Print & Online, Open Access, Research Journal Available on http://jbsd.in
ISSN: 2229-3469 (Print); ISSN: 2231-024X (Online)
Research Article

Studies of Physico-chemical Parameters to Evaluate Quality of Groundwater at Different Zones from Degloor Tahsil, (MS) India

Patil Sachin R[1] and Patwari Jayprakash M[2]

[2]Assistant Professor and [1] Research Scholars
N. S. B. College, Nanded
Swami Ramanand Teerth Marathwada University Nanded-431606
Maharashtra (India)
1. Email: sachinpatil2181989@gmail.com

Article Info

Received: 12-07-2019,
Revised: 19-09-2019,
Accepted: 26-09-2019

Keywords:
Hydrological Studies, Physico-chemical parameters, Groundwater and BIS.

Abstract

A systematic study is carried out to explore the physico-chemical parameters of groundwater. Groundwater is an important source of fresh water for agricultural and drinking purpose in Degloor Tahsil. It is also one of the best sources for irrigation and domestic use with high demand. Nowadays contamination has become one of the major problems for human consumption. The duration of analysis work has been carried out for one year from August-2018 to July 2019. These collected samples have been assessed on qualitative parameters. The variations of physico-chemical parameters such as pH, EC, TS, TH, Ca, Mg, Na, K, TA, Cl, NO_3^- and SO_4^{-2} contain were analysed for period of one year. These parameters are effectiveness in calculating quality of groundwater. After analysis it was observed that few parameters like EC, TS, TH, Ca and NO_3^- are above permissible limit. The obtained results were compared with BIS (2012) to evaluate its suitability for drinking and for irrigation suitability SAR, KR, SSP %Na, RSC and MH methods were followed. So the key plan of our study is to find the quality of groundwater in Degloor Tahsil.

INTRODUCTION

The contemporary research revived of environmental quality is to focus on water, owing to its significance in maintaining the human health as well as ecosystem (Singh *et al.*, 2015). All groundwater contains minerals carried in solution the type and concentration of which depend upon the surface and subsurface environment (Patil *et al.*, 2018).

The wander of the natural world is water. For all living organisms present on earth water is vital requirement (Patil and Bhosle., 2018). Therefore it is true that "No water No life. There are two types of primary resources of water one is groundwater and another is surface water. To sustain underground life is more essential natural resource (Shahida and Ummatul, 2015).

Day by day increasing population and improper management of natural resources are the reasons for increasing in population (Kolekar, 2017). Majority of the people in India are direct dependent on ground water for drinking and irrigation purpose (Patil and Bhosle., 2018). Water is essential for survival of all living organisms so water should be clean and fresh the quality of water is directly linked with human welfare the water should be free from pollution and other impurities (Patel *et al.*, 2016).

The groundwater quality is normally characterized by different physical characteristics.

These parameters change widely due to the type of pollution, seasonal fluctuation and groundwater extraction (Patil *et al*., 2012). Monitoring of water quality levels is thus important to assess the level of pollution and also to assess the potential risk to quality levels (Panaskar *et al*., 2016).

A variation of water groundwater quality in an area is a function of physical and chemical parameters which are greatly influenced by geological formations and anthropogenic activities (Wagh *et al*., 2014).

In India the need for groundwater is enormous since the country economy depends highly on agriculture (Bano and Ahmad, 2014). The groundwater pollution occurs when used water is returned to the hydrological cycle (Mittal and Arora, 2014). All the various sources of groundwater is said to be the safest water for drinking and domestic purpose.

MATERIALS AND METHODS

Degloor is a town and a municipal council in Nanded district in the state of Maharashtra, India. It is largest tahsil of Nanded and is known for its socio-cultural history. Degloor is situated near where the Telangana, Maharashtra and Karnataka boundaries meet. Telangana and Maharashtra state boundary is around 1.5 kilometers away from the down center (Fig 1). The town boundaries there are several village boundaries. The Primary occupation is agriculture with output predominantly sugarcane, cotton, grains and bananas. The population of this tahsil is directly dependent on groundwater for domestic use.

About 35 groundwater samples were analysed for physico-chemical analysis to show is suitability for domestic and agricultural use. The samples were collected for duration of one year from August-2018 to July-2019 on monthly basis to evaluate different variations. The samples were collected in precleaned bottles and precaution was taken for another contamination. After collection of samples immediately it was transferred to laboratory for further analysis.

