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Estimation of Groundwater Pollution With Respect To Physiochemical Characterization In Various Sources of East Godavari Area - Ap, India

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Abstract: *The present study of physicochemical characteristics and heavy metal levels in water samples obtained from different sample locations. People on globe are under tremendous threat due to undesired changes in the physical, chemical and biological characteristics of air, water and soil. Due to increased human population, industrialization, use of fertilizers and man-made activity water is highly polluted with different harmful contaminants. Natural water contaminates due to weathering of rocks and leaching of soils, mining processing etc.The availability of suitable quality water is an indispensable feature for preventing diseases and improving quality of life. It is necessary to know details about different physico-chemical parameters such. The evaluation was done by the chemical and heavy metals characterization by measure of contamination levels with the Ground waters and Soil samples were collected and analyzed for metal ions viz., Li, Be, Al,V, Cr, Mn, Fe, Co, Ni, & U etc. by Inductively Coupled Plasma Mass Spectrometry (ICP-MS). The purposes of this study are, specifying spatial distribution of groundwater quality parameters such as Chloride, Electrical Conductivity (EC), pH, hardness and sulphate. The research results reveals that their common origin, especially from industrial effluents and municipal wastes that are responsible for the enhancement of these toxic metals as moving together in groundwater higher values of physicochemical parameters reveal the anthropogenic sources of these variables. The high concentration of heavy metals in groundwater water may cause serious threat to public health as well as the aquatic environment.*

Key Words: *physicochemical characteristics,heavy metal levels, Electrical Conductivity,aqua Environment*

I. Introduction

Water is essential for all dimensions of life. Over the past few decades, utilization of water has increased and in many places water availability is falling to crisis levels. More than 80 countries with 40% of world's population are already facing water shortages. The quality of water in rivers and underground has deteriorated, due to pollution by waste and contaminants generated from cities, industry and agricultural and aqua cultural activities. Ecosystems are also being destroyed. Over one billion people lack of safe water while 3 billion lack sanitation and 80% of infectious diseases are water borne and killing millions of children each year.

Ground water accounts for half of the drinking water. This resource is susceptible to contamination from many sources which include septic system, infiltration of industrial run off, landfills and irrigation return flows and among which agriculture is a major source of pollution. Agricultural activities contribute many pollutants to the environment such as phosphates, herbicides, pesticides, nitrates and bacteria. Nitrates and pesticides are common contaminants of ground water derived from agricultural runoffs and irrigation return flows. Groundwater is generally employed for domestic, industrial water supply and irrigation all over the world. In the last few decades, there has been a tremendous increase in the demand for fresh water due to rapid growth of population and the accelerated pace of industrialization. Once the groundwater is contaminated, its quality cannot be restored by stopping the pollutants from the sources. It therefore becomes imperative to regularly monitor the quality of groundwater. Water *quality is also influenced by natural and anthropogenic effects including climate, geology and irrigation practices. Once undesirable constituents. Enter the ground; it is difficult to control their dissolution the chemical characteristics of ground water play an important role in assessing the water quality.*

Groundwater plays a vital role as important source of drinking water in rural and urban areas of India. According to some sources it accounts for nearly 80 per cent of the rural domestic water needs, and 50 per cent of the urban water needs in India. Naturally surface water bodies are highly subject to contamination and pollution whereas groundwater is less susceptible. Groundwater pollution is a challenging global problem and particularly people, who are living near to coastal areas, are facing a struggle to have safe drinking water. Coastal regions are having both spatial and temporal variations in the groundwater characteristics. In these

regions, the ground water system is influenced by many factors like rainfall, landform, soil, lithology, seawater intrusion and other anthropogenic activity which determine the ground water quality in coastal region. The quality of ground water has become vulnerable in coastal areas mainly due to salt water intrusion and is due to rigorous pumping of fresh ground water. The salinization processes

Groundwater has become the major source of water supply for domestic, industrial and agricultural sectors of many countries. It is estimated that approximately one-third of the world's population use groundwater for drinking UNEP, 1999.. Poor quality of water diversely affects human health and plant growth. In developing countries like Ghana, around 60% of all diseases are directly related to poor drinking water quality and unhygienic conditions. The World Health Organization WHO., has repeatedly insisted that the single major factor adversely influencing the general health and life expectancy of a population in many developing countries is lack of ready access to clean drinking water Davies,.

