Water quality index, heavy metal pollution index and seasonal variation correlation of groundwater of Bailadila iron ore mine area and its peripherals: Dantewada district, Chhattisgarh, India

G. Jareda[a], S.P. Mahapatra[a,*], P.Y. Dhekne[b,*]

[a]*Department of Chemistry, National Institute of Technology, Raipur 492010, India, email: spmahapatra.chy@nitrr.ac.in (S.P. Mahapatra)*
[b]*Department of Mining Engineering, National Institute of Technology, Raipur 492010, India, email: pdhekne@nitrr.ac.in*

ABSTRACT

Groundwater quality of Bailadila iron ore mine area has been studied. Groundwater samples were collected from hand pumps, and analysed in order to find out water quality index (WQI) and heavy metal pollution index (HPI). A comprehensive study has been carried out with respect to aluminium (Al^{3+}), chromium (Cr^{6+}), lead (Pb^{2+}), iron (Fe^{2+}) and zinc (Zn^{2+}). Seasonal variation in the metal concentration has been assessed in pre-monsoon and post-monsoon seasons. The physio-chemical parameters have been analyzed with standard procedure and instrumental techniques. It is found that a sizeable number of groundwater samples contain iron at toxic level. At few locations, Pb^{2+} concentrations are also found higher than permissible limit. Al^{3+}, Cr^{6+} and Zn^{2+} content of groundwater were found to be within the guideline value of World Health Organisation (WHO). The metal concentration of groundwater in Bailadila iron ore mine area follows the trend $Fe^{2+} > Zn^{2+} > Al^{3+} > Cr^{6+} > Pb^{2+}$ in both pre and post monsoon seasons. The correlation ability of five heavy metals has been selected for the study area and these metals cause eco-toxicology and health hazards to the human being as well as to aquatic biota. The estimation of the concentration of these heavy metals associated element may establish the trend of heavy metals distribution. Monitoring and correlation data show that the quality of groundwater is vulnerable to anthropogenic contamination. The overall results indicate that groundwater quality of Bailadila iron ore mine area and its peripherals is very poor and not safe for human consumption without treatment.

Keywords: Bailadila; Groundwater; Water quality index; Heavy metal pollution index; Pearson correlation; Seasonal variation

* Corresponding author.