The laboratory analyses were undertaken by adopting the standard procedures given by Trivedi and Goal (Trivedi and Goel, 1998). pH, EC, TS were analysed by using their specific meters, TH, Ca, Mg, TA and Cl were analysed by using titration method, Na and K were analysed by using flame photometer and NO_3^- and SO_4^{-2} were analysed by using UV Spectrophotometer. Except PH, EC other samples are shown in mg/L.

RESULT AND DISCUSSION

The suitability of groundwater water is most important for domestic and agricultural use. The obtained results were compared using guidelines prescribed by BIS (BIS, 2012).

Classification of groundwater for Domestic Use

pH, EC and TS: After analysis it was observed that the mean values of pH were ranged from 7.2 to 7.9 which remain alkaline in nature, the maximum value was ranged from 7.7 to 8.4 and minimum value ranged from 6.6 to 7.4 which are below permissible limit prescribed by BIS (2012). EC mean values were ranged from 1829.9 to 3158.4, the maximum values were ranged from 2560.9 to 4830.3 and minimum values were ranged from 1005.8 to 1606.3 in μS/cm after comparing with standard limit it reveals that few samples are within permissible limit and majority of samples are above permissible limit. TS obtained mean values are 1464.9 to 3614.5, maximum obtained results are 1962.2 to 4793.4 and minimum values were obtained as 1006.7 to 2226.3 in mg/L. That few of the samples are within permissible limit but most of the samples show its presence in above permissible limit (Table 1) (Fig 2, 3 & 4).

TH, Ca and Mg: Evaluation of samples revel that the TH mean value was ranged from 410.9 to 886.3 mg/L, maximum value obtained from 612.4 to 998.9 and minimum obtained range was 232.9 to 813.2 in mg/L. Obtained results of TH show that few samples are within permissible limit but most of the sample are found above permissible limit. Ca mean values are 210.3 to 392.2, maximum value ranged from 285.3 to 721.9 and minimum values ranged from 113.5 to 244.2 in mg/L which fall in above permissible limit category. Mg mean values were ranged from 3.1 to 12.0, maximum values were ranged from 7.0 to 15.4 and minimum values were ranged from 0.1 to 8.8 in mg/L which show that the samples are within permissible limit (Table 1) (Fig 5, 6 & 7).

Na and K: After analysis it is seen that the Na mean value ranged from 31.0 to 70.6, maximum value obtained from 56.2 to 99.2 and minimum value ranged from 10.6 to 24.8 mg/L that are below permissible limit. The K mean values received were 2.3 to 8.7, maximum value ranged from 3.9 to 23.7

Table 1: Obtained parameter readings within and above permissible Limit during August-2018 to July 2019.

Sr. No	Parameters	BIS (2012)	
		PL	APL
1	pH	1 to 35 = 35	-
2	Temperature	-	-
3	Electrical Conductivity (EC)	3,5,11,12,15,17,22,23,27,32,34 = 11	1,2,4,6,7,8,3,10,13,14,16,18,19,20,21,24,25,26,28,29,30,31,33,35 = 24
4	Total Solids (TS)	1,3,4,8,9,10,11,12,15,18,19,22,23,27,29,31,33,34 = 18	2,5,6,7,13,14,16,17,20,21,24,25,26,28,30,32,35 = 17
5	Total Hardness (TH)	4,9,18,21,23,27,33 = 7	1,2,3,5,6,7,8,10,11,12,13,14,15,16,17,19,20,22,24,25,26,28,29,30,31,32,34,35 = 28
6	Calcium (Ca)	-	1 to 35 = 35
7	Magnesium (Mg)	1 to 35 = 35	-
8	Chloride (Cl)	1 to 35 = 35	-
9	Sodium (Na)	1 to 35 = 35	-
10	Potassium (K)	1 to 35 = 35	-
11	Total Alkalinity (TA)	1 to 35 = 35	-
12	Sulphate (SO_4)	1 to 35 = 35	-
13	Nitrate (NO_3)	1,2,3,4,5,7,8,9,10,12,13,16,17,18,19,20,21,22,23,24,25,26,27,28,29,30,31,32,33,34,35 = 31	6,11,14,15 = 4
14	Dissolved Oxygen (DO)	1 to 35 = 35	-

Note: PL- Permissible Limit and APL- Above Permissible Limit.