The chemical composition of groundwater is controlled by several factors which include composition of precipitation, anthropogenic activities, geological structure and mineralogy of the watershed and aquifers and geological processes within the aquifer medium Andre etal.Chemistry of groundwater is an important factor determining its use for domestic and irrigation purposes. Interaction of groundwater with aquifer minerals through which it flows greatly controls the groundwater chemistry. the quality of ground water varies from place to place, with the depth of water table, and from season to season and is primarily governed by the extent and composition of dissolved solids present in it. Worldwide, aquifers are experiencing an increasing threat of pollution from urbanization, industrial development, agricultural activities and mining enterprises. The ground water

In recent years, an increasing threat to ground water quality due to human activities has ecome of great importance Ravikumar and Somashekar.,[64] ; Deshpande and Aher., AherK.R.,Reddy et al.,67.

In the present Circumstances a continuous monitoring on groundwater becomes mandatory in order to minimize the groundwater pollution and have control on the pollution-caused agents. Keeping in view the present scenario of urbanization, Industrialization and Agricultural activities in East Godavari District, it is proposed to characterize Ground waters from urban, semiurbon and rural locations to assess their quality for considering the utility of these ground waters for various applications like drinking ,domestic and irrigation purpose .Further it is proposed to analyze these ground waters for estimation of MPN count so as to evaluate the quality of ground waters in terms of Microbial content in order to assess the concerned authorities/organizations to take remedial measures to protect the health of the public

Study area Map

II. Methods And Experimental

In this part the details of sampling sites and the methods for collecting water samples, containers used for the samples and the procedures of physicochemical analysis and Microbial analysis are summarized.

B1.1. Sampling Sites and Study Area

The proposed study area for the present research in East Godavari District of Andhra Pradesh, India. It is located in between Latitude $16^0.30^1$ and 81.20^0 N and Longitude $81^0.30^1$ and $82^0.30^1$ .The ground water sampling locations are in Metro (Municipal corporations),Urban (Municipalities) Semi urban (Mandal Headquarters) and Rural areas .Te study area map is presented in Diagram-1 and the details are presented in the

Table-1.

S Code	Sample Location	Water source
S-1	Indraqpalem	OW
S-2	Ramaraopeta	BW
S-3	Raidupalem	OW
S-4	Panduru	BW
S-5	Acimpeta	OW
S-6	Ramanyyapeta	BW
S-7	Bommuru	OW
S-8	Sarpavaram	BW
S-9	Vasanthanagar	OW
S-10	Draksharama	BW
S-11	Panasapadu	BW
S-12	Hunduru	BW

BW=Bore well; OW= Open well

TABLE-2(a): Details of Physicochemical parametric ranges

Sample Location	Temp	pH values	EC (µmohs)/cm)	TDS (mg/L)	TH (mg/L)	CH (mg/L)	MH (mg/L)	Ca^{+2} mg/L)	Mg^{+2} (mg/L)	Total alkalinity
GS-1	30	7.33	2477	1400	480	269	215	108	45	186
GS-2	26	7.7	2827	1672	142	78	73	31	13	129
GS-3	30	8.20	2620	1809	280	148	144	59	21	200
GS-4	27	8.23	2990	1914	230	126	110	51	19	143
GS-5	29	7.40	1790	1146	242	150	78	60	19	102
GS-6	29	8.37	1913	1483	223	119	83	48	13	181
GS-7	28	7.87	1743	1116	236	169	73	67	16	143
GS-8	32	7.60	1803	1154	407	261	165	104	32	119
GS-9	31	8.77	3000	1920	197	102	77	41	16	158
GS-10	27	8.67	1860	1190	339	212	136	85	22	104
GS-11	26	6.75	2250	1440	420	253	167	107	34	238
GS-12	28	7.56	1380	1523	378	200	178	89	36	287

