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ANALYSIS OF WATER QUALITY OF RIICO INDUSTRIAL AREA RANPUR KOTA AND THEIR STATISTICAL INTERPRETATION

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ABSTRACT

Kota is a fastest growing city of Rajasthan from last two decades now the population of this city is exorbitantly increase and cross the figure of 10 Lakh. It is famous for its education and industries in various fields like fertilizers, cement and power plants are situated near the bank of Chambal River. Although Rajasthan is known as the water scarce region in India but because of river Chambal people lives in Kota doesn't face problems related to water scarcity. Ranpur is a newly developing industrial and educational area having more than 15 educational institutes including 8 engineering colleges, various oil industries, Agro industries, soft drink manufacturers and mineral water industries. These industries and population of Ranpur depend on ground water because bank of Chambal is far away from this area. So it is worthwhile to know water quality status and its effect on entity and various data are also statistically interpreted under this research.

Keywords: Water quality, Ground water, statistical analysis, SAR (Sodium absorption ratio), PI (Permeability index), Kota, Ranpur

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INTRODUCTION

Kota district lies in eastern part of the state, between $24^0 25'$ and $25^0 51'$ North latitude and $75^0 17'$ and $76^0 00'$ East longitude. It covers a geographical area of 5198 Sq. Km and is surrounded by Sawai Madhopur in north and north west, Bundi in west, Baran district in east, south by Mandsore district of Madhya Pradesh and south east by Jhalawar district. The district Kota has a dry climate. The cold season lasts for about three and a half months from November to the end of February. The period from April to the end of June constitutes the hot seasons. The monsoon season starts in the middle of July. Average maximum temperature is 45^0C and minimum 9^0C respectively. Seven major dam (Gandhi Sagar, Rana Pratap Sagar, Jawahar Sagar, Kota Barrage, Parvati Pick up, Harish Chander Sagar and Gudha Dam), thirteen medium and 134 minor irrigation projects in Chambal river basin were constructed.

Major part of district, leaving aside pockets in Itawa, Sangod and Ramganjmandi block, has shallow water level less than 10 m, where as part of Itawa block along Chambal River and small area around Ramganjmandi and west of Sangod have depth to water level between 10 m to 20 m range. In the present study we choose the area which is approximately at distance of 12 Km from Kota city and the population of almost 20000 people of this region is depend on ground water for their domestic and industrial chores.

EXPERIMENTAL

In the present study we took 10 samples of ground water collected from tube well and kept in PVC bottles thoroughly rinsed 2-3 times. Water samples were collected after pumping the water for 10 minutes[1]. Water samples were analyzed for various physico-chemical parameters using standard methods recommended by American Public Health Association (APHA, 1989)[2]. EC (Electrical Conductivity), pH, determined on same day when we collect samples.

Total hardness and calcium hardness were determined by complexiometric method by EDTA titration using eriochrome black –T (EBT) and murexide indicator respectively. Magnesium concentration calculated with the help of these titrations.

Total alkalinity (TA), carbonate and bicarbonate concentration were estimated by titrametric methods using phenolphthalein and methyl-orange indicator. For determination of chloride we use $K_2Cr_2O_7$ indicator via Argentrometric method. Fluoride nitrate and sulphate concentration determined by UV-VIS spectrophotometer (systronic -2201) using zirconyl SPANDAS Dye, brucine and turbidimetric methods respectively. Sodium, Potassium and calcium were carried out by Flame-photometric method (Systronic-128, Compressor-126).

RESULTS AND DISCUSSION

Results obtained are reported in Table-1. Ten water samples were analyzed for following parameters, pH, Specific Conductance, Carbonate, Bicarbonate, Chloride, Sulphate, Nitrate, Phosphate, total hardness (in terms of $CaCo_3$ equivalents), Ca, Mg, Na, K, F, Fe.

pH

pH is important parameter for various chemical & biological reactions. The lower value of pH may cause tuberculation and corrosion while the higher value may produce incrustation, sediment deposit and difficulties in chlorination for disinfection of water[4].

Specific Conductance

Conductivity is co- related with concentration of ionized substance in water are in the ionized form and hence contribute to conductance.

Carbonate

It is responsible for temperature hardness along with Ca & Mg although concentration of Carbonate in all samples is not so high.

Bicarbonate

It is responsible for temporary. Hardness along with Ca & Mg in the entire samples bicarbonate amount is very high.

Chloride

It is very harmful[5-9] for plants and higher amount show water pollution and it is most trouble anion in the irrigation water.

Sulphate

If Sulphate is present in higher amount it may cause intestinal disorder. Its highest permissible limit is 200 mg/lit.

Nitrate

Maximum permissible limit of nitrate is 50 mg/lit [ICMR], It's higher value responsible for methamoglobinemia or blue baby disease.

Phosphate

Phosphorous mainly present in water in form of phosphates .Presence of phosphate in large quantities show sewage and industrial waste disposal in fresh water. It promotes growth of micro organism.

Total Hardness

Total hardness is important parameter for use of water for various purposes. Permissible limit of total hardness of water by ICMR is 300 mg/lit. Water hardness is mainly due to result of interaction between and the geochemical formation[10].

Calcium
It is most abundant natural element present in all ground water sources. It comes in ground water by erosion of rocks such as lime stone and minerals, such as calcite. Very high concentrations of calcium affect the absorption of other essential minerals in the body.

Magnesium
It comes in ground water by minerals such as dolomite, magnetite and erosion of rocks. It brings undesirable tastes in water.

