Environment Conservation Journal 13(3) 105-109 , 2012
ISSN 0972-3099 (Print) 2278-5124 (Online)
Abstracted and Indexed

Seasonal variation in water quality of River Vishwamitri with reference to physico-chemical parameters

Gaurang Parmar and Punita Parikh ✉

Received: 22.03.2012 **Accepted: 28.08.2012**

Abstract

River Vishwamitri at Vadodara was studied for physico-chemical parameters at four sites for summer and monsoon seasons in the year 2011. The correlation between various water quality analysis was performed. In summer, pH, EC, TDS, TSS, Turbidity and BOD showed positive correlation with temperature and negative correlation with COD, Chloride and hardness. In monsoon, TDS, EC, Turbidity, BOD, COD, Chloride and Hardness showed positive correlation with temperature and negative correlation with pH and TDS. The undesirable changes in the river quality parameters suggested that the river is highly polluted as it is used as a sewer collector.

Keywords*: Correlation, physico-chemical parameters, pollution, seasonal variation, Vishwamitri, water quality*

Introduction

Natural streams and rivers are the sources of water to fulfill human needs at different location (Mahadev *et al.*2010). River pollution in India has now reached to a point of crisis due to unplanned urbanization and rapid growth of industrialization. The entire array of life in water is affected due to pollution in water (Saksena *et al.* 2008). The problem of water quality deterioration is mainly due to human activities such as disposal of dead bodies, discharge of industrial and sewage wastes and agricultural runoff which are major cause of ecological damage and pose serious health hazards (Meitai *et al.*2004). Vadodara is a major industrial city of Gujarat state. There are number of industries located in and around the residential areas of the city which are having significant environmental impact. The Vishwamitri flows west through the city of Vadodara and joins with the Dhadhar river and Khanpur River and empties into the Gulf of Khambhat, near Khanpur village. As it flows through Vadodara, the Vishwamitri river is subjected to the drainage of the city's sewage and effluents from nearby industries. It definitely causes some significant impact on the water environment. The river water remains turbid all through the year with characteristic odour at many places. Examining physico-chemical characteristics of the river help discern changes brought about by industrial and domestic wastewater discharge during the river course. Hence, the present study focused on assessing river water parameters in two different seasons.

Author's Address

Department of Botany, Faculty of Science, M. S. University of Baroda, Vadodara, Gujarat
E-mail: punitaparikh@gmail.com

Material and Methods

Four sampling station were selected based on accessibility and introduction of waste. Samples for physico-chemical analysis were collected for two seasons; summer and monsoon (March-October) during the year 2011. Standard methods (APHA 1995) were used during collection, preservation and estimation of different parameters.

Results and Discussion

The results of seasonal variation of physico-chemical parameters of river water are presented in Fig. 1 to10. Correlation coefficients between various parameters are indicated in Table 1 and 2.
Study of physico-ch emical characteristic of river water suggests that the various parameters depend upon the hydrochemistry of study area and also upon the waste water released (Sharma *et al.* 2011).

