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Short Communication

Appraisal of ground water quality to estimate its appropriateness for farming uses

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Abstract

In Dapoli, Ground water had a specific significance where groundwater used as a primary supply of water utilized for consumption, household & farming. Water of the 15 wells was selected for study chemical characteristics. Analyzed data was used to conclude foremost result that is appraisal of appropriateness of groundwater for irrigation purpose. It was workout with the help of correlation among ground water quality factors viz, PI, Na%, TH, EC, SAR, KR, RSC, and TDS comparing with World Health Organization standard for drinking water. It shows that Mg, Na, HCO_3, Ca, K and SO_4 concentrations were lesser than the allowable limits among 90 per cent wells. According to TDS, ground water wells were categorized. Groundwater was appropriate for irrigation because TDS level was less than desirable in 96% of wells.

Keywords: Irrigation, ground water quality, ground water pollution.

Introduction

Water is greatly vital for endurance of each and every one living beings. Water quality is very important concern for mankind as it is in a straight line associated with human wellbeing. In India, the majority of the people are needy of ground water as a single resource of consuming water. It is assumed that the ground water relatively to a great amount fresh and free from pollution as compared to river water. Since widespread discharge of industrial effluents, household sewage causes ground water to become contaminated and created wellbeing hazard[1]. As per the standards WHO for consumption water, the groundwater quality factors viz, TDS, EC, pH, Cl, Ca, TH and Na, etc. must in allowable limits[2]. But concentration of these factors crossed the permissible limit, and then they may causes harsh health hazards. In the present work, ground water from Dapoli block was exemplified by physico-chemical observations to decide the groundwater suitability for irrigation use & drinking. Appraisal of ground water suitability for drinking and irrigation purposes by put side by side various parameters: Na percentage, RSC, SAR, Kelly's ratio, permeability index, etc. To discover the harmless drinking water and irrigation water, it is necessary to know physico-chemical characteristics and by comparing the factor to standard values.

Materials and methods

The area is a part of a coastal tract situated on the western part of Ratnagiri district, Maharashtra (Figure-1) were study was conducted. It flanked by Latitude 17°33'59.489"N to 17°56'22.54"N and Longitude 73°2'56.16"E to 73°23'7.915"E and covers an area of about 910 km^2. Annual mean daily min and max temperature range between 23°C to31°C. RH ranges to 70% -75% with annual rainfall is 338cm. Rainfall take place in the month of June to September. As an expansion of Dapoli Talika is going on at to a large extent, the housing colonies have started makes use of groundwater as a resource of water supply for household use.

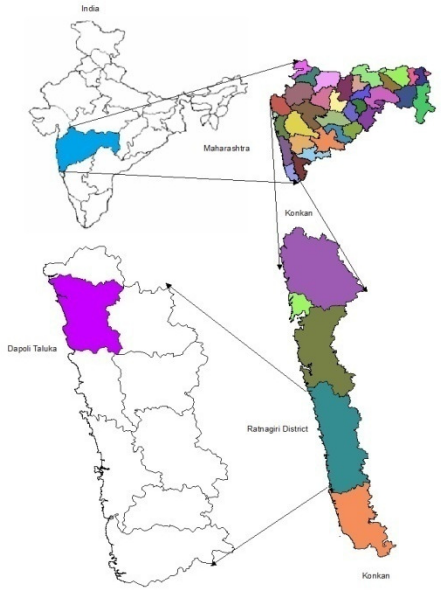

Figure-1: Location map.

Groundwater suitability was judge for irrigation and drinking reason. It depends on physico-chemical parameters. Ground water quality was examined for the year 2010. Data was analysised statistical to reduce range of uncertainty.

Electrical Conductivity (EC): Electric Conductivity depends on anion and cations presence in groundwater and also on mobility, temperature and ions valence. EC means capability of water to send out electrical current. It is a indicator for degree of mineralization of water[3].

TDS: The concentration of various dissolved minerals in water is called TDS. According to ISI and ICMR the allowable limit of TDS was 500 mg/l, if greater than 500mg/l is disagreeable for consumption and much industrial use. TDS value of 500mg/l as allowable limit and 1500 mg/l as highest permissible limits[4].

