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Effect of industrial effluents and wastes on physico-chemical parameters of river Rapti

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ABSTRACT

Rapti river is the vital source of surface water in Gorakhpur area and is being polluted increasingly by effluents discharged from Saraya sugar factory and distillery. The present study was made to investigate the water quality by performing physico-chemical analysis. For this purpose samples were collected from two sites namely Faren Nallah and river Rapti to evaluate variations in temperature (21.2±0.69-32.8±0.87 ^{0}C), pH (6.11±0.4-6.7±0.047), EC (381±4.68-741±6.62 µS/cm), DO (1.36±0.73-5.8±1.07 mg/l), BOD (34.2±5.43-102±2.04 mg/l), COD (106±0.98-298±3.01 mg/l), chloride (30.2±4.93-90.20 ±23.3 mg/l), nitrate (0.47±0.01-3.67±0.86 mg/l), phosphate (0.13±0.05-0.26±0.049 mg/l), sulph ate (38.6±1.89-45.80±6.49 mg/l), free CO_2 (2.2±0.78-35.3±3.62 mg/l), alkalinity (148±4.27-227 ±13.41 mg/l), total hardness (156±6.55-202±14.14 mg/l), total solid (557±32.58-936±34.5 mg /l) and oil and grease (17.9±0.67-25.97±0.43 mg/l). From the result it revealed that the water quality of Faren Nallah is more worst that caries effluent to river Rapti from sugar factory and distillery. Thus, sugar factory and distilleries are pouring poisonous effluents in the river, which deadly affect both the human beings and their environment.

Key Words: Water pollution, physico-chemical analysis, river Rapti, industrial effluents.

INTRODUCTION

Life cannot exist without water because it is the major component of all living things. It is important both physiologically and ecologically as it plays an essential role in temperature control and also is the medium in which many organisms live. Now a days due to rapid growing urbanization, the quality of land water is being deteriorated by mixing up of industrial wastes and

domestic sewage in our rivers [1]. Especially in urban areas, the careless disposal of industrial effluents and other wastes contributes greatly to the contamination of the water [2]. Increased pollution load in fresh water bodies increases the nutrient level of water [3] and causes a violent alteration in pH, reduction in oxygen content and high osmotic pressure. A study on the impact of industrial effluents on water quality of Kosi river in Rampur district (India) was carried out which showed physico-chemical parameters above the permissible limits [4]. Most of the rivers flowing in urban areas are at the end point of effluents discharge and if not treated and properly controlled can also pollute the ground water [5].

River Rapti originates from the hills of Nepal and runs towards Gorakhpur via 'Tarai' lands namely Balrampur, basti, Siddharth Nagar and Mahrajganj districts. Besides, effluents of Saraya sugar factory and distillery are carried in different areas of Gorakhpur through various water passages namely Gorrah river and Baisy Nallah resulting in spoiling of agricultural land and damaging the homeostasis of ecosystem.

Sugar industry is one of the most important industries in eastern U.P. and is highly reasonable for creating significant impact on rural economy. A huge amount of waste is generated during the manufacture of sugar [6]. There are many sugar mill, distillery and other industries in Gorakhpur region and thus a large amount of effluents and wastes are being discharged in river Rapti via Faren Nallah.

Therefore, the aim of the present study is to assess the extent of chemical pollution of the river Rapti as it is increasingly polluted by industrial effluents.

MATERIALS AND METHODS

Water samples were collected respectively in summer winter and monsoon season of year 2010 for the analysis of physico-chemical parameters from two sampling sites in the early hours (7.00 a.m.-10.00 a.m.). A careful water sampling was made in iodine treated polyethylene bottles free of air bubbles. Some of the physico-chemical characteristics of water measured at the sampling sites, while others were analyzed in the laboratory according to standard method [7, 8]. Samples were collected in a routine manner from both the Faren Nallah as well as river Rapti subsequently receiving the effluents from Saraya sugar mill and distillery (Fig.1)

RESULTS AND DISCUSSION

Faren Nallah carries large amount of effluents from adjacent Saraya sugar factory and distillery, which in turn spoil the water quality of river Rapti causing unfavorable changes in phsico-chemical parameters. In the present investigation, wide range of variations was recorded in dissolved oxygen, biological oxygen demand (BOD), colour and nitrate etc (Table-1). Effluents from sugar industry may have different amounts of solid particulate matter either as suspended solids or total dissolved solid that affect the light intensity of water [6]. pH of collected samples have varied from 6.11±0.4 to 6.7±0.047. It is evident that the pH of water body is very important in determination of water quality since it affects other chemical reactions such as solubility and metal toxicity [9]. Water temperature at both sampling sites was found elevated up to 32.8 ±0.87

^{0}C. It is evident that temperature is basic factor for chemical reaction and biological radiations taking place in water for organisms inhabiting aquatic media [10] have also reported an increase in temperature, which accelerates the chemical reaction [11].