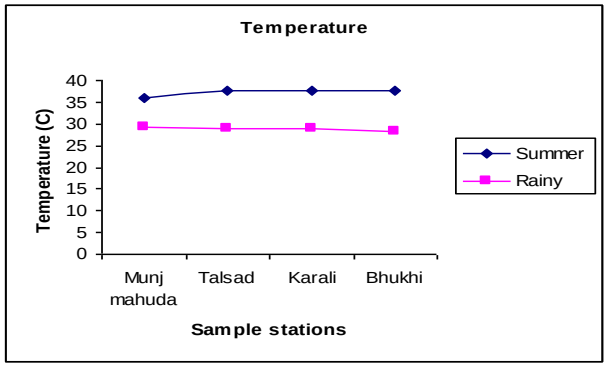

Fig. 1

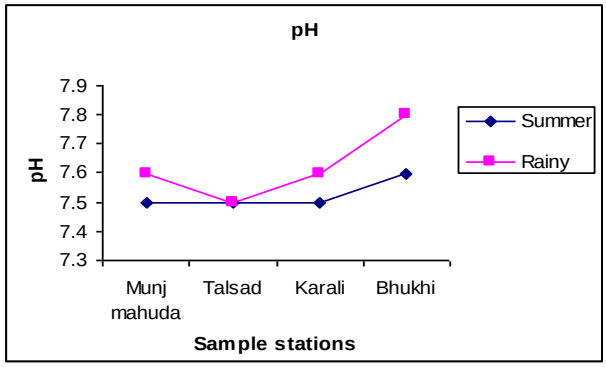

Fig. 2

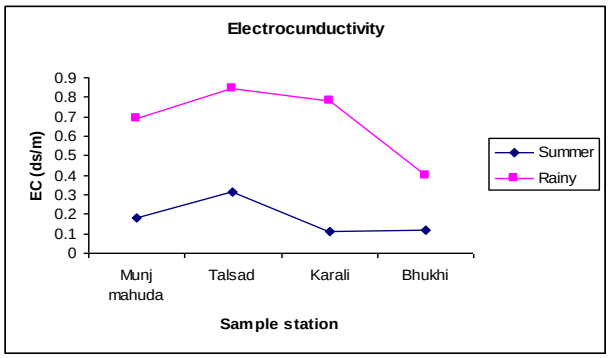

Fig. 3

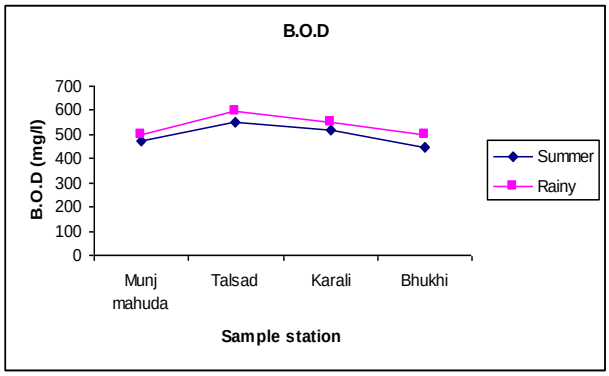

Fig. 4

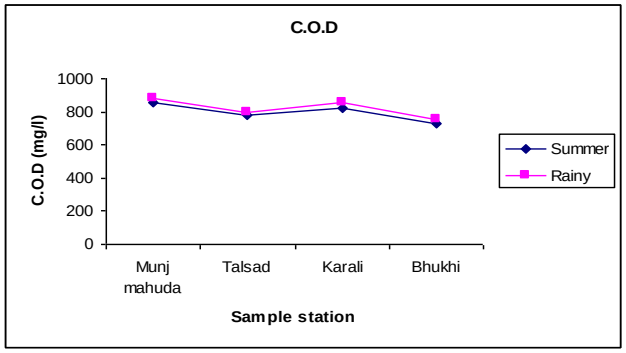

Fig. 5

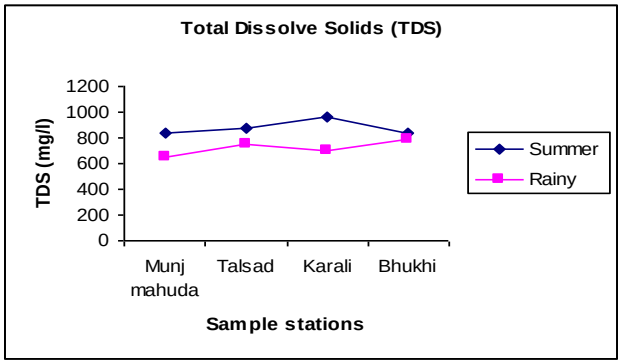

Fig. 6

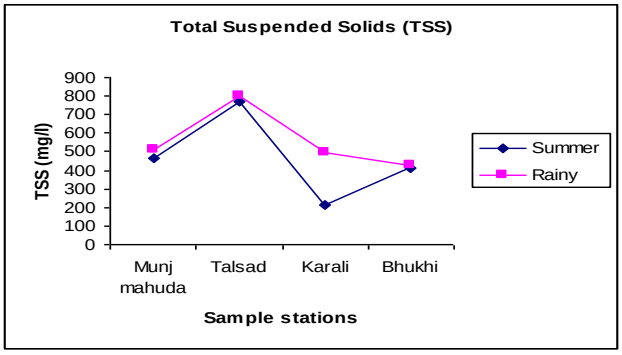

Fig. 7

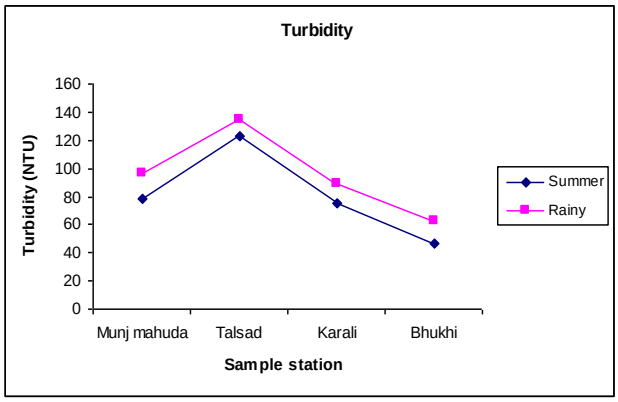

Fig. 8

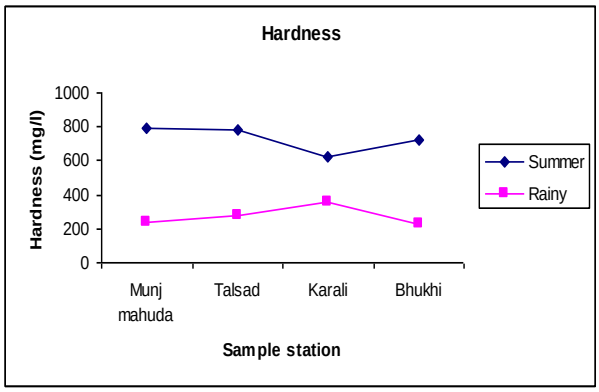

Fig. 9

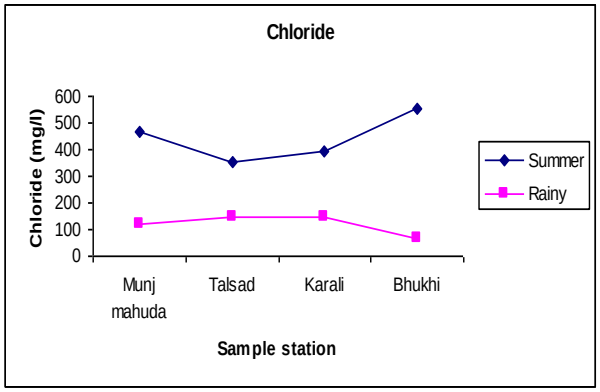

Fig. 10

Table No. 1 Correlation coefficients between the parameters during summer season

	Temp.	pH	TDS	TSS	Turbidity	EC	BOD	COD	Chloride	Hardness
Temperature	1	0.333	0.518	0.017	0.156	0.077	0.477	-0.635	-0.304	-0.518
pH		1	-0.426	-0.159	-0.722	-0.446	-0.713	-0.812	0.855	-0.059
TDS			1	-0.555	0.083	-0.288	0.489	0.264	-0.538	-0.859
TSS				1	0.742	0.946	0.446	-0.215	-0.343	0.825
Turbidity					1	0.919	0.897	0.237	-0.88	0.414
EC						1	0.693	-0.005	-0.626	0.689
BOD							1	0.174	-0.971	-0.022
COD								1	-0.4	0.02
Chloride									1	0.04
Hardness										1

Table No. 2 Correlation coefficients between the parameters during rainy season

	Temp.	pH	TDS	TSS	Turbidity	EC	BOD	COD	Chloride	Hardness
Temperature	1	-0.866	-0.846	0.437	0.662	0.867	0.356	0.871	0.833	0.554
pH		1	0.467	-0.81	-0.932	-0.975	-0.76	-0.521	-0.941	-0.895
TDS			1	0.075	-0.191	-0.485	0.189	-0.977	-0.454	-0.025
TSS				1	0.963	0.712	0.877	-0.059	0.66	0.947
Turbidity					1	0.849	0.832	0.21	0.794	0.951
EC						1	0.765	0.578	0.992	0.863
BOD							1	-0.076	0.773	0.96
COD								1	0.57	0.101
Chloride									1	0.843
Hardness										1

