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ASSESSMENT OF WATER QUALITY AND ASPECTS OF POLLUTION IN STRETCH OF RIVER GOMTI AROUND SULTANPUR (U.P.) INDIA

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ABSTRACT

A The clay fraction (<2 µm) of Gomti river sediments shows relatively higher values for Cu, Mn, Pb, Cr and PO_4 in comparison to background values. Fe, Co and Ni do not show any increase and Cd is not within detectable limits. PO_4 shows very good positive correlation with Cu, Pb, Zn and Mn. It is concluded that municipal waste discharged into the river through drains is responsible for the higher values of heavy metals and PO_4, but in general Gomti river sediments can be termed as unpolluted with heavy metals.

KEYWORDS:Water Quality,Pollution,River, Gomti

Gomti is an alluvial plain river which originates from a swampy area in Pilibhit district and meets Ganga river in Ghazipur district, Uttar Pradesh. Three cities, Lucknow, Sultanpur and Jaunpur, are situated on the banks of this river. The entire Sultanpur municipal waste, including industrial and sewage wastes, flows into Gomti through small open drains or nalas. This waste alters the quality of the water, which in turn affects the associated sediments of the river. All fine-grained materials with large surface area are capable of accumulating heavy metal ions, Fostner and Whittmann (1979). Thus the clay fraction (i.e. <2 µm fraction) in a fluvial system is most affected by heavy metal pollution and may acquire a level that may adversely affect the food chain of the aquatic ecosystem. Some of the heavy metals in sediments, specially Pb, Hg, Cu and Cd, are potentially hazardous not only to the aquatic ecosystem but also for human use. In the light of these facts the present paper deals with heavy metal concentration in Gomti river sediments around Sultanpur.

MATERIALS AND METHODS

A stretch of 5 km of Gomti river was selected for the present study. Eight bank mud samples were collected in April 2012.

The <2 µm fraction was separated from the mud in sedimentation cylinders using double-distilled water at 24^0C. This fraction was then dried at 60^0C in a procelain dish. The dried sample (1 g) was digested in 10 ml of 65% pure conc. HNO_3 and heated on a sand bath for 2 h at 140^0C. After cooling it was made up to 50 ml and transferred to a plastic bottle. Suspended material was allowed to settle for 12 h. Heavy metals were determined using a Perkin Elmer atomic absorption spectrophoto-meter 3030. For determination of P, 10 ml of the solution was mixed with 3 ml $HCLO_4$ and heated for 5-6 h at 180^0C. After cooling 5 ml distilled water was added and the solution was made up to 50 ml. This solution (20 ml) was taken in a 50 ml flask and 10 ml HNO_3+vanadium molybdate reagent was added, and the solution made up to 50 ml. After 10 min absorbance measurements were taken on an Elko II colorimeter with an S 42 E (418 nm) filter. The results are correct to ±6%.

RESULTS AND DISCUSSION

The heavy metal content of the clay fraction of Gomti sediments is given in Table 1. The values for sample no. 1 (locality no. 1) are taken as background values for the respective metals for the present study. From locality no. 1 to locality no. 8 (sample no. 8) downstream, there is a slight increase in Cu, Mn, Zn, Pb, Cr and PO_4 concentration at locality no. 1 is only 0.5% and as the municipal waste is dumped into the river from different drains, it increase and reaches the maximum (1.83%) near locality no. 4. This increase in phosphate affects the quality of water as it causes rapid spread of flora, mostly algae, which results in depletion of oxygen content of the water. The highest

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concentrations of Mn, Zn and Pb were recorded near locality no. 6 and of Cr near locality no. 8. At present, no specific reason can be assigned for this increase.

Table 2 gives correlation coefficients for the data given in Table 1. PO_4 shows a very good positive correlation with Cu, Pb, Zn and Mn, suggesting that these metals might by linked to PO_4. The source of PO_4 has yet to be established but most probably it is linked to the municipal waste. Cr shows a good correlation with Zn while Pb shows good correlation with Zn, Cu and Mn. As municipal waste is the only source of pollution for the Gomti the relative increase in heavy metals and PO_4 in the sediments can be described to it. There is more or less no increase in Fe, Co and Ni. Cd is not within detectable limits. In comparison with world shale standard the Gomti clay fraction comparable values for Mn, Ni and Cr and low values for Cd and Fe. For Cu, Pb, Zn and Co the Gomti clay fraction has less than thrice the world standard shale values (table- 1), however, in comparison with the background values (in the present case values for sample no. 1 are taken as the background values), these are less than double. Only one sample (sample no. 4) shows PO_4 values more than thrice the background value.

Thus there is a definite increase in heavy metals and PO_4 in Gomti river sediments due to anthropogenic activity but in comparison with background values and world shale standard (Turekian and Wedepohl (1961) these sediments can be said to be unpolluted with heavy metals. A more than three-fold increase in PO_4, with which the heavy metals show good positive correlation, can be linked to organic pollution due to municipal waste discharged into the river. It is suggested that attempts should be made to minimize this by treating the municipal waste before it is dumped into Gomti river.

Table 1: Metal concentrations in clay fraction of Gomti river sediments

Sample No	(ppm)								%	%
	Cu	Mn	Cd	Zn	Co	Pb	Ni	Cr	Fe	PO_4
1	77	643	nd	144	32	38	73	83	0.37	0.50
2	94	897	nd	181	30	46	66	83	0.39	1.05
3	78	1014	nd	156	30	43	69	83	0.40	0.67
4	109	1115	nd	189	32	53	70	83	0.39	1.83
5	92	1082	nd	159	33	45	73	87	0.41	0.91
6	101	1165	nd	230	32	65	70	91	0.40	1.06
7	84	792	nd	164	30	46	67	83	0.39	0.80
8	104	1062	nd	193	29	53	73	94	0.38	0.80
Mean	92	974	nd	177	31	49	70	86	0.39	0.95
shale average	45	850	0.3	95	19	20	68	90	4.5	-

Table 2: Correlation coefficients for the data in table 1

	Mn	Zn	Co	Pb	Ni	Cr	Fe	PO_4
Cu	0.738	0.880	-0.075	0.879	0.049	0.463	0.024	0.814
Mn		0.690	0.350	0.710	0.208	0.572	0.564	0.754
Zn			-0.200	0.988	-0.073	0.600	0.049	0.730
Co				-0.139	0.387	-0.028	0.425	0.302
Pb					-0.093	0.538	0.074	0.763
Ni						0.562	-0.158	-0.222
Cr							0.168	0.178
Fe								0.358

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