The huge accumulation of inorganic elements such as nitrate (3.67±0.86 mg/l), sulphate (45.8±6.49 mg/l) and phosphate (0.26±0.049 mg/l) has created condition for eutrophication resulting in reduced DO (1.36±0.73 mg/l). The lower DO indicates lesser number of living organisms in the water system. Whereas higher DO (5.8±1.07mg/ml) indicates the plankton growth [12]. Water samples collected from Faren Nallah have shown increased (35.3±3.62 mg/l) free CO_2. This might be due to the discharges if large amount of carbonate ion from sugar factory which on hydrolysis releases free CO_2 as reported earlier workers namely Ugochukwo [13] and Singh [14]. The other important physicochemical parameters of water namely electric conductivity (741±6.62 µS/cm), alkalinity (227±13.41 mg/l), total hardness (202±14.14 mg/l), total solid (936±34.5 mg/l) and oil and grease (25.97±0.43 mg/l) were significantly found beyond normal limit (Table -1). Total hardness and electric conductivity of the water is due to presence of calcium carbonate, sulphate, chloride and nitrate of Ca and Mg. Further increased alkalinity might be due to more CO_2 release in the water stream [15]. Oil grease is a common effluent released from sugar industry that is immiscible to water [16]. However, heavy metals present in discharged from sugar industry have tendency to accumulate in various organs of marine organisms especially fish, which in turn may inter into the human metabolism through consumption causing serious health hazards [17].

Table 1: Physico-chemical characteristics of water from sampling sites

Sampling Stations	Faren Nallah (Station -1)			River Rapti (Station-2)		
Parameters	Summer	Winter	Monsoon	Summer	Winter	Monsoon
Temp (^{0}C)	28.60±1.34	21.80±2.56	32.8±0.87	29.1±1.09	21.2±0.69	31.3±1.56
Colour	Brownish	-do-	-do-	Greenish	-do-	-do-
Odour	Unpleasant	-do-	-do	-do-	-do-	-do-
pH	6.11±0.4	6.17±0.29	6.52±1.72	6.7±0.047	6.5±1.92	6.22±0.39
EC (µS/cm)	741±6.62	606±12.98	711±8.01	422±10.19	381±4.68	409±2.02
DO (mg/l)	2.17±0.3	1.36±0.73	2.17±0.87	5.67±0.12	5.8±1.07	5.67±0.47
BOD(mg/l)	102±2.04	86±1.93	102±12.8	34.4±7.32	34.2±5.43	34.4±3.28
COD(mg/l)	290±6.7	298±3.01	290±9.38	108.5±5.26	106±0.98	108.5±1.38
Chloride (mg/l)	90.2±23.3	79.90±17.5	88.2±11.6	30.2±4.93	32.9±4.71	31.5±5.8
Alkalinity (mg/l)	224±16.54	195±12.29	227±13.41	184±8.25	148±4.27	181±3.06
Total hardness (mg/l)	202±14.14	186±16.23	190±9.36	183±9.74	156±6.55	181±5.93
Total solid (mg/l)	878±45.7	936±34.5	911±56.1	557±32.58	610±45.63	588±23.61
Nitrate (mg/l)	0.8±0.03	0.47±0.01	0.8±0.034	2.98±0.61	2.96±0.34	3.67±0.86
Phosphate (mg/l)	0.23±0.067	0.26±0.049	0.23±0.09	0.14±0.021	0.14±0.011	0.13±0.05
Sulphate (mg/l)	38.6±1.89	41.6±7.93	45.8±6.49	42±11.46	45.6±2.94	44.6±4.71
Oil & Grease (mg/l)	17.9±0.67	22.80±0.39	21.3±1.45	19.2±0.92	25.97±0.43	21.5±4.32
Free CO_2 (mg/l)	32.6±5.23	19.6±3.94	35.3±3.62	2.7±0.45	2.2±0.78	2.63±0.81