Table 2: Irrigation water quality classification based on SAR

Rank	SAR	Quality	No. of Samples Aug-2018 to July-2019	% of Samples
1	0 - 10	Excellent	1 to 35	100 %
2	10 - 20	Good	Nil	Nil
3	18 - 26	Fair	Nil	Nil
4	>26	Poor	Nil	Nil

Table 3: Irrigation water quality classification based on Kelly's Ratio

Rank	SSP	Quality	No. of Samples Aug-2018 to July-2019	% of Samples
1	< 1.0	Suitable	1 to 35	100 %
2	>1.0	Unsuitable	Nil	Nil

Table 4: Irrigation water quality classification based on SSP

Rank	SSP	Quality	No. of Samples Aug-2018 to July-2019	% of Samples
1	< 60	Suitable	1 to 35	100 %
2	>60	Unsuitable	Nil	Nil

Table 5: Irrigation water quality classification based on % Na

Rank	% Na	Quality	No. of Samples Aug-2018 to July-2019	% of Samples
1	**< 20**	**Excellent**	1 to 35	100 %
2	**20 - 40**	**Good**	Nil	Nil
3	**40 - 60**	**Permissible**	Nil	Nil
4	**60 - 80**	**Doubtful**	Nil	Nil
5	**80 - 100**	**Unsuitable**	Nil	Nil

Table 6: Irrigation water quality classification based on RSC

Rank	RSC	Quality	No. of Samples Aug-2018 to July-2019	% of Samples
1	**< 1.25**	**Good**	1,2,4,5,6,8,10,11,12,13,14,15,16,17,19,20,21,22,23,24,25, 26,27,29,30,31,32,33,34,35 = 30	85.90 %
2	**1.25-2.50**	**Doubtful**	9 = 1	2.58 %
3	**>2.50**	**Unsuitable**	3,7,18,28 = 4	11.52 %

Table 7: Irrigation water quality classification based on MH

Rank	MH	Quality	No. of Samples Aug-2018 to July-2019	% of Samples
1	**< 50**	**Suitable**	1 to 35	100 %
2	**>50**	**Unsuitable**	Nil	Nil

and minimum value ranged from 0.2 to 2.4 in mg/L within permissible limit (Table 1) (Fig 8 & 9).

TA and Cl: Alkalinity of water is the capacity to neutralize acidic nature and the presence of carbonates and hydroxides are main cause of alkalinity in natural water. Obtained mean value of TA ranged from 208.8 to 329.8, maximum values obtained from 289 to 848 and minimum values obtained as 52 to 236 mg/L which are within permissible limit. Chloride is a widely distributed element in all types of rocks in one or the other forms its affinity towards sodium is high. The mean values of Cl obtained from 338.7 to 784.7, maximum values obtained from 490.6 to 888.3 and minimum values ranged from 106.4 to 604.6 in mg/L which are within permissible limit (Table 1) (Fig 10 & 11).

NO_3^- and SO_4^{-2}: The obtained mean values of NO_3^- ranged from 57.9 to 118.4, maximum value obtained from 71 to 155 and minimum value obtained from 25 to 77. Majority of the samples fall within permissible limit but few samples fall in above permissible limit category. The SO_4^{-2} mean value ranged from 44.8 to 87.1, maximum value obtained from 4.97 to 15.74 and minimum value was obtained from 1.06 to 3.18 in mg/L which are within permissible limit (Table 1) (Fig 12 & 13).

Classification of groundwater for Irrigation:

To evaluate the groundwater suitability for irrigation the ratios like SAR, KR, SSP, %Na, RSC and MH methods were used.

SAR: Sodium absorption ratio is an irrigation water quality parameter used in the management of sodium affected soils. It is the indicator of suitability of groundwater for irrigation. It is the ration which measures the amount of sodium relative to calcium and magnesium in the groundwater. The mean value of SAR WAS RANGED from 2.20 to 4.29 meq/L. After applying this method it is revealed that the 100% of groundwater samples fall in excellent category (Richard LA, 1954) (Table 2).