Sodium Adsorption Ratio (SAR): SAR was measure of sodium / alkali hazard to crops because of this; it is an important factor for classifying water used for irrigation. Whenever sodium acts in response along with soil, it decreases soils permeability & it was tricky for cultivation. SAR calculated as follows[5].

$$SAR = \frac{Na^+}{\sqrt{\frac{Ca^{2+} + Mg^{2+}}{2}}} \quad (1)$$

Where Na, Mg, Ca given in meq/l.

SAR as an index for sodium hazard was recommended by USDA salinity laboratory (Table-1).

Table-1: Sodium adsorption ration class[6].

SAR	Classes
Greater than 26.0	Poor
18.0 – 26.0	Fair
10.0 -8.0	Good
Less than 10	Excellent

Per cent Sodium: When amount of sodium dissolved in water turn into surplus, it modifies properties of soil & reducing soil permeability took place[7]. Because of that, the evaluation of percent sodium is necessary while considering irrigation suitability.

$$\% \text{ Na} = \frac{(Na^+ + K^+)}{(Ca^{2+} + Mg^{2+} + Na^+ + K^+)} \times 100 \quad (2)$$

Where Ca^{2+}, Mg^{2+}, K^+ and Na^+ given in meq/l.

Groundwater suitability depends on % sodium and EC Wilcox[8] classified for irrigation purpose.

Table-2: Classification of % sodium[9].

Per cent Sodium	Class
> 80	Unsuitable
60 - 80	Doubtful
40 - 60	Permissible
20 - 40	Good
< 20	Excellent

Residual Sodium Carbonate (RSC): RSC is calculated as given below[10]. The addition of bicarbonate and carbonate in groundwater when more than total of Ca and Mg also controls inappropriateness of ground water for irrigation.

$$RSC = (CO_3^{2-} + HCO_3^-) - (Ca^{2+} + Mg^{2+}) \quad (3)$$

Table-3: Classification of Residual sodium carbonate[10].

Class	Ranges
Un suitable	> 2.5
Doubtful	1.25-2.5
Good	<1.25

Permeability Index: PI values point out whether the ground water is appropriate for irrigation or not. Elongated tenure of irrigation water influence the soil permeability because it was prejudiced by means of HCO_3, Na, Mg and Ca, contents in soil. PI formula is used to evaluate soil permeability for evaluate appropriateness for irrigation purposes is given below[11].

$$PI = \frac{Na + \sqrt{HCO_3}}{(Mg + Ca + Na)} \times 100 \quad (4)$$

As a result, PI is categorized as class I if PI value >75%, class II if PI value is in the range of 25–75% and class III if PI value less than 25%. Water good for irrigation categorized as class I & class II waters with 75% or more maximum permeability. Water unsuitable for irrigation categorized as Class III waters with 25% of max permeability.

Kelley Ratio: If KR value is more than one point then that surplus stage of Na in waters. Water is suitable for irrigation because KR value less than one. It is greater than one then unsuitable for irrigation[12].

It is calculated as given below

$$KR = \frac{Na^{+}}{Ca^{2+} + Mg^{2+}} \quad (6)$$

Where all parameters in meq/l.

Groundwater Suitability Estimation: Groundwater appropriateness for irrigation can be estimated by SAR, RSC Na%, TDS, KI, PI, and TH. Na%, TDS, SAR, PI, RSC, KI and TH criteria's were utilized to calculate groundwater quality. Its suitability for irrigation purpose (Table-4).

Results and discussion

Different physico-chemical properties have been applied to categorize well sequentially to evaluate ground water quality and correctness for various uses. Suitability of groundwater quality is depending on particular standards.

Suitability of groundwater quality for irrigation: Agricultural practices depend on groundwater as a source of irrigation. KR, TH, RSC, TDS SAR, Cl Na%, and PI, used to evaluate quality of groundwater and its suitability for irrigational.

TDS ranges between 95 to 184 mg/l. TDS of all wells not as much of 500mg/l, therefore, ground water was suitable for irrigation as well as for drinking (Table-4). The majority of groundwater samples drop in group of excellent (100%). The analyzed value of SAR in study area varies from 0.12 to 0.33 and categorized as excellent (100%) and suitable for irrigation.

Table-4: Classification of ground water to evaluate its suitability for irrigation.