**Values are presented in Mean±SD; each analysis was performed in six replicate (n)= 6*

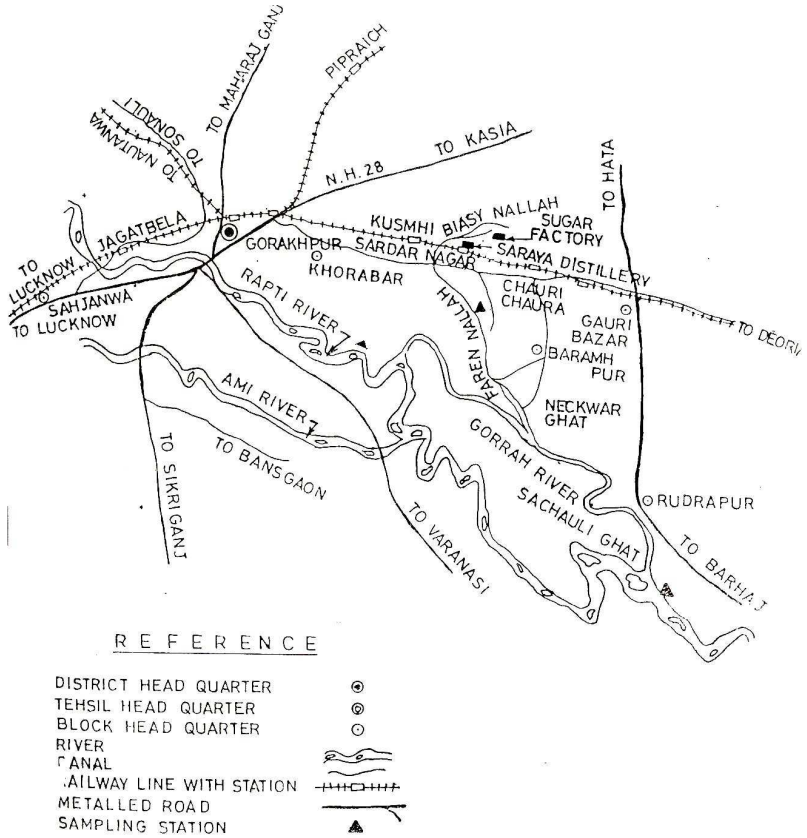

Figure 1: Map showing location of sampling sites

CONCLUSION

Conclusively, present investigation indicates that river Rapti is on danger and effluents released from sugar industry and distillery have a significant negative impact on the water quality. The continued discharge of the effluents may result in severe accumulation of the contaminants. This may affect the lives of human as well as animals around this river. Hence, there is an urgent need to treat the effluents before the final discharge.

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REFERENCES

[1] A. Begum, M. Ramaiah, Harikrishna, I. Khan and K. Veena, *E-J. Chem*., **2009**, 6(1), 47-52.
[2] H. I. Islam M. M. Rahman and F.U. Ashrat, *Int. J. Water Resour. Env. Eng*., 2(8), **2010,** 208-221.

[3] P. Raja M.A. Amarnath R. Elangovan and M. Palanivel, *India. J. Env. Biol*., **2008,** 29(5), 765-786.
[4] S. S. Yadav and R. Kumar, *Adv. Appl. Sci. Res.*, **2011,** 2(2), 197-201
[5] S. Moscow, K. Jothivenkatachalam and P. Subramani, *Der Chemica Sinica,* **2011, 2(2)**199-206.
[6] M. M. Lakdawala and B. N. Oza, *Der Chemica Sinica*, **2011**, 2(4), 244-251.
[7] R. K. Trivedi and P.K. Goel, *Environmental Publications, Karad*, **1986,**
[8] APHA, AWWA, WPCF, (21th Ed.), *Washington. D. C.* **2005.**
[9] J. A. Sayyed and A. B. Bhosle, Der Chemica Sinica, **2010,** 1(2), 104-109.
[10] A. Begum and Harikrishna, *J. Chem.,* **2008,** 5(2), 377-384.
[11] Y. A. Maruthi, M. V Subba Rao and S. Rama Krishna Rao, *India. J. Envr. Ecoplan*., **2000,** 31(1), 45-48.
[12] A. Agrawal and M. Saxena, *Adv. Appl. Sci. Res.,* **2011,** 2(2), 185-189
[13] C. N. C. Ugochukwo, *Ajaem Ragee*., **2004,** 8, 27-30.
[14] A. Singh, *26th - O. S.T.A. Annual Convention part-I*, **1999**
[15] A. Kumar B. S. Bisht V. D. Joshi A. K. Singh and A. Talwar, *J. Hum. Ecol.,* **2010,** 32(3), 169-173.
[16] S. R. Manal, *Dissertation Report, Dr. B.A.M.U., Auranhgabad,* **2002.**
[17] I. Sen, A. Shandil and V. S. Shrivastava, *Adv. Appl. Sci. Res.*, **2011,** 2(2), 161-166