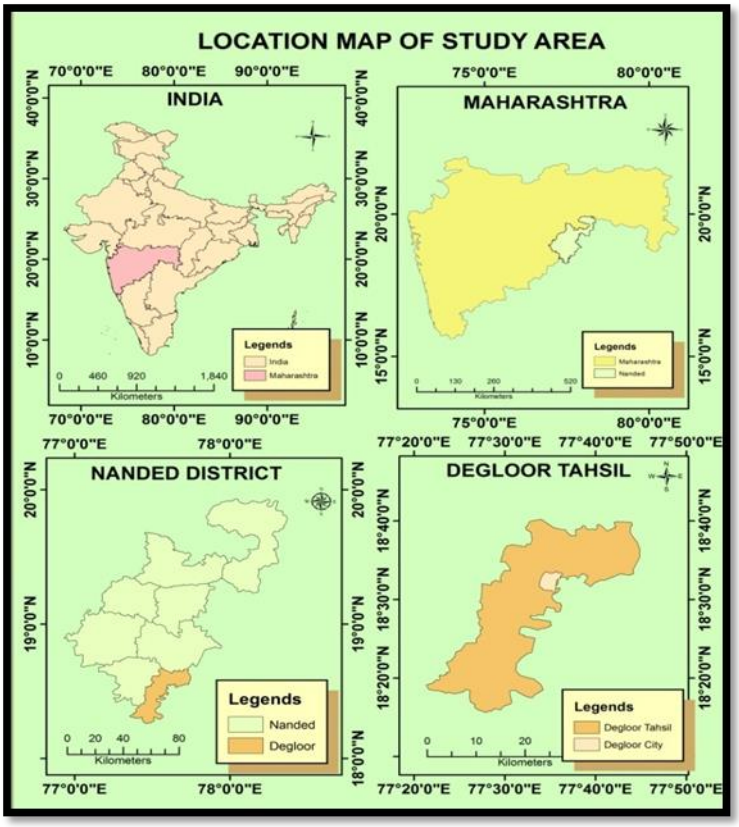
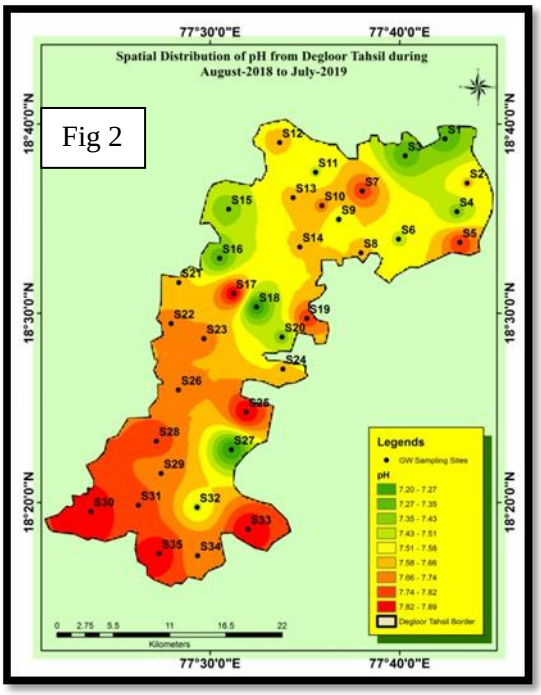


Figure 1: Location map of study area.



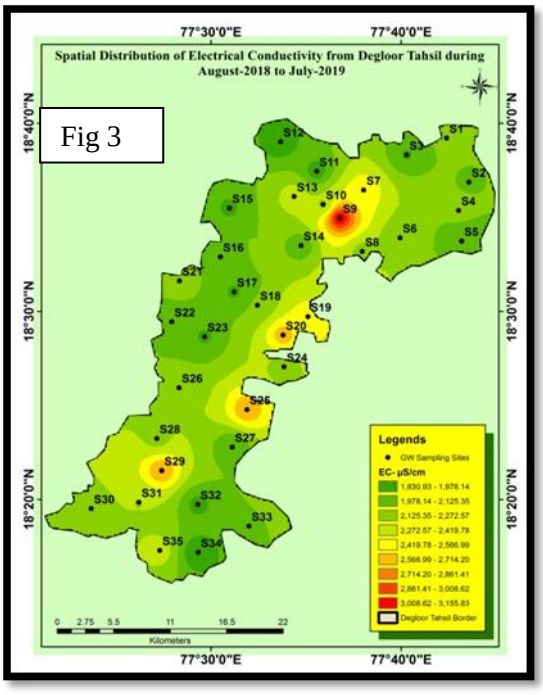
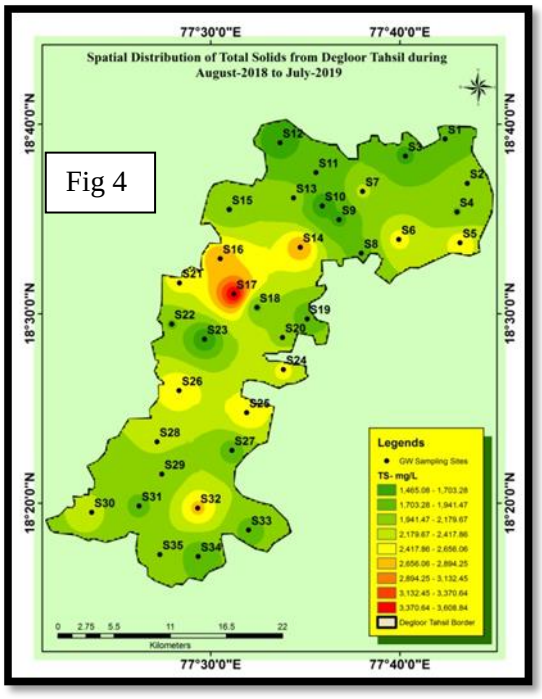


Figure 2 & 3: Spatial distribution of pH and EC.



