulation Index value is found to be high for Fe than for all other metals in this area. This indicates that the study area is unpolluted. So the groundwater of this area is safe to use.

According to (Shaik Rameeza et. al., 2012) the highest pH (8.5) value is observed at SINDEA comparable to permissible value. The chloride concentration is exceeds the permissible limits at Malkapuram (177 mg/l), Old Gajuwaka (400 mg/l) and at Hindustan Zinc Area (290 mg/l). The highest value of the hardness is observed at Malkapuram (155 mg/l), Old Gajuwaka (191 mg/l), Hindustan Zinc Area (234 mg/l), Mindhi (290 mg/l), BHPV (193 mg/l) and at Sheela nagar (292 mg/l). The highest values of hardness which are observed at these sites are lies in moderately hard category. The nitrate and sulphate is found to be within the permissible values at all locations. The dissolved oxygen is also found to be oxygen is also found to be within the permissible limits.

According to (Parul Virk et. al., 2010) most of the samples have Fe concentration is found to be exceeds the permissible values. The concentration of Pb has low value at most of the locations. The concentration of Hg is found to be exceeds the permissible limit at Nohan (0.002 ppm), Rangilpur (0.0002 ppm), Chaunta (0.002 ppm) and at Ghanaula (0.002 ppm) and at all other places the concentration of Hg is within the permissible limit. The concentration of Cd is found to be within the permissible limit

at all locations. Arsenic (As) is not found in this study area or it has zero value at all these sites.

According to (K. Mohan Kumar et. al., 2016) the concentration of all the metals such as As, Cd, Hg has found to below the detection limit at all the locations around the industrial estate. But the concentration of As is found to be very high value in Singanallur (0.0014 mg/l), Gandhipuram (0.0010 mg/l) and in Selvapuram (0.0022 mg/l) and also Cd (0.002 mg/l) has high concentration at Singanallur in the samples of the regions in the city non- industrial area.

According to (A. Abdul Jameel et. al., 2012) the concentration of Cu, Fe and Mn is found to be low value in three different seasons at all locations. The concentration of Cr exceeds the permissible value at the Kollapuram (0.06 ppm) and at Kottcherry (0.05 ppm) in the monsoon period but at all other sites in different seasons the concentration of Cr is not exceeded the permissible limit. The concentration of Pb is found to be large value than the permissible limit at all sites in the three seasons.

According to (Dinore J. M. et. al., 2015) the observed concentration of Cd and Zn is found to be lower than the permissible limits at all sites. The concentration of Pb, Cr and Fe is found to be exceeded the permissible values in most of the samples. The maximum value of Pb is observed at Shivaji Nagar (0.082 mg/l). The maximum value of Cr (0.07 mg/l) and Fe (2.806 mg/l) is observed at Milind Nagar and the maximum value of Cu is observed at Ramnagar (0.23 mg/l).

According to (Mohammed Ilyas Fazil et. al., 2012) the concentration of Cu is large at some sites which exceed the permissible limit. The concentration of Zn is found to be low value than the permissible limit at all locations. The concentration of Cr and Cd is found to be low value in most of the samples but at other locations the concentration of these metals is found to be higher value than the permissible value.

According to (O. Venkata Subba Raju et. al., 2014) the concentration of Cr is below the permissible limits at all sites. The maximum value of Co concentration is observed at Mallam (0.043 mg/L). The maximum value of As is observed at Thummalapenta (0.075 mg/L) which exceeds the permissible limit. The maximum value of Se is observed at Mallam (0.015 mg/L) and at Venkannapalem (0.02 mg/L) which exceeds the permissible limit. The concentration of Cd and Hg is found to be low value than the permissible values at all locations. The maximum value of Pb is observed at Meezuru (0.035 mg/L) which exceeds the permissible limit. According to (P. Susan Verghese et. al., 2015) the concentration of Cr exceeds the permissible limit in all the samples. The maximum concentration of Cu observed in river water samples which exceeds the permissible limit. The concentration of Pb and Cd exceeded the permissible values in all the water samples. The concentration of Fe, Hg, Ag and Zn is found to be within the permissible limits in all the water

samples. According to (Dutta et. al., 2015) most of the samples have pH value is large than the permissible limit in the pre- monsoon and in the post- monsoon season. The maximum values of TDS (2087 mg/l), DO (4.3 mg/l) and BOD (6 mg/l) are observed in the post- monsoon season. The maximum value of COD (500 mg/l) is observed in the pre-monsoon season. The maximum chloride concentration is observed in the post- monsoon. The concentration of Cr and Pb exceeded the permissible limit at all sites in the pre-monsoon and in the post monsoon season.

#### IV. CONCLUSION

Most of the samples have exceeded the permissible limits at all locations but the concentration of some metals such as U, Mo, Cr, Pb, Mn etc. has very high values at some sites of the study area. The concentration of toxic elements in the groundwater of the villages in the Bathinda district is more than the sites near the Chandigarh. The concentration of Cu, Mn, Pb and Zn are not found in the higher concentration in Bhopal and Sehore district but the concentration of Fe and Cr is found to be high concentration at some sites. The concentration of heavy metals is high in the fly ash than in the feed coal in the coal fired thermal power plant Paricha (Jhansi). The concentration of metals such as Fe, Cr, Pb, Mn and As are not found in the high concentration at Alangudi taluk in Tamilnadu at varying depths. Also the index values such as  $E_f$ , MPI and  $I_{geo}$  are very small. So the groundwater of Alangudi taluk in Tamilnadu is safe to use. Most of the samples in the industrial zone of Visakhapatnam have high values of toxic elements than the permissible limits. The concentration of Fe, Hg and Pb has high values than the permissible limits at some places of the industrial belt of Ropar block (Rupnagar) but the concentration of Cd and As is not exceeded the permissible limits at all places. The groundwater is not contaminated in the regions around the Kurichi industrial area in Coimbatore but the groundwater is contaminated in the city non- industrial area. All the samples have large value of the concentration of Pb than the permissible limit in the Karaikal area between Tamilnadu and Pondicherry. The Cr concentration is large in Kollapuram and in Kottocherry. The concentration of Cd and Zn is lower than the permissible limit but the concentrations of Cr, Cu and Fe have large values than the permissible limits at some sites of Mehkar city of Buldana district. The concentration of all the metals is within the permissible limits except Cu and Cr at all sites of the Beed city of Maharashtra state. Most of the samples have metal concentration are within the permissible limits except Ni, Se, Pb and As at all sites of SPSR Nellore district, Andhra Pradesh. The concentration of Cr, Cu, Pb and Cd exceeded the permissible limits at all sites of Agra city but the concentrations of other metals are within the permissible limits in different locations of Agra city. Almost all the samples have high values of the toxic elements at all the

locations of Pali industrial area, Rajasthan. So the water should be treated before drinking.

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