Parameters	Class	Samples (%)	Range
KR	Suitable	90	<1
	Un suitable	10	>=1
RSC	Good	100	<1.25
	Doubtful	0	1.25-2.5
	Unsuitable	0	> 2.5
PI	Class-I	7	>75
	Class-II	3	25-75
SAR	Excellent	100	up to 10
	Good	0	Oct-18
	Fair	0	18-26
	Poor	0	>26

Conclusion

The evaluation of ground water quality and its appropriateness for irrigational purposes was based on above criteria. Those criteria were TH, Na%, RSC, SAR, PI, and KR. Groundwater wells were categorized according to TDS. 100% wells had TDS less than 500mg/l, Therefore groundwater was appropriate for irrigation. The evaluated value of SAR categorized all 100% of groundwater wells were suitable for irrigation. Classification of groundwater wells with respect to Na% revealed that Na% ranged between 6.74% and 19.41%, with an average of 10.8% in groundwater. In study area,

References

1. Raja R.E., Lydia Sharmila, Princy Merlin and Chritopher G. (2002). Physico-Chemical Analysis of Some Groundwater Samples of Kotputli Town Jaipur, Rajasthan, Indian. *J Environ Prot*., 22(2), 137.

2. World Health Organization (WHO) (1996). Guidelines for Drinking Water Quality. *health criteria and other supporting information*, 940-949.

3. Meena B.S. and Bhargava N. (2012). Physico-Chemical Characteristics Of Groundwater Of Some Villages Of Dag Block In Jhalawar District Of Rajasthan State (India). *Rasayan J Chem*, 5(4), 438-444.

4. Jain C.K, Kumar C.P. and Sharma M.K. (2003). Ground Water Qualities of Ghataprabha Command Area Karnataka. *Indian Journal Environ and Ecoplan*, 7(2), 251-262.

5. Karanth K.R. (1987). Ground water Assessment, Development and Management. *Tata McGraw Hill*, New Delhi, 720.

6. Todd D. (1980). Groundwater hydrology (2nd ed.). New York: Wiley.

7. Rao N.S. (2006). Seasonal variation of groundwater quality in a part of Guntur District, Andhra Pradesh, India. *Environmental Geology*, 49(3), 413-429.

8. Wicox L.V. (1995). Classification and Use of Irrigation Waters. US Department of Agriculture, Washington Dc, 19.

9. Ragunath H.M. (1987). Groundwater. Wiley Eastern Ltd, New Delhi, 563.

10. Weihe G., Robert H.C., Bruce M.S. and Peter H.D. (1999). Mapping submerged aquatic vegetation with GIS in the Caloosahatchee Estuary: evaluation of different interpolation methods. *Marine Geodesy*, 22(2), 69-91.

11. Doneen L.D. (1964). Water Quality for Agriculture. *Department of Irrigation*, University of Calfornia, Davis, 48.

12. Narsimha A., Sudarshan V. and Swathi P. (2013). Groundwater and Its Assessment for Irrigation Purpose in Hanmakonda Area, Warangal District, Andhra Pradesh, India. *Int. J. Res. Chem. Environ*, 3, 195-199.

13. Szabolcs I. and Darab C. (1964). The Influence of Irrigation Water of High Sodium Carbonate Content on Soils. In I. Szabolics (Ed.), Proc 8th International Congress Soil Science Sodics Soils, Res Inst Soil Sci Agric Chem Hungarian Acad Sci, ISSS Trans II, 802-812.

14. Hem J.D. (1985). Study and Interpretation of the Chemical Characteristics of Natural Water. USGS, Water Supply Paper, 264.

15. Sawyer C.N. and McCarty P.L. (1967). Chemistry of Sanitary Engineers. 2nd ed., McGraw-Hill, New York, 518.

16. Schoeller H. (1967). Geochemistry of Ground Water. *An International Guide for Research and Practice*, UNESCO, 15, 1-18.

17. Raman V. (1985). Impact of corrosion in the conveyance and distribution of water. *Jour. I.W.W.A*, 15(11), 115-121.

18. Mahadevaswamy G., Nagaraju D., Siddalingamurthy S., Lakshmamma lone M.S., Nagesh P.C. and Rao K. (2011). Groundwater Quality Studies in Nanjangud Taluk, Mysore District, Karnataka, India. *International Journal of Environmental Sciences*, 1(7).

19. Kurumbein W.C. and Graybill F.A. (1965). An Introduction to Statistical Models in Geology. McGraw-Hill, New York.

20. Patil V.T. and Patil P.R. (2010). Physicochemical Analysis of Selected Groundwater Samples of Amalner Town in Jalgaon District, Maharashtra, India. *E-Journal of Chemistry*, 7(1), 111-116.