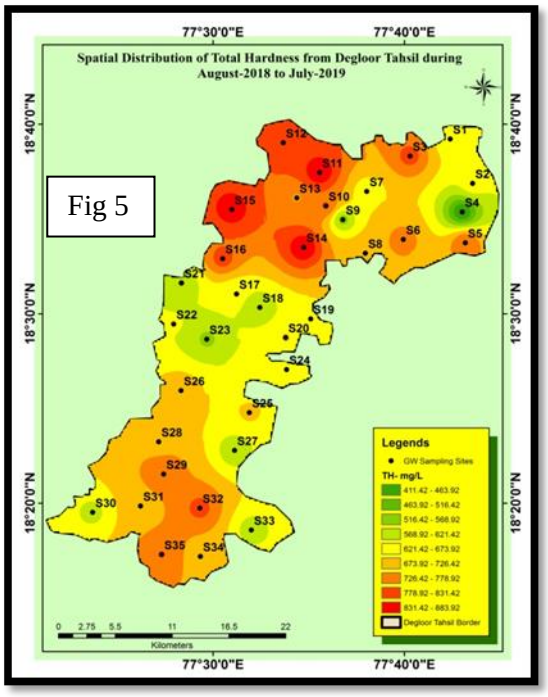
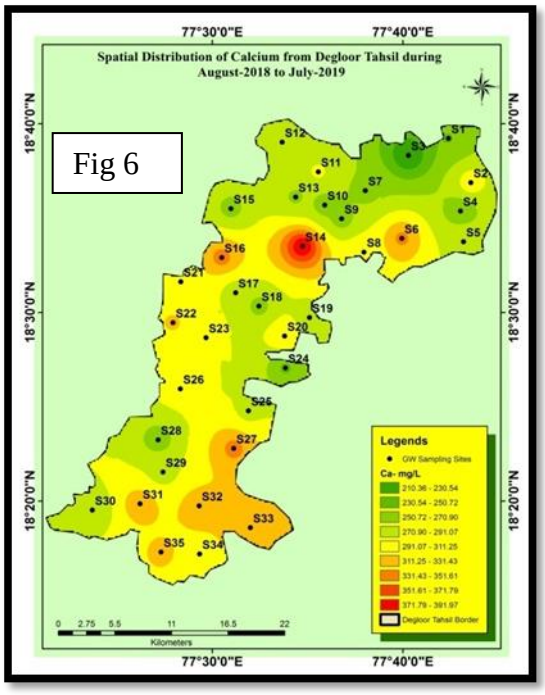


Figure 4 & 5: Spatial distribution of TS and TH.



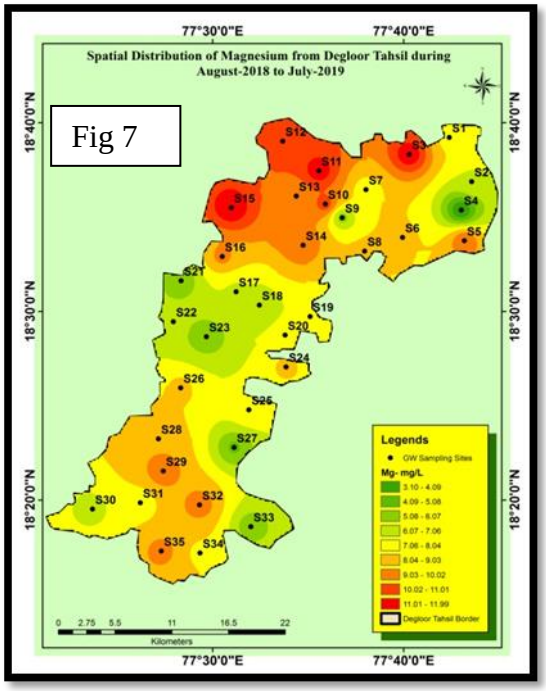
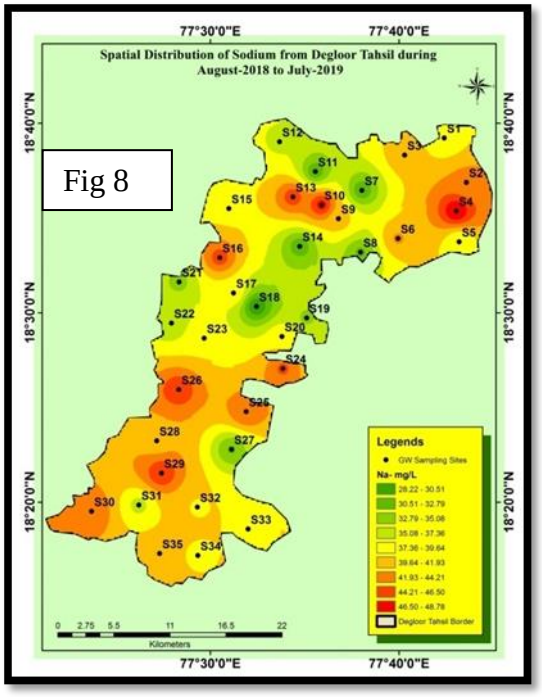


