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Assessment of seasonal variation in physico-chemical characteristics and quality of Pravara River water for irrigation use in Sangamner, Dist Ahmednagar, Maharashtra

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Abstract

In present investigation an attempt was made for assessment of Seasonal Variation in Physico-chemical Characteristics and Quality of Pravara River Water for Irrigation during year 2008. The study reveals that most of the physicochemical parameters of river water at five selected sites show moderate variation in their concentration for all seasons. However site 3 and 4 stands evidence of discharge of waste water from the city in the river. This intern indicated the quality of water for irrigation in the study area. The Sodium absorption ratio and Residual sodium carbonate values show good water quality for irrigation. However at site 3 and 4 the values of Kelly's index and Soluble Sodium Percentage exceed their standards in monsoon season indicating doubtful quality of water for irrigation.

Keywords - Assessment, Variation, Water quality, Irrigation.

Introduction

Indian agriculture receives most of its water from surface sources like river, reservoir, dam etc. However, now a day the river water is largely influenced by discharge of industrial as well as domestic waste while flowing through big towns and increases the water pollution in rivers [6]. This changes the physical and chemical characteristics of river water and hence the quality for different use [5]. River water though have some self purification capacity, but in most instances the level and quality of wastes and effluent discharged are far beyond the purifying capacity [1].

In spite of the fact that, the quality of river at any point reflects several major natural influences, like lithology of the basin, atmospheric inputs and climatic conditions but on the other hand municipal and industrial activity on the bank of river constantly discharge degraded water in all season and pollute the river water artificially. In many parts of the world the polluted water from river is used for irrigation purpose in agriculture without assessing its suitability [3-4]. This affects the crop productivity as well as deteriorates the quality of soil. Hence, in present investigation an attempt has been made to assess the seasonal variation of physico-chemical characteristics and hence quality of Pravara river water for irrigation purpose in Sangamner of District Ahmednagar.

Study Area

Pravara River is a tributary of Godavari and originates at the hilly region of Ratangarh from Akole tahesil of Ahmednagar district, MS, (India). The river supplies water for different purposes including agriculture, domestic, drinking and industrial purpose to number of towns before meeting to the Godavari River. Sangamner is one of well known town of Ahmednagar district situated on Pravara River and geographically located at $19^{\circ}35'$ E and $74^{\circ}16'$ N longitude (Fig.1) having the population 61,920 according to 2001 census. The untreated domestic sewage of the town is being discharged directly in the river throughout the year and increases the pollution load on the river water. Water from this river in Sangamner area is being used mostly for agriculture purpose. Therefore suitability of water for irrigation is always in question throughout the year.

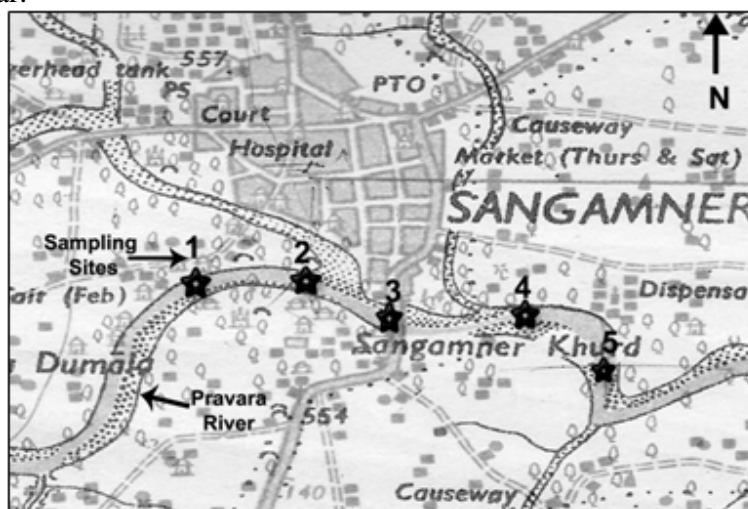


Fig. 1- Showing Sangamner town, Pravara River and Sampling Location in study area

Methodology

In all, five sampling sites were selected for all season (Pre-monsoon, Monsoon, Post-Monsoon) on the river at Sangamner, keeping in view the flow of water and discharge of domestic waste in river (Fig 1). These sites were recognised as Site 1, 2, 3, 4 and 5. The samples were collected from these sites on bimonthly basis for a period of one year during 2008. The pH, Electrical Conductivity (EC) and Total Dissolved Solids (TDS) were measured on site using digital pH, EC and TDS meters respectively. One litre sample from these sites were collected in plastic container and filtered in laboratory. The filtered samples were analyzed for the parameters such

as Total Hardness (TH), Calcium, (Ca), Magnesium (Mg), Alkalinity(TA) , Chloride (Cl), Dissolved Oxygen (DO), Chemical Oxygen Demand (COD), Biological Oxygen Demand (BOD). Sodium (Na), Potassium (K), Sulphate (SO₄), Phosphate (PO₄), Nitrate (NO₃) as per the methods given in APHA [2] and Trivedi and Goyal [7]. The results obtained are averaged out for different seasons and are presented in table 1. The data from table 1 was used to get index like Sodium Absorption Ratio (SAR), Residual Sodium Carbonate (RSC), Kellys Index (KI) and Soluble Sodium Percentage (SSP) with the help of computer program to assess the suitability of water for irrigation and are presented in table 2.

