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HEAVEY METALS ANALYSIS IN SOIL AND WATER SAMPLES OF SMALL VILLAGES OF NORTH COASTAL, UDDANAM MANDAL, ANDHRA PRADESH, INDIA CAUSING CHRONIC KIDNEY DISEASE

K. Aruna*[1] and T. Mohammad Munawar[2]

[1*]Department of Biotechnology, JNTUA College of Engineering Pulivendula-516390, Andhra Pradesh, India.
[2]Department of Chemical and Biological Engineering, Mekelle Institute of Technology (MIT) Mekelle University, Ethiopia.

ABSTRACT

Uddanam Region of srikakulam district, a North Coastal Andhra Pradesh state is gifted with full of lush greenery and vegetation stretched along the coastal belt of Bay of Bengal. Uddanam region suffers with high prevalence of chronic kidney disease (CKD) presenting clinically or sub clinically ultimately leading to high mortality and morbidity with RRT and other types of diseases. Ground water samples were collected from different areas such as Kopasakudi, Rajapurarn, Kaviti, Khojiiria and Palasa control of uddanam region were analyzed for heavy metals such as Hg, Fe, Mn, Se, Cu, Zn and phenolic compounds by using as per the standard methods for the examination of water and wastewater by APHA, WEF and AWWA. Among the seven heavy metals detected in the soils of the study area, only Hg, Se and phenolic compounds such as C_6H_5OH are within the permissible limits. The increased levels of Fe, Mn, Cu and Zn in the study area are a major concern for the agricultural and land practices. Based on test results, copper shows the least concentration among the heavy metals and while iron shows the highest concentration in the soil samples. However these elements need continuous monitoring in this uddanum region which may enter the food chain and maybe hazardous to human health.

KEYWORDS

Heavy metals, CKD, Uddanum, Andhra Pradesh and India.

Author for Correspondence:
Aruna K,
Department of Biotechnology,
JNTUA College of Engineering Pulivendula,
Andhra Pradesh, India.

Email: annu.kasoju@gmail.com

INTRODUCTON

The uddanam region that lies in north-coast Andhra Pradesh state consists of the mandals of Kaviti, Kopasakudi, Rajapurarn, Kaviti, Khojiiria, Palasa and Vajrapukotturu, consisting of higher than 100 villages in total. The people of Uddanum region are suffering with chronic kidney disease of unnoted etiology, a disease that particularly affects farmers

and agricultural workers[1]. CKD was mostly affected nearly 120 villages in six mandalas of udanum region. The following mandals such as Kancheli, Kavite, Sompeta, Mandasa and Vajrapu Kotthuru are endemic. Unpublished cross-sectional estimates from Uddanam suggest that the prevalence of chronic kidney disease of unknown etiology is between 40% and 60% according T Raviraju, Dr, NTR University of health sciences, personal communication, August 2017. This range is nearly three times higher than the national prevalence of 17.2%[1,2] as of 2015, it was estimated that more than 4500 people had died from chronic kidney disease in the last ten years and around 34,000 people had kidney diseases in Uddanam[1,3]. Chronic kidney disease (CKD), also known as chronic renal disease, is progressive loss in kidney function over a period of months or years[4,5]. The sign of illness of kidney failure conditions are imprecise, and may found of feeling generally unhealthy and experiencing a reduced appetite. The main objective of the research was to use the standard methods for the examination of water and wastewater by APHA, WEF & AWWA in order to assess the heavy metals distribution in some areas of uddanam region of srikakulam district, a north coastal Andhra Pradesh, India.

MATERIAL AND METHODS

Sample collection and preparation

The soil samples and ground water samples were collected from different areas such as Kopasakudi, Rajapurarn, Kaviti, Khojiiria and Palasa Control of uddanam region indicated as GW1 is the sample of water taken from Kopasakudi 1, GW2 (Rajapurarn 2), GW3 (Kaviti 3), GW4 (Khojiiria 4), GW 5 (Palasa 5) and soil samples indicated as S-1 is the sample of water taken from Kopasakudi 1, S-2 (Rajapurarn 2), S-3 (Kaviti 3), S-4 (Khojiiria 4), S-5 (Palasa 5).

Soil samples were collected from 0-10 cm depth and ground water samples were collected from a depth of 0-40 cm. For two days, the soil samples were dried in a thermostatically controlled oven at 60^{o}C temperature. The dried sediments were then segregated in a porcelain mortar with a pestle, and sieved through a 2 mm nylon mesh. The samples were subsequently ground in agate swing grinding mill to a fine powder for the better homogenization of the sample, in order to obtain a representative aliquot for precise analytical results. Two grams of each powdered samples were weighed using an analytical balance with a precision as low as 0.0001g[6]. 10ml of ground water samples were used for analytical purpose.

