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ASSESSMENT OF THE TOXIC EFFECT OF BRASS AND STEEL INDUSTRIES WASTE ON AQUATIC LIFE IN NEAR BY RAMGANGA RIVER

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ABSTRACT : Manufacturing process of brass and steel based on coal furnaces generate a lot of dangerous waste material containing ash and metals like Cu, Ni, Zn, Cr and Fe which are generally be dumped in the river & lakes available in the nearby areas. During the present investigations, we assessed the toxic effect of these metals on fishes in the river. At the place of waste dumping, the water become heavily polluted and even at nearly 50% concentration of these metals, there was no survival of fishes. The dumping of such highly toxic metals in the river disturbs the aquatic life and creates an ecological imbalance.
Key Words: River Water, Heavy Metal, Fish, Aquatic Life, Brass & Steel Industries

INTRODUCTION

Waste generation usually been affected by climate, degree of industrialization and economic development. Generally, the greater the economic prosperity and the higher percentage of urban population, the greater the amount of solid waste produced which is generally dumped in the nearby lakes and rivers.

Water is essential to all forms of life and makes up 50-96 % of the weight of all plants and animals. It is also a vital resource for agriculture, manufacturing and other human activities. In urban areas, the careless disposal of industrial effluents and other wastes may contribute greatly to the poor quality of the water.

Moradabad is a major city in Northern India and it situated at the banks of Ramganga River. Its altitude from sea level is about 670 feet and is at 28˚20', 29˚15' N and 78˚4', 79˚E. Moradabad,[1] also known as brass city of India, is the first important industrial city in the flow of Ramganga River has a large number of small-scale manufacturing units of brass and steel situated in the heart of the city where brass & steel bricks and sheets are manufacture. During manufacturing process, high temperature coal based furnaces used to melt the metal. After the completion of the process, large amount of ash, uncombused coal with small pieces of brass, steel and other chemicals are obtain as residue