Potassium
In lower concentration it is a useful and essential element for both plants and human and occurs in ground water as a result of mineral dissolution.

Fluoride
It is useful for development of bones and teeth required level is 1.0-1.5 mg/lit. Higher concentration gives skeletal fluorosis, deformation in knee joints etc.

Iron
Higher amount of Fe in water cause stains in plumbing and objectionable taste and odour. US FAO recommended level for irrigation water is 5 mg/lit & for drinking water is 0.3 mg/lit. CO_3^{-2}

Statistical Analysis of Collected Data
All statistical interpretation is given in Table-1 and Table -2

Sodium Absorption Ratio (SAR)
Richard has classified water on the basis of SAR[11]**.** SAR is an important parameter for determination of soil alkalinity by the use of ground water for irrigation purpose[12].
The value of (SAR) can be calculated by the following formula-

$$\text{SAR (Sodium Absorption Ratio)} = \frac{Na}{\sqrt{\frac{(Ca+Mg)}{2}}}$$

Permeability index (PI)
Done has determined a formula permeability index (PI) to measure the soil permeability for assessment of quality and suitability of water for irrigation purposes

$$\text{PI} = \frac{\text{Na}+\sqrt{\text{HCO}_3}}{\text{Ca}+\text{Mg}+\text{Na}}\times 100$$

Where, all ionic concentrations are expressed in terms of mg/lit.

Chloro alkaline indices (CAI)
Schoeller has given a formula to calculate chloro alkaline[13] indices to know the ion exchange between the ground water and its surroundings.
The CAI can be measured as-

$$\text{CAI} = [\text{Cl}^- - (\text{Na}^+ + \text{K}^+)]/\text{Cl}^-$$

Where, all ionic concentrations are expressed in terms of mg/lit.

The negative value of CAI indicates that there is exchange between sodium and potassium ($Na^+ + K^+$) in water with calcium and magnesium ($Ca^{+2} + Mg^{+2}$) in the rocks by a type of Base Exchange reactions. The Positive value of CAI represents the absence of Base Exchange reaction and existence of cation anion exchange type of reactions[14].

Sodium percentage (% Na)

Wilcox planned a method for rating the irrigation waters based on percentage sodium and electrical conductivity. The percentage of sodium is calculated by the formula-

$$\%Na = \frac{(Na+K)}{Na+K+Ca+Mg)} X100$$

Where, all ionic concentrations are expressed in terms of mg/lit.
In all 10 samples (SAR) comes in excellent range.

Table-1: Statistical analysis of various water samples

S.No.	S-1	S-2	S-3	S-4	S-5	S-6	S-7	S-8	S-9	S-10
SAR	3.95	3.73	4.61	5.26	4.74	4.25	5.25	4.27	4.06	4.77
%Na	29.14	32.46	35.25	34.80	32.81	27.81	34.47	32.05	28.89	32.41
PI	40.92	46.54	46.36	46.22	45.57	38.72	45.87	47.03	40.47	42.10
CAI	-0.21	0.07	-0.22	-0.73	-0.27	0.09	0.11	0.32	0.38	-0.39
Where, all ionic concentrations are expressed in terms of mg/lit.										

Table-2: Classification of ground water samples of RIICO industrial area of district, Kota

Classification Pattern	Categories	Range	No. of Sample	Percentage %
Sodium Absorption Ration (SAR)	Excellent Good Fair Poor	0-10 10-18 18-26 >26	All	100%
Sodium percentage (%Na)	Excellent Good Permissible Doubtful Unsuitable	0-20 20-40 40-60 60-80 >80	All	100%
Permeability Index (PI)	Class-I Class-II	>75 25-75	All	100%
Chloro Alkaline Indices (CAI)	Base exchange reactions Cation exchange reactions	Negative valve Positive valve	Five Five	50% 50%

CONCLUSION

Analysis shows that all samples are slightly alkaline in nature although all parameter are in the permissible range. Although for drinking purpose and industrial purpose proper purification required to remove various salts before using ground water.

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Table-3: Physico-chemical analysis of ground water of RIICO industrial area of district Kota

S.No.	S-1	S-2	S-3	S-4	S-5	S-6	S-7	S-8	S-9	S-10
pH	8.40	8.35	7.91	8.20	8.25	8.20	7.99	7.80	7.87	7.57
Cond.	400	375	360	355	350	360	368	340	355	390
CO_3^{-2}	24	32	27	22	36	24	20	18	22	27
HCO_3^-	153	172	148	181	174	172	151	176	149	128
Cl^-	21	27	24	20	23	32	36	37	42	22
SO_4^{-2}	17	19	24	29	31	18	26	30	34	13
NO_3^-	33	37	42	46	40	39	31	42	36	32
PO_4	0.24	0.19	0.21	0.26	0.27	0.23	0.34	0.21	0.24	0.16
TH	190	185	181	192	197	169	172	161	156	193
Ca	40	32	37	42	40	49	36	32	41	40
Mg	22	20	17	23	20	26	25	21	23	24
Na	22	19	24	30	26	26	29	22	23	27
K	3.5	6.0	5.4	4.7	3.3	2.9	3.1	3.0	3.0	3.7
F	0.60	0.71	0.76	0.52	0.59	0.57	0.59	0.62	0.87	0.88
Fe	0.70	0.64	0.89	0.76	0.92	0.68	0.52	0.59	0.61	0.59

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