Temperature is basically important for its effects on certain chemical and biological reactions taking place in water and aquatic organisms. It depends upon the season, time of sampling and also upon the temperature of effluents which are being added into the river. The higher temperature was recorded in summer than in rainy season in the present study of river Vishawamitri water which were within range 28-38^{0}C (Fig.1). Similar seasonal variation in water temperature was recorded by Saksena *et al.*

(2008) in Chambal river and Nath and Shrivastva (2001) in river Narmada. In summer season temperature showed negative correlation with COD, Chloride and hardness and positive correlation with pH, TDS, TSS, turbidity, EC, and BOD. While in rainy season temperature showed negative correlation with TDS and pH and positive correlation with TDS, turbidity, EC, BOD, COD, chloride and hardness.pH is an important parameter which is important in evaluating the acid-base balance of water. The pH values of water at sewage discharge points were usually lower than that of the river water (Sharma *et al.* 2011). If pH value is higher than the permissible limit, it will affect adversely alkalinity of the soil, microbial life and corrosion rate (Saikh and Mandre, 2009). Slightly alkaline pH is preferable in waters, as heavy metals are removed as carbonate or bicarbonate precipitates (Ahipathy and Puttaiah, 2006). Patel and Patel observed summer minima but recorded monsoon high. Summer minimum are due to increased decomposition rate, leading to acidification and lowered the pH of water (Chetana *et al.* 1997). In present study, pH was found slightly alkaline in all four study site between ranges 7.5 to 7.8. pH value in all the sites showed the same seasonal trend with summer minima and monsoon maxima (fig.2). pH showed negative correlation with TDS, TSS, turbidity, EC, BOD, COD and hardness and was positively correlated with chloride and temperature in summer season. During rainy season pH showed positive correlation with TDS and negative correlation with TSS, Turbidity, EC, BOD, COD, Chloride, Temperature and Hardness.Conductivity is the measure of capacity of substance or solution to conduct electrical current through the water and also an excellent indicator of TDS, which is a measure of salinity that affects the taste of potable water. Concerned to season it was found maximum in monsoon season compare to winter and summer (Saikh and Mandre, 2009). In present study maximum EC was observed during rainy season (0.400 - 0.842 ds m^{-1}) and minimum in summer season (0.115 – 0.316 ds m^{-1}) (Fig.3). Conductance showed significant positive correlation with turbidity, TSS, temperature, BOD and hardness, while negatively correlate with COD and Chloride in summer season. In rainy season conductance showed significant positive correlation with hardness, chloride, BOD, COD, turbidity, TSS and temperature and negative correlation with pH and TDS.BOD and COD are the most important parameter used to assess the quality of water regarding organic matter present in both suspended and dissolve form. COD is the amount of oxygen required to carry out oxidation of organic waste by using strong oxidizing agent, where BOD is the amount of oxygen required to microorganism to degrade organic waste anaerobically (Saikh and Mandre, 2009). In all four sites, highest BOD and COD values were observed during summer with lowest value in rainy season (Fig.4 and 5).Dissolved solids in water include all inorganic salts, silica and soluble organic matter. Pure water must be free from most suspended particles, which are responsible for turbidity. TDS was highest in summer due to evaporation, reduced input of water and also greater solubility of ions at higher temperature which contribute to increased concentration and was at the minimum value in the rainy season due to an increased input from rains. The TDS concentration of river Vishwamitri water samples in summer and rainy season was found to be in range of 842 – 961 mg L^{-1} and 650 – 790 mg L^{-1} respectively as shown in fig. 6. TDS showed negative correlation with pH, TSS, EC, chloride and hardness in summer and in rainy season TDS showed negative correlation with turbidity, EC, COD, chloride, hardness and pH.Turbidity is a measure of the amount of suspended colloidal particles and dissolved materials. Increase in turbidity indicated an enhanced pollution status of the water body. The present study reported high values in rainy days (63-135 NTU) for turbidity with low summer averages (46-123 NTU)(Fig.8). High monsoon averages are owing to the turbulence arising out of flood like situation observed during the rainy season, resulting also in the formation of foam. Low summer averages are due to gradual sedimentation in the stream (Ahipathy and Puttaiah, 2006). Turbidity showed negative correlation with chloride during summer season and also showed negative correlation with TDS and pH during rainy season.In the present study, maximum values (624