Table 1-Average values of physico chemical characteristics, of Pravara River water for different seasons in study area

Season	Site	Physico- chemical parameters															
		pH	EC	TDS	TH	Ca	Mg	Na	K	Cl	TA	SO ₄	PO ₄	NO ₃	DO	BOD	COD
Pre-monsoon	1	7.1	209	111	54	27	17	6.5	0.9	25	60	9	0.1	1.8	5.9	2.6	11
	2	6.9	410	191	106	58	19	20	1.4	32.3	63	15.5	0.7	10.2	7.3	24.6	153
	3	7.1	1178	452	145	61	22	15	0.9	95.7	66	22.5	1.2	47.5	6.2	42	262
	4	7.2	1343	574	186	106	20	42	2.6	242	106	40	0.9	48.5	5.2	54.5	301
	5	7.2	1079	635	188	61	17	24	1.6	16.8	83	31.5	0.8	32	6.1	31.1	190
Monsoon	1	7.3	193	110	64.5	36	19	2.5	0.4	40	55	14.5	0.1	0.2	7	2	17.5
	2	7.5	258	163	84	44	23	15	0.9	46	50.5	16.5	0.2	2.6	7	22	19
	3	7.4	355	210	136	41	23	53	2.1	152	37	28.5	1.4	33.5	3.9	28	136
	4	7.5	468	271	100	44	32	68	5.5	260	71	34	1.3	48	3.4	37	153
	5	7.5	698	241	123	55	41	36	2.5	102	43.5	21.5	0.7	34	4.3	28.5	117
Post-monsoon	1	7.7	260	150	44	28	13	4.5	3.5	30.5	70	7.5	0.1	0.2	5.1	3.5	21.5
	2	7.8	482	232	51	31	32	7	7.5	30	53.5	14.5	0.5	0.2	6.1	3	11
	3	7.4	640	425	64	51	36	31	7	166	62	12.5	1.2	26.9	4.2	44	138
	4	7.0	1270	538	87	60	45	52	3.5	235	72.5	23.5	1.6	44	3.8	50	158
	5	7.2	1056	491	115	80	39	26	6.5	58	38	25	1.3	30	4.8	27.5	116

*All values are in ppm except pH and EC

Result and Discussion

It is observed from table 1 that average values of 16 (Sixteen) physicochemical parameters of Pravara River water at Sangamner shows wide fluctuation in their concentration for different seasons. Some important parameters like TDS (111 to 635 mg/l), Total Hardness (54 to 188 mg/l), Calcium (27 to 106 mg/l), Magnesium (17 to 22 mg/l), Sodium (6.5 to 42 mg/l), Chloride (25 to – to 42 mg/l), Alkalinity (60 to 106 mg/l), Sulphate (9 to 40 mg/l), Phosphate (0.1 to 1.2 mg/l), Nitrate (1.8 to 48.5mg/l) and the indicator parameters like BOD (2.6 to 54.5 mg/l), COD (11-301 mg/l) showed minimum and maximum concentration as shown in parenthesis for Pre-monsoon season.

It is also clear that variation in parameter of water in pre-monsoon are not remain constant for minimum and maximum concentration during monsoon. The decrease in concentration of parameter in monsoon may be due to dilution of water with rainwater. However the parameters like Na, Cl, SO₄ and PO₄ shows increase in concentration which may be due to runoff from agriculture field and discharge of untreated domestic waste water from the city [5]. However

Post-monsoon characteristics of river water when compared with Pre-monsoon and monsoon shows increased concentration of EC, TDS, K, TA, PO₄, BOD and COD, while the parameters like TH, Na, Cl, SO₄, NO₃ and DO shows decrease in concentration. This fluctuation may be attributed by the activities like discharge of sewage in the river and decreased and periodical flow of water in the river after monsoon season. From forgoing discussion it is clear that at site no 3 and 4 concentration of Na exceeds the concentration of Ca and Mg during monsoon season.

Water Quality for Irrigation

Table 2- Average values for WQI of Pravara River water for Irrigation Purpose in study area

Season	Site	Irrigation Quality Index			
		SAR	RSC	KI	SSP
Pre-monsoon	1	0.34	-0.38	0.20	17.07
	2	0.82	-1.19	0.39	28.07
	3	0.59	-1.34	0.26	21.18
	4	1.38	-1.73	0.52	34.50
	5	0.99	-0.86	0.46	31.96
Monsoon	1	0.11	-0.77	0.06	6.079
	2	0.64	-1.21	0.31	24.19
	3	2.32	-1.36	1.17	53.93
	4	2.69	-1.25	1.22	55.05
	5	1.26	-2.34	0.51	33.85
Post-monsoon	1	0.24	-0.08	0.15	13.69
	2	0.29	-1.21	0.14	12.71
	3	1.14	-1.73	0.48	32.87
	4	1.74	-2.16	0.67	40.31
	5	0.84	-2.97	0.31	23.90

The quality of water required for irrigation depends especially on the dissolved salts like Na, Ca, Mg and HCO₃ and their concentration in water. Increase or decrease in concentration of these salts and their ratio to one another influence the quality of water for irrigation [8]. This quality was evaluated with the help of Index SAR, RSC, KI and SSP (Table 2) in present study. It is observed from Table 2 that SAR and RSC values shows good quality water at all sites for all seasons. However, the KI and SSP value indicate good to permissible quality of water except site 3 and 4. The KI at these sites are more than 1 epm indicating unsuitable quality of water for irrigation. Similarly, SSP values at these sites are more than 50 meq indicating unsafe water for irrigation in monsoon season. The Na concentration which was high (Table 1) in monsoon at these sites may have disturbed the quality of water. This excess sodium in water can produce the undesirable effects on soil properties and reduces soil permeability which also leads to sodiac nature of soil in study area. The sodium saturated soils tend to peptize and make them unsuitable for cultivation [8].

Conclusion

It is concluded that the RSC and SAR values of Pravara river water are within the permissible limits at all the sites for different seasons. While slight fluctuation was observed in KI and SSP values at site 3 and 4 during monsoon. So the river water is good for irrigation in pre and Post-monsoon while water quality is slightly doubtful in monsoon season at site 3 and 4 only.

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