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Evaluation of Lake Waters Quality in and Around Pochampally, Telangana State, of India for Irrigation Purpose.

Idrees Ali Abdul Khudhur[1]* and Praveen Raj Saxena[2]

[1]*Department of Environmental Sciences, Osmania University, University College of Sciences, Hyderabad, Telangana, India.*
[2]*Department of Applied Geochemistry, Osmania University, University College of Sciences, Hyderabad, Telangana, India.*

**Corresponding Author's E-mail: idreesali7999@yahoo.com*

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ABSTRACT

The study comprised suitability and evaluation of water quality for irrigation uses. About seven samples were collected in and around Pochampally from different lake bodies. Water samples were collected and analyzed for PH, EC, TDS, TH, Na^+, K+, Ca^{2+}, Mg^{2+}, HCO_3^-, CO_3^{2-}, SO_4^{2-}, Cl^-, F^- and NO_3^-. In addition to classify water quality and evaluating its suitability for irrigation purpose (i) Sodium Absorption Ratio (SAR), (ii) Soluble Sodium Percentage (SSP), (iii) Residual Sodium Carbonate (RSC), (iv) Permeability Index (PI) were calculated.

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Introduction:

Irrigated agriculture is dependent on adequate water supply of usable quality. Irrigation water quality is related to its effects on soil and crops and its management, characteristics of irrigation water that defines its quality vary with the source of water. There are regional differences in water characteristic, based on mainly on geology and climate. There are many differences in the quality of water available on local level depending on whether the source is from surface water bodies (river, lakes, ponds) or ground. Agriculture water sources may be of poor quality because of natural causes, contamination or both and often required treatment before it is acceptable for a given use. The water quality in watershed is directly affected by vegetative cover, agriculture and other management practices. The chemical constituents of irrigation water can affect the plant growth directly through toxicity or deficiency or indirectly by altering plant availability of nutrients (Ayers and Westcot, 1985; Rowe et al.,1995). This situation is now changing in many areas. Intensive use of nearly all good quality supplies means that new irrigation projects and old projects seeking. New or supplemental supplies, must rely on lower quality and less desirable sources (cuena, 1989). Water quality concerns have often been neglected because good quality water supplies have been plentiful and readily available (shamsad and Islam, 2005 Islam et al.,1999).

Study area:

Pochampally lies between $17^0 23' 9.96''$ N and $78^0 38' 35.88''$E. popularly known as city of silk. The study area belongs to nalgonda district of telangana state india.

Materials and Methods:

Pre-cleaned High density Polyethylene (HDPE) bottles were used to collect surface water samples from seven different lakes distributed throughout the area of pochampally and numbered sequentially (Table 1). The bottles were rinsed with the same water which is to be taken as sample to avoid possible cross contamination and every other precautionary measure was taken for the best result. The water samples were then analyzed for major ion chemistry employing standard methods (APHA,1995).

The pH and conductivity were measured with respective meters. Total hardness as $CaCO_3$ and (Ca^{+2}) were analyzed titrimetrically using standard EDTA. (Mg^{+2}) was computed taking the reference between TH and (Ca^{+2}) values. Carbonate ($CaCO_3^{-2}$) and Bicarbonate (HCO_3^-) were estimated by titrating with standard

H_2SO_4. Chloride (Cl^-) was estimated by standard $AgNO_3$. Sodium (Na^+) and Potassium (K^+) were measured by Flame Photometer. Sulphates (SO_4^{-2}) were measured by Spectrophotometry. Nitrate (NO_3^-) and Fluoride (F^-) were analyzed using a Ion-Selective Electrodes. Total Dissolved Solids (TDS) calculated from Electrical Conductivity (EC) using an empirical equation. All the parameters are expressed in mg/lit except for pH and EC. EC is expressed in micro Siemens/cm .All ionic concentrations are expressed in terms of meq/l.

Table: 1. Summary of the analytical data

S. No	Locations	pH	EC	TH	TDS	Ca^{+2}	Mg^{+2}	Na^+	K^+	CO_3^{-2}	HCO_3^-	SO_4^{-2}	NO_3^-	Cl^-	F^-
1	Mukthapuram lake	7.8	1300	195	832	44	20.6	108	10	0	384	58	8.36	244	0.95
2	Pochampally lake	7.9	1500	260	960	58	27.9	110	9	12	445	77	184	273	1.05
3	Peddaravulapally lake	7.7	1300	245	832	54	26.7	102	9	21	372	72	41	248	0.96
4	Revanpally lake	7.8	1500	255	960	62	24.3	120	6	15	481	57	14	227	1.3
5	Kapripally lake	7.9	1400	205	896	48	20.6	106	12	0	445	77	32	259	1.06
6	Rudravelli stream	7.5	1200	185	768	42	19.4	90	312	0	280	91	84	170	0.88
7	Peddaravulapally stream	7.5	1200	185	768	48	15.8	88	312	0	298	146	101	181	0.9

Table: 2. Comparison with Indian standards

Parameters	**minimum**	**maximum**	**average**	**IS 2296**
pH	7.5	7.9	7.7	8.5
EC	1200	1500	1342	2500
TH	185	260	218	------
TDS	768	960	859	2100
Ca^{+2}	42	62	50	---
Mg^{+2}	15.8	27.9	22	----
Na^+	88	120	103	----
K^+	6	312	95	----
CO_3^-	0	21	6.8	----
HCO_3^-	280	481	368	-----
SO_4^{-2}	57	146	82	1000
NO_3^-	8.36	184	66	-----
Cl^-	170	273	228	600
F^-	0.88	1.3	1.01	-----