TABLE-2(b): Details of Physicochemical parametric ranges

Sample Location	Chloride	$So4^{-2}$	Nitrate	Na (mg/L)	K (mg/L)	D.O Values	% Na	SAR	MH	KR	MPN
GS-1	199.59	85	35	15.38	39.77	5.13	8	2.16	30	0.11	15
GS-2	333.68	132	36	14.63	1.27	5.73	26	6.17	35	0.37	0.0
GS-3	98.67	178	70	31.71	1.76	5.37	31	5.60	27	0.44	63
GS-4	167.14	81	45	6.18	1.51	6.23	8	1.08	30	0.11	33
GS-5	268.85	79	36	13.32	0.80	5.50	18	2.32	30	0.22	14
GS-6	255.35	49	60	10.30	5.52	6.03	16	2.05	27	0.22	13
GS-7	268.55	359	35	7.96	0.54	6.47	10	1.36	23	0.11	20
GS-8	69.28	44	32	33.57	2.48	6.03	21	4.31	26	0.27	23
GS-9	107.31	61	49	20.45	11.86	6.10	24	4.11	31	0.39	10
GS-10	379.14	41	52	15.16	2.26	5.90	13	2.11	20	0.13	11
GS-11	187.32	94	28	32.21	37.56	6.20	28	5.23	24	0.44	28
GS-12	210.41	48	56	18.45	21.74	6.33	22	4.87	26	0.78	43

III. Results, Discussions And Conclutions

- pH values of some water samples collected from Mandal Head Quarters (Semi urban) areas and Rural areas indicate slight to moderate alkaline nature of ground waters indicating their unsuitability for drinking and domestic purposes.
- Electrical conductivity values in majority water samples crossed even the limits of irrigation standards confirming their unsuitability for irrigation purposes.
- Total Dissolved solids (TDS) level in all ground waters from Metro, Urban, Semi Urban and Rural Areas crossed the permissible limits of IS: 10500-1992 drinking water standards indicating the presence of soluble salt content and the waters lose palatability and can cause gastro intentional irritation if consumed for drinking purposes.

- Total hardness and Calcium levels in case of majority ground water samples collected for Metro, Urban, Semi Urban and Rural areas were within the permissible limits indicating their suitability for domestic use.
- Magnesium levels in majority ground water samples were within the permissible limits of IS: 10500-1992
- Total Alkalinity levels in majority samples of ground waters were within the permissible limit.
- Chloride levels in maximum no of ground waters samples were within the permissible limits while only in few ground waters chloride levels were above the permissible limit and hence these waters lose taste and corrosion and palatability will be effected.
- Sulphate levels in almost all except in few ground water samples collected from Metro and Rural areas were within the permissible limits (200mg/l) of IS; 10500-1992 while sulphate levels in fifty percent water samples collected from Mandal Head Quarters (semi urban) were above the permissible limits (200 mg/l) and hence these waters cause gastro 7intertionel irritation, if consumed for drinking purposes.
- Nitrate levels in nearly fifty percent samples collected from all locations Metro, Urban, Semi Urban and rural areas were more than the permissible limits (45 mg/l) of IS;10500-1992 indicating their unsuitability for drinking purposes.
- Dissolved oxygen levels in all ground water levels were more than 4 mg/l indicating their suitability for aqua cultural purposes.
- Percent sodium levels and sodium Adsorption Ratio (SAR) levels in all ground water samples were within the permissible limits (60 mg/l and 26 mg/l) of irrigation standards indicating their suitability for irrigation purposes.
- Magnesium hazard (MH) levels and Kelly's Ratio (KR) values of all ground waters collected for Metro, Urban, Semi Urban and Rural areas were within the permissible limits and hence can be considered for irrigation purposes.
- The ground waters collected from Metro, Urban, and Semi urban and rural areas were observed with MPN count indicating the microbial contamination and hence these waters were highly unsuitable for drinking purposes and, if consumed for drinking, they cause adverse effects on human health.
- Based on the analytical data and on interpretation, it was concluded the these ground waters collected for Metro, Urban Semi Urban and Rural areas were not suitable for drinking and domestic purposes, however they can be considered for irrigation and aquaculture purposes. The presence of MPN court confirms the unsuitability of these waters for drinking purposes and can cause adverse effects, if consumed for drinking or domestic purposes.

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