Figure 6 & 7: Spatial distribution of Ca and Mg.



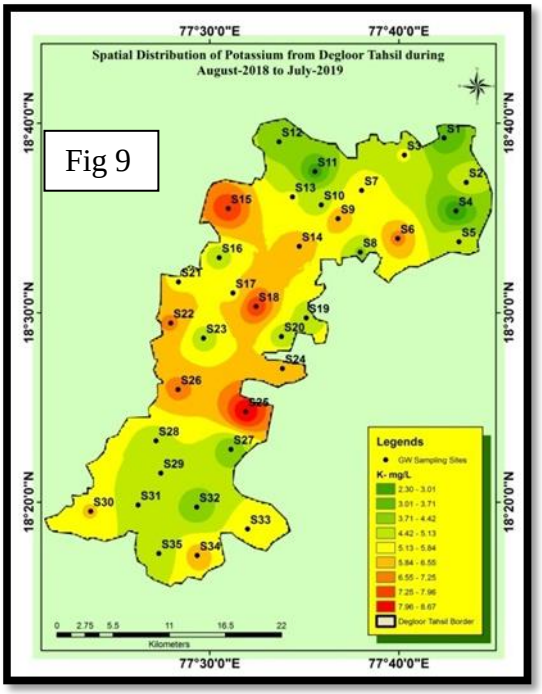
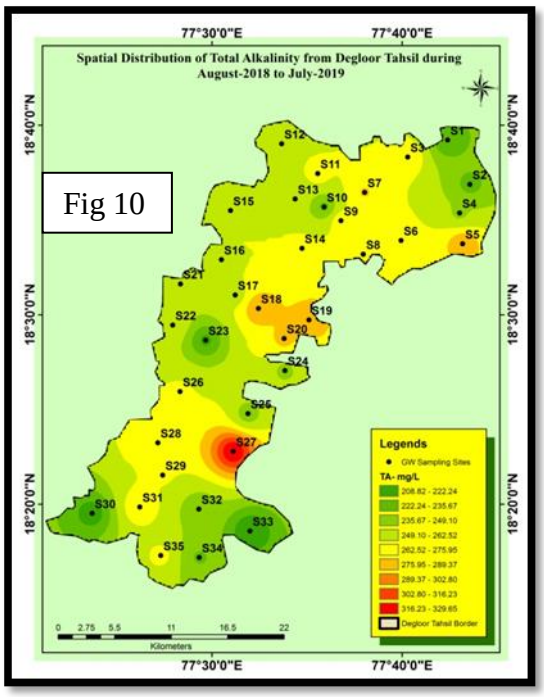


Figure 8 & 9: Spatial distribution of Na and K.