– 791 mg L^{-1}) of hardness were observed due to evaporation and reduced inflow in summer, and minimum values (230 – 276 mg L^{-1}) due to dilution in the rainy season (Fig.9). Hardness is due to the presence of calcium and magnesium salts in water. Hardness showed negative correlation with BOD, TDS, pH and temperature and significant positive correlation with chloride, COD, EC, turbidity and TSS in summer season. It showed negative correlation with pH and TDS and positive correlation with chloride, COD, BOD, EC, turbidity, TSS and temperature. An excess of Chloride (Cl^-) in inland water is usually taken as an index of pollution. Sewage water and industrial effluents are rich in Cl^- and hence the discharge of these wastes results in high chlorides levels in fresh waters. In present study maximum chloride was observed during summer season (355- 554 mg L^{-1}) while minimum chloride values were recorded during rainy season (65 – 150 mg L^{-1}). Only hardness and pH were positively correlated with chloride in summer season. Whereas in rainy season Cl^- showed positive correlation with number of parameters like hardness, temperature, TSS, turbidity, EC, BOD and COD.It is therefore conclude that the river is highly polluted as it is used as a sewer collector and is unfit for domestic and agricultural purposes.

Acknowledgement

The present study has been financed by University Grant Commission, New Delhi, India. The authors are thankful to University Grant Commission for their financial support and Prof. Arun Arya, Head of the Botany department, M.S.University of Baroda, Vadodara to provide lab facilities for these experiments.

References

Ahipathy, M. and Puttaiah, E., 2006. "Ecological characteristic of river vrishabhavathy river in banglore (India)." ***Environ Geol.,*** 49**:** 1217-1222.

APHA, AWWA and WPEC., 1995."Standard methods for the examination of water and waste water." 19th ed. *American public Helth Association, Washington,* D.C.

Chetana, S. A. and Somasekhar, R. K., 1997. "Ecological study on the riverian ecosystem of Karnataka-III. Physico-chemical characterization of river Vrishbhavathi." ***Journal of environmental pollution,*** 4 (1)**:**71-77.

Mahadev, J., Syed, A. A. and Belagali, S. L., 2010. " Analysis of seasonal variation in water quality of Cauvery and kabini river with reference to physico-chemical parameters and calcium carbonate saturation index." ***Journal of applied Geochemistr,*** 12 (2)**:** 224-230.

Meitai, N. S., Bhargava, V.and Patil, P.M., 2004. "water quality of Purna river in Purna town, Maharastra state." ***Journal of aquatic biology,*** 19: 103-105.

Nath,D. and Srivastava 2011. " Physico-chemical characteristic of Narmada for the stretch sandia to mola in M.P. state in context of constraction." ***Journal of Indian Fishries society of India,*** 33:17-24.

Patel, M. K. and Patel, T. K., 1993. "Assessment of water quality in the rivers of wastern Orrisa: part-I river Sankh." ***Journal of environmental protection,*** 13 (12): 909-916.

.

Ravindra, K., Ameena., Meenakshi., Monika., Rani and Anubha, K., 2003. " Seasonal variations in physic-chemical characterictics of river Yamuna in Haryana and its ecological best-denignated use." ***J. Environ. Monitoring,*** 5: 419-426.

Saikh, A. M. and Mandre, P. N., 2009. " Seasonal study of physic-chemical parameters of drinking water in khed (Lote) industrial area." ***Shodh, Samiksha aur mulyankan,*** (7): 169-171.

Saksena, D. N., Grag, R. K. and Rao, R. J., 2008. " Water quality and pollution status of Chambal river in national Chambal sanctuary, Madhya Pradesh." ***Journal of environmental biology,*** 29 (5): 701-710.

Sharma, S., Vishwakarma, R., Dixit, S. and Jain, P., 2011. "Evaluation of water quality of river Narmada with reference to physico-chemical parameters at Hoshangabad city, MP, India." ***Research Journal of Chemical Sciencs,*** 1(3):40-48.