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Assessment of surface water quality in Manendragarh and Its surrounding coal field area using statistical technique

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ABSTRACTS

The Manendragarh region is one of the coal field area in Chhattisgarh and the surface water is increasingly depreciated due to human activities and anthropogenic pollution from the rapid monetary growth. The water samples were characterized for the Heavy metals concentration such as Iron, Lead, Cadmium, Chromium and Arsenic. Principal component analysis was used to recognize physiognomies of water quality in this region. The results of PCA for surface water quality in Manendragarh the first two components of PCA analysis 68.66% (2015) of the total variance in the statisticscircles of Manendragarh region. In this study the results found that Iron, Lead excess the permissible limit in this region. Since, the results suggest that PCA techniques are useful tools for assessment of water quality and management of water resources.

Key words: surface water, coal field region, Manendragarh, Heavy metals, Principal component analysis.

INTRODUCTION

Water is one of the crucial to both natural ecosystems and human development (**Jayalakshmi et al 2011)**. The nature and extent of water pollution is characterized by several physical, chemical and biological parameters. The deterioration of water quality has led to the destruction of ecosystem balance, contamination and pollution of ground and surface water resources (**Gebreyohannes et al. 2015)**. The main water resources for domestic, industrial and irrigation purposes and they often carry large municipal sewage, industrial wastewater discharges and

seasonal run-off from agricultural land to the coastal region (Isaiah et al. 2012).Factor analysis technique is very useful in the analysis of data corresponding to large number of variables, analysis via this technique produce easily interpretable results **(Sarita et al. 2015)**.

MATERIAL AND METHODS

Study region

Manendragarh is a township of the Koriya district. Koriya district is a study zone in the North-Western fragment of the Chhattisgarh state in Central India. Area of Manendragarh has immense reserves of high-grade petroleum. The main coal girdles are in the Hasdo basin. There are minor fire clay, red oxide,deposits of limestone.The latitude of Manendragrah 23.213890 and the longitude is 82.201279.

Selection of Specimen Locations

Surface Water samples of Manendragarh its surrounding coal field area were collected from 15 sampling location for the period of pre monsoon, post monsoon, winter and summer seasons for years, 2015. In each model, three replicates were composed every time. The sampling was done amongst 8.30 to 11.00 AM. The list of different specimen station of surface water are shown in the table -1. The used approaches of estimation of Heavy metals by Atomic absorption spectrophotometer.

Table 1: List of sampling station of Surface water

Sampling location code	Sampling Station of Surface water
SW1	Manendragarh. Bisalvora River, Manendragarh
SW2	Away from Manendragarh, 3 km chainpur gram panchayat pond
SW3	Railway Station pond Manendragarh Part- 1
SW4	Away from Manendragarh, 5 km Hasiya River
SW5	Near Electrical office Jhiria Manendragarh.
SW6	Railway Station pond part-2, Manendragarh.
SW7	Away from Manendragarh, 3 km Lalpur Gram panchayat pond
SW8	Away from Manendragarh, 3 km Hasdeo River
SW9	Near Railway station Manendragarh Jhiria
SW10	Manendragarh. amakherwa pond, 3.50 km
SW11	Manendragarh T.V Tower road Pond
SW12	Away from Manendragarh, 4 km Lalpur Gram Panchayat Part-2 pond
SW13	Manendragarh. Nagar Palika Pond
SW14	Near Khedia Takies Pond Manendragarh
SW15	In front of Manendragarh Police station Jhiria

SW- Surface water

PURPOSE OF PROPERTIES OF AQUATIC

For water sample five parameters had been done these parameters including: Chromium, lead, cadmium, Iron. All analyses were done according to standard specifications presented by**(APHA 22ND Ed., 2012).**

RESULTS AND DISCUSSIONS

Principal Component analysis of Heavy metals concentration of Surface water

The principal component analyses of heavy metals for the surface water sample year 2015 of shown in table- 2. It comprises loading with the rotated component matrix, eigenvalues for each component, per cent and cumulative per cent of variance clarified by each component. It specifies that the first three principal components together account for 68.665 % and of the total variance in the dataset, in which the first principal component is 37.530 % second principal component is 68.665 % of the total variance. The eigenvalues of the first three principal components (>1) can be used to assess the dominant hydro geochemical processes. The concentrations of Lead show high negative loadings (-0.771). Iron shows positive loadings (0.906) for the first principal component. In the second principal component Lead have high negative loadings (-0.911). The varifactors were initiate from the biplot between PC1 and PC2 where in the scores of samples drawn and the loadings of variables have been plotted (Figure 1). The results showed that lead and chromium be close association between these parameters.