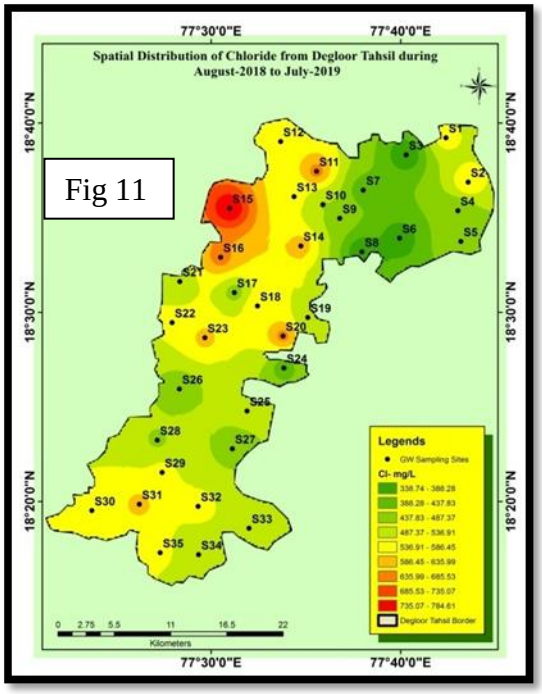


Figure 10 & 11: Spatial Distribution of TA and Cl.

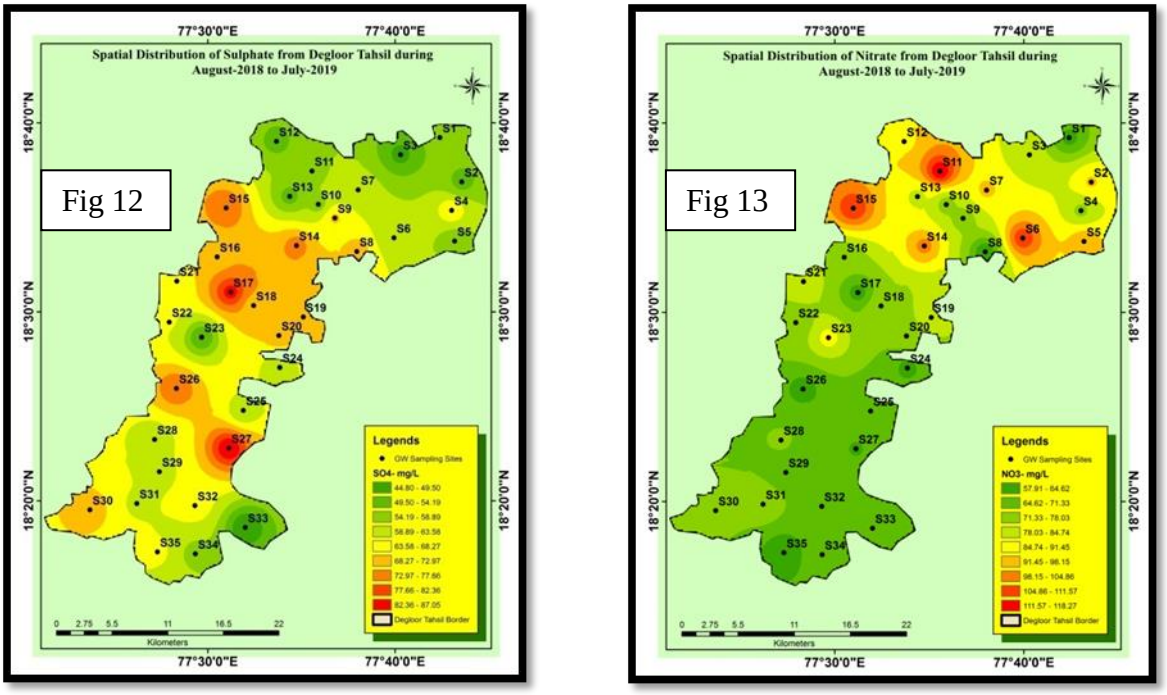


Figure 12 & 13: Spatial Distribution of NO_3 and SO_4.

KR: According to the Kellys Ratio there are two type of water quality properties < 1.0 is suitable and >1.0 is unsuitable category. But after analysis it is clear that the values obtained are from 7.21 to 15.85 meq/L. The 100% of the samples fall in suitable category for irrigation **(Kelly, 1951)** (Table 3).

SSP: By considering Soluble Sodium Percentage method which is classified in two forms < 60 is suitable form and >60 is unsuitable form. The results of SSP obtained from 7.21 to 15.85 meq/L. After evaluation of groundwater samples it is clear that the all samples show their presence in suitable category (Table 4).

%Na: The Percent Sodium is classified in five categories that are excellent, good, permissible, doubtful and unsuitable. Its values were obtained from 8.54 to 17.35. That clearly indicates that the 100% of samples fall in excellent category and show its suitability for irrigation (Wilcox, 1955) (Table 5).

RSC: Residual Sodium Carbonate is also classified in three categories good, doubtful and unsuitable. But according to this method 85.90% of samples fall in good category, 2.58% of samples fall in doubtful category and 11.52% of samples fall in unsuitable category (Wilcox, 1955) (Table 6).