Results and Discussion:

These parameters mainly consist of certain physical and chemical characteristics of water are listed in table 1 and data compared with Indian standards2296 in table 2 that are used in the evaluation of agricultural water quality. Numerous water quality guidelines have been developed by many researchers for using water in irrigation under condition. However, the classification of US Salinity Laboratory (USSL) is most commonly used. Parameters such as EC, TDS, pH, Sodium Adsorption Ratio (SAR), Soluble Sodium Percentage (SSP) and Residual Sodium Carbonate (RSC) and Permeability Index (PI) were used to assess the suitability of water for irrigation purposes. The criteria used to evaluate quality of water for use in agriculture are listed in table 3

General Hydrogeochemistry:

Physical and chemical compositions of the surface water samples were statistically analyzed and the results obtained were summarized in the Table 2 and Table 3. The temperature variation of surface Physical and chemical parameters: The PH of the water samples in study area ranges from 7.5 to7.9 with a mean of 7.7 hence, 100% of water samples within the permissible limits. EC of the water samples ranges from 1200µs/cm to 1500µs/cm with a mean of 1342µs/cm. 100% of water samples within the permissible limits. The dissolved solids of water samples in the study area varying from 768 to 960mg/l with a mean of 859mg/l. Total hardness in the study area varies from 185 to 260mg/l with an average of 218mg/l. Calcium concentrations are varying from 42 to 62mg/l with an average of 50mg/l. Magnesium concentration varies from 15 to 27mg/l with a mean of 22mg/l. Sodium concentration ranges from 88 to 120mg/l with a mean of 103mg/l. Potassium concentration varies from 6 to 312mg/l with an average of 95mg /l. Carbonates concentration varies from 0 to21mg/l with an average of 6.8mg/l. Bicarbonates concentration ranges from 280 to 481mg/l with a mean of 386mg/l . Chlorides (Cl^-) concentrations are varying from 170 to 273mg/l with an average of 228mg/l. All the water samples were with the limits. Sulphates (SO_4^-) concentration ranges from 51 to146mg/l with a mean of 82mg/l the irrigation water standards for SO4-2 is specified as1000 mg/l according to IS 2296.Hence all the water samples falls within the permissible limits. Fluoride (F-) concentration of the water samples in study area ranging from 0.8 to 1.3mg/l with a mean of 1.0mg/l. Nitrate (NO3-) concentration of the study area ranging

from 8.36 to 184mg/l with an average of 66mg/l. Hence all the samples are within the permissible limits when compared to IS 2296.

Table: 3. Classification of water classes

Parameters	Range	Water class	Number of samples exceed
SAR	10	Excellent	All
	18	Good	Nil
	18-26	Fair	Nil
	26	Unsuitable	Nil
RSC	>1.25	Good	2
	1.25-2.50	Doubtful	3
	2.5	Unsuitable	2
TDS	0-1000	Fresh	All
	1000-10,000	Brackish	Nil
	10,000-1,00,000	Saline	Nil
	>1,00,000	Brine	Nil
SSP	20	Excellent	Nil
	20-40	Good	Three
	40-60	Permissible	Four
	60-80	Doubtful	NIL
	80	Unsuitable	NIL
PI	<75	Class I	Two
	75-150	Class II	Five
EC	250	Excellent	NIL
	250-750	Good	ALL
	750-2000	Permissible	NIL
	2000-3000	Doubtful	Nil
	>3000	Unsuitable	Nil

Irrigation water quality:

Parameters that were generally considered for evaluation of the suitability of surface water for irrigation were the residual sodium carbonate (RSC), sodium adsorption ratio (SAR), electrical conductivity (EC), total dissolved solid (TDS), soluble sodium percentage (SSP) and permeability index (PI) . According to the US Department of Agriculture, water having more than 2.5 meq/l of RSC was not suitable for irrigation purposes. RSC value of surface water samples was calculated using the formula proposed by Eaton (1950) and Ragunath (1987) and results are presented in the table 3. The RSC values of the water sample varied from 0.9 to 3.3 meq/l and 28% samples had values less than 1.25 meq/l and were safe for irrigation and only 42% samples exceeded the values 1.25 meq/l indicating that water was moderately suitable for irrigation uses and 28% samples had values more than 2.5meq/l indicating that the waters are unsuitable for the irrigation (Table3). Classification of surface water samples from the study area with respect to SAR measured using the formula of Karla and Maynard (1991) in terms of alkali hazard is presented in the Table 2. The SAR values of all the samples were found to be less than 10.00 and were classified under excellent category for irrigation. The salinity hazard to crop irrigation can be measured on the basis of specific conductance. The specific conductance values of all the sampling stations fell under the permissible hence 100% of the samples were suitable for irrigation. Total dissolved solids of the samples ranging from the 768mg/l to 960 mg/l 100% of the samples were falling under the class of fresh. Soluble sodium percentage of the surface waters values ranging from 23 to 52meq/l. 42.9% of samples were falling in water class of good and 57.1% of samples were in permissible hence all the surface waters samples in the study area were suitable for the irrigation. Permeability index of the surface water samples were ranging from 73 to 111meq/l. 28% of the samples were falling under the water class of I which were suitable for the irrigation purpose and 71.4% samples were unsuitable for irrigation.

Conclusion:

Hydrochemical introspection of surface water in the study area indicated that all the water samples fall in fresh water class type and waters were alkaline in nature. All water samples were fell within the recommended permissible limits and were good for irrigation purposes. Finally, water quality of the study area indicated that all samples were suitable for crop irrigation with a little danger of permeability index.

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