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Ground Water Quality Analysis of Pali (Raj)

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Abstract: Peoples initial attitude of taking groundwater – a fundamental natural resource and vital competent of our environment – for granted and simply exploiting it according to individuals demands had prevailed in the world recently, demographic pressures, economic and technological development and otherfactors have triggered unprecedented changesin the state of our groundwater system, which has resulted in a growing awareness as to the finiteness and vulnerability of this critical resource. There is an endless variation in groundwater system in the Pali district, mainly as a result of variation in geology. The Chemical characteristics of ground water determine its usefulness for various purpose. The groundwater quality reviewed includes pH, total dissolved solids etc.

Key words: groundwater, pH, TDS, rainfall, agriculture.

Introduction: The utilization of groundwater for domestic, livestock and irrigation purposes has been constantly increasing in the arid districts of Rajasthan, especially because of the absence of perennial surface water sources over most part and a rapid growth of human and livestock population which are largely dependent on ground water for their survival. Because of the increasing trend of groundwater exploitation it has become necessary to assess the quality of usablewater from different reasons of Pali district. Groundwater is a precious natural water resource considered as a readily available and safe source of water for domestic, agriculture and industrial use.

The district is divided in ten subdivisions namely Pali, Rohat, Bali, Sojat, Marwar junction, Jaitran, Raipur, Rani, Sumerpur and Desuri.The shape of district resembles to

any regular triangle and has generally undulating plainswith scattered hills. The area may be called sub mountainous. The south eastern and north eastern part is traversed by the Aravaliranges which are the most physiographic feature of district. There is no perineal river in the district. The tributaries Lilri, Sukri, Bandiand jawai discharge their water into Luni the principal drainage ofwesternRajasthan. There is no lake or natural spring in the district. But there are number of big and small dams constructed for irrigation purposes. There are five dams in district – Jawai, Hemawas, Kharda, and Birantiya Khurd dams which are being used basically for irrigational purposes. Pali has hot semi-arid climate. Rainfall in the district in quite erratic. The forest are scatteredover a large area, mostly is hills and ridges. Those in plains are grass birds or tree servants. The forest are generally open and poorly stocked except in forest blocks of Desuri range and Sadri range.

In the pre- industrial era, surface and subsurface water was considered as safe for drinking and human welfare. No such significant negative impression of water quality and related environmental hazard was found during that period. After industrial revolution in 18th century, uncontrolled development of anthropogenic activities leads water resources vulnerable through contamination of various pollutants. (Al-Sudani).

Generally quality of GW depends on physiochemical properties of aquifer media (Acheampong and Hess 1998; Foster et al. 2000; Raji and Alagbe 1997).Different hydro geochemical process determines different physicochemical characteristics of GW particularly in the zone of saturation (Islam et al. 2017a ;. Bhuiyan et al. 2016) Chemical compounds of industrial, agricultural, urban sewage, mining extracts are the main causes of high pollutant contamination in GW. (Amirabdollahianand Datta 2013, Carpenter et. al. 1998; Simeonov et al. 2003, Nagaraju et al.; Shaji et al.).

Health risk assessment on an agricultural region of Nanganur South India, showed higher health risk of children than adult by intake of nitrate in drinking water (Adimalla and Qian,). Adimalla and Wu assessed non carcinogenichealth risk of central Telangana and showed that infant was mostexposed to health risk by ingestion of nitrate and fluoride in drinking water. Application of remote sensing and spatial zonation by GIS techniques easily helped to identify the pollutionpockets of GW and associated health risk (Taheri et al. 2015; Singh et al. 2015; Thapa et al.).

Suitability of ground water for drinking purposes:

1. **pH:** The acceptable limit of pH is 6.5-8.5. The PH is ground water varied from 6.80 to 9.63.
2. **Electrical conductivity:**It is a measure of total mineral contents of dissolved solids in water. An increase in disowned solids causes a proportional increase in electrical conductivity. This is a function of temperature and the ionic strength of solution. The electrical conductivity values of ground water samples of in the area is found to vary within the range of 370 to 32880 µS/cm with the minimum and maximum values found in Marwar Jn Block and Rohat block respectively. In Rohat Block the water column below the depth of 40 m is entirely saline reflecting the high EC values for the field observationit is clear that salinity is one of the major hazardous problems in the entire Pali district.
3. **Total Dissolved Solids (TDS):** Total Dissolved Solids in water include all dissolved materials in solutions, whether ionized or not. The TDS contents of ground water are controlled by mineral dissolution rate, chemical character of ground water and ionic saturation status of solution. Theconcentration of total dissolved solids in the ground water vary between 190 mg/l to 21210 mg/l.