Instrumentation

Elemental composition was determined using a CHNS analyzer. Its high level performance enables, therefore, a sensitive and accurate determination of major and trace elements (Hg, Mn, Cu, Fe, P, S, As, Ba, Co, Cd, , Ni, Pb, Rb, Se, V, Zn and Phenol compounds). The accuracy of analytical results was evaluated by comparison with certified values of the analyzed reference materials[7]. Results of certified reference materials were within the quoted confidence limits. Environment Protection Training and Research Institute (EPTRI), Hyderabad (India) was used for the detection of trace elements, and to check the accuracy of analytical data according to the standard methods for the examination of water and wastewater by APHA, WEF and AWWA[8].

RESULTS AND DISCUSSION

Contamination of soil and ground water by heavy metals appear to be virtually permanent, as heavy metals can be transformed from one chemical form to another chemical form through chemical and biochemical reactions, but are not destroyed. The heavy metals (Hg, Fe, Mn, Cu, Se, Zn and phenolic compounds) are shown in the Table No.1, Table No.2 and Table No.3. The results of chemical analysis of major heavy metals were compared with international standards for major oxides in soil[9]. To access the soil and ground water samples, among the seven heavy metals detected in the soils of the study area, only Hg, Se and phenolic compounds such as C_6H_5OH are within the permissible limits. Mercuric compounds (Hg) concentration of five ground water samples are within the limit of 20µg/L, Phenolic compounds concentration of five ground water samples are within the limit of 0.1mg/L and selenium compound concentration of

five soil samples are within the limit of 0.5 mg/Kg[10]. The increased levels of Fe, Mn, Cu and Zn in the study area are a major concern for the suitability in agricultural and other land management practices[11]. Among the five soil samples, based on test results, copper shows the least concentration among the heavy metals while iron shows the highest concentration in the soil samples.

Test results for the collected ground water and soil samples evidenced the existence of the following major and minor elements.

Table No.1: Test results of Phenolic compounds concentration (in mg/L) in ground water samples

S.No	Test Parameter(s)	Unit	Test Method	Results				
				GW1	GW2	GW3	GW4	GW5
1	Phenolic compounds as C_6H_5OH	mg/L	5530.D	BDL	BDL	BDL	BDL	BDL

Opinion and Interpretation: Not Applicable.

BDL - Below detection limit

Detection limit - Phenols - 0.1 mg/L

Table No.2: Test results of Mercuric compounds concentration (in µg/L) in ground water samples

S.No	Test Parameter(s)	Unit	Test Method	Results				
				GW1	GW2	GW3	GW4	GW5
1	Mercury as Hg	µg/L	3500. Hg.B	BDL	BDL	BDL	BDL	BDL

Opinion and Interpretation: Not Applicable.

BDL - Below detection limit

Detection limit - Mercury as Hg - 20 µg/L

Table No.3: Test results of Trace elements concentration (in mg/Kg) in soil samples

S.No	Test Parameter(s)	Unit	Test Method	Results				
				GW1	GW2	GW3	GW4	GW5
1	Iron as Fe	gr/Kg	SW846-6010B	14.4	5.7	4.1	5.0	15.1
2	Manganese as Mn	mg/Kg	SW846-6010B	127	186	176	125	224
3	Copper as Cu	mg/Kg	SW846-6010B	9.0	2.0	2.0	3.3	11
4	Selenium as Se	mg/Kg	SW846-6010B	BDL	BDL	BDL	BDL	BDL
5	Zinc as Zn	mg/Kg	SW846-6010B	26	9	12	3	25

Opinion and Interpretation: Not Applicable.

BDL - Below detection limit

Detection limit - Selenium as Se- 0.5 mg/Kg.

CONCLUSION

The results of research reveals that the study area is siding with the problem of soil and water quality downfall, due to the absence of a perennial source of surface water, inadequate rainfall and over exploitation. Wind erosion and the rain water is main responsible of the contaminant spreading over in the mining area and water quality is decrease due to over population and soil exploration. The extent of the contamination by Fe, Mn, Cu and Zn should be treated as sensitive zones for further research. It is recommended to have a periodical monitoring, soil and water testing of the environment in this area is necessary and mitigative measures which are implemented to avoid further deterioration of the environment for sustainable development.

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CONFLICT OF INTEREST

No potential conflict of interest was reported by the authors.

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