MH: Magnesium Hazards is classified in two categories suitable and unsuitable category. After evaluation it is clear that values obtained from 1.20 to 5.31 which are found in suitable category for irrigation (Paliwal, 1972) (Table 7).

Discussion

After detailed hydrochemical study of the groundwater has remained suitable for domestic and irrigation purpose. Few parameters like EC, TS, TH, Ca and NO_3^- shown it way towards alkaline in nature. For drinking purpose obtained results were compared with standard limit prescribed by BIS (2012) which indicates its potability and for irrigation different methods used and that indicates its suitability for irrigation.

ACKNOWLEDGEMENT

Authors are thankful to N.S.B. College, Swami Ramanand Teerth Marathwada University, Nanded for providing necessary laboratory facility to carryout analysis work.

REFERENCES

Bano N and Ahmad A, 2014. Groundwater quality assessment of Firozabad city (India) a physico-chemical analysis. *International Journal of Scientific Research*, **3** (5): 294-296.

BIS, 2012. Indian Standards Drinking Water Specification (Second Revision Amendment No.1 June 2015 to IS 10500: 2012). *Publication Unit*, BIS, New Delhi, India.

Kelly WP, 1951. Alkali Soils-their formation properties and reclamation. Reinold Publ.Corp, New York

Kolekar SS, 2017. Physico-chemical analysis of ground water quality parameters-A Review. *Journal of Chemical and Pharmaceutical Sciences*, **10** (1): 376-378.

Mittal S and Arora SK, 2014. A study of evaluation of groundwater quality of Bathinda region of Punjab. International Journal of Engineering and Innovative Technology, **4**(1): 149-154.

Paliwal KV, 1972. Irrigation with saline water, Water Technology Center, *Indian Agriculture Research Institute*, New Delhi, India: Pp 198.

Panaskar DB, Wagh VM and Pawar RS, 2016. Assessment of Groundwater Quality for Suitability of Domestic and Irrigation from Nanded Tehsil, Maharashtra, India. SRTMUN's Research Journal of Science: 71-83.

Patel T, Mahour PK, Mahour R, Lautre HK, and Shah P, 2016. Physico-chemical analysis of groundwater quality of Dhrol. *Environmental Science: An Indian Journal*, **12** *(*12): 1-7.

Patil PN, Sawant DV and Deshmukh RN, 2012. Physico-chemical parameters for testing of water a review. International Journal of Environmental Science, **3** (3): 1194-1207.

Patil SR and Bhosle AB, 2018, Spatial Distribition of Municipal Water from Pangri, (MS) India. *Bioscience Discovery*, **9**(3): 416-423.

Patil SR and Bhosle AB, 2018. Bacteriological Evaluation of Groundwater for Potability from Pangri, (MS) India. *Bioscience Discovery*, **9**(3): 381-388.

Patil SR, Patwari JM and Mushtaq AD, 2018, Assesment of Groundwater Suitability for Drinking Purpose from Nrangal, (MS) India. *Bioscience Discovery*, **9**(3): 396-402.

Richard LA, 1954. Diagnosis and Improvement of Sline and Alkaline Soils. Agric Handbook. *Washington D.C:US Dept. of Agriculture* **60**(160).

Shahida P and Ummatul F, 2015. Physico-chemical analysis of groungwater quality in Alighar City, Uttar Pradesh. *International Journal of Science and Nature*, **6** (3): 397-405.

Singh S, Raju J and Ramakrishna C, 2015. Evaluation of groundwater quality and its suitability for domestic and irrigation use in part of the Chandauli Varanasi region, UP India. *Journal of Water Resources and Protection*, **7:** 572-587.

Trivedi RK and Goel PK, 1998. *Practical Methods in Ecology and Environmental Science.* Enviro Media Publication, Karad, Pp 1- 175.

Wagh VM, Pawar RS, Panaskar DB and Aamalawar, 2014. Status of Groundwater Quality: A Case Study of Vishnupuri Village, Nanded Tahsil, Maharashtra. Asian Journal of Biochemical and Pharmaceutical Research, **3**(4): 59-65.

Wilcox LV, 1955. Classification and Use of Irrigation Waters. Washington D.C: *US Dept. of Agriculture* (Circulation, 969, 19.).

How to cite this article

Patil Sachin R and Patwari Jayprakash M, 2019. Studies of Physico-chemical Parameters to Evaluate Quality of Groundwater at Different Zones from Degloor Tahsil, (MS) India. *Bioscience Discovery*, **10**(4):147-155.