This results supported by (**Saritaet al. 2015**) the concentrations of pH, Cr and Nitrate show high positive loadings (0.75-0.95) whereas concentrations of Sulphte, Fe and Na have low positive loadings (0.16-0.34) for the first PCA. In the second PCA Fe, Na and TH have high positive loadings (0.70-0.91) and the concentration of Cr, Sulphate and Nitrate shows low positive loading (0.01–0.32). For the third PCA, the concentrations of EC and Sulphate show high

positive loadings (0.83-0.94), the concentrations of Na show moderate positive loadings (0.61), the concentrations of pH, Fe, Nitrate, Chloride and TA show low positive loadings (0.11-0.33).

Table-2. Average Rotated Component Matrix of heavy metals in surface water

	Year-2015	
RCM	1	2
Iron	**.906**	.275
Lead	**-.771**	.516
Cadmium	-.033	**-.911**
Chromium	-.005	.399
Eigenvalue	1.501	1.245
% Variance	37.530	31.135
Cumulative %	37.530	68.665

CONCLUSION

The surface water samples in study area iron and lead were found excess, the drinking water quality standards by WHO. Iron is not considered a health risk but water with a high concentration of iron may cause the staining of pipes fixtures or washing. Lead was excess the permissible limit (WHO 0.01 mg/L). Lead is a majorreason harm in adults, including increased risk of kidney damageand high blood pressure. Lead may be ingested in surface water from various dust contaminated by lead paint, as well as soil, food and drinking water.

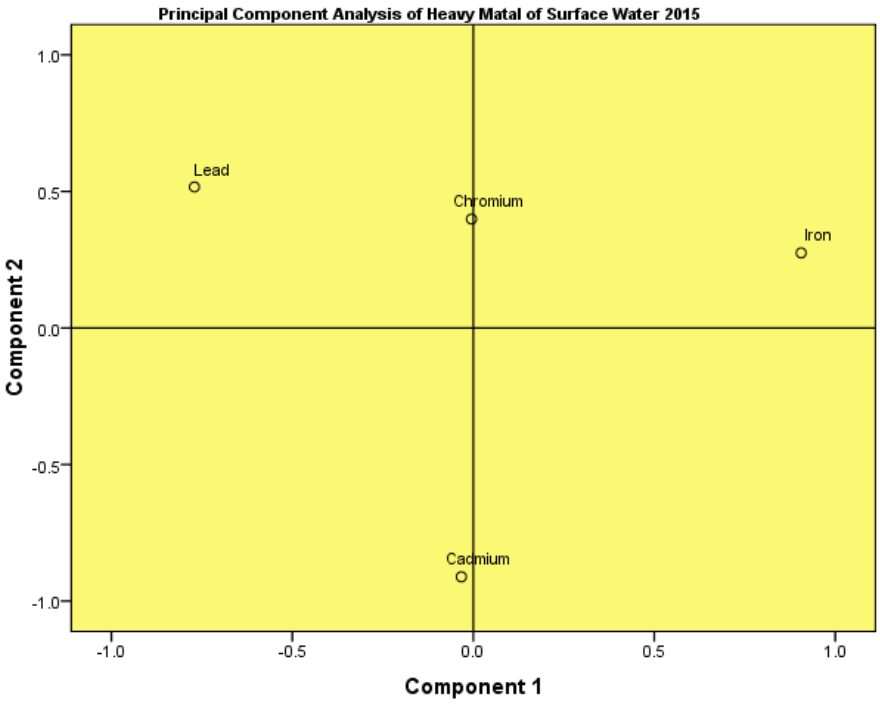

Fig-4.51. Heavy metals PCA analysis of SW-2015

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