4. **Nitrate:** Concentration of nitrate has been found to vary from 0.7 mg/l to 420mg/l higher concentration of NO_3^- are attributed to the anthropogenic sources mainly due to the application of more fertilizers and sewage carring drains. Excess nitrate in drinking water can cause methaemoglobinaemiain infants, gastric cancer, goitre, birth malformations and hypertensions.

5. **Fluorides:** Fluoride is an essential element for maintaining normal development of healthy teeth and bones. However, higher fluoride concentration causes dental and skeletal fluorosis. Such as mottling of teeth, deformation of ligaments and bending of spinal cord. Concentration of fluoride in ground water sample has been found to vary between 0.03 mg/l to 12.0 mg/l. Geogenic factors including weathering of rocks containing fluorine bearing minerals like fluorite, apatite and mica is the major source of fluoride contamination in the area.

6. **Total Hardness:**Total hardness has been found to very between 55 mg/l to4500 mg/l, indicating soft to very hard type of groundwater. High hardness may cause precipitation of calcium carbonate and encrustrationon water supply distribution system.

   The quality of groundwater is of great significance. Groundwater study involves a description of the occurrence of the various constitutes in groundwater and

relationship of these constitutes to water use. The total number of 150 samples collected during pre-monsoon and were analysed involving use of different instruments such as pH metre, EC metre, flame photometer, UV/ visible Spectrophotometer, Titrimetric methods. The concentrations of variableswere reported in milligram per litre (mg/l) except for EC (micro Siemens per centimetreμs /cm) and pH.

The data collected from state GWD and CGWBWR Jaipur have been compiled and analysed. It has been observed that available data are limited largely to state highways and main roads only. Hence to get a clear behaviour of aquifer, there need togenerate data by groundwater exploration for better understanding of groundwater regime behaviour in terms of quality.

Table: Ranges of Chemical parameters and their comparison with the Indian standards for drinking waterin pali District.

Parameters		BIS rages for drinking (IS10500:2012)		Total number of samples	Samples <DL		Samples between DL and PL		Samples >PL	
		DL	PL		No. of samples	% (Approx.)	No. of Samples	% (Approx.)	No. of samples	% (Approx.)
1.	pH	6.5-8.5	No. relaxation	150	-	-	112	74	38	26
2.	Total dissolved solids	500	1000	150	15	10	37	24	98	65
3.	Total Hardness	200	600	150	30	20	75	50	45	30
4.	Ca^{+2}	75	200	150	80	53	60	40	10	6
5.	Mg^{+2}	30	100	150	15	10	76	50	59	40
6.	Cl^{-}	250	1000	150	76	50	58	38	16	10
7.	So_4^{-2}	200	400	150	110	73	16	10	24	16
8.	No_3^{-}	45	No relaxation	150	105	70	-	-	45	30
9.	F^{-}	1	1.5	150	35	23	15	10	100	66

Groundwater related issues:-

1. Over exploitation of ground water:

At present 7 blocks is categorised as over exploited. The main reason for increase in stage of groundwater development in overdraftfor irrigation purpose. The demand of

groundwater in agriculture has increased drastically. The decline trend of stage of groundwater extraction is being observed in Pali, Rohat and Sumerpur blocks.

2. **Erotic rainfall and droughts:**

The uneven distribution of rainfall during monsoon season has affected crops putting farmers in distress. The frequency of occurrence of drought in the district (1971 to 2017) is 47%. The strange phenomenon is where the district has registered an increase in average rainfall (2011-2017) 628.58 mm. compared to the average rainfall (2001-2010) of 472.21 mm. District still had to face shortage of drinking water and fodder, and affects both, human and animal health almost every year.

3. **Limited subsurface storage availability:**

There is limited subsurface space is available for storage of groundwater therefore possibility to recharge groundwater is less.

4. **Industrial pollution:**

The textile and dyeing industries cluster located in Pali town are discharging industrial effluents into the river Baudi therefore severly contaminating both the river as well as the groundwater is the major point of concern.

5. **Ground water quality:**

From the above chemical quality data and field observation it is evident that salinity is one of the major hazardous problem in all the blocks of Pali district. Rohat block his entirely saline below the depth of 30 mbgl. High concentrations of fluorides and nitrate i.e. greater 1.5 mg / l for fluoride and greater > 45mg / l for nitrate have been reported at scattered locations in all the blocks of the district is one of the major quality issue in the district.

Based on the field experience author is of the opinion that the governing agencies should monitor the groundwater quality in the downstream areas of river as the groundwater quality has deteriorated to the extent that it is no more suitable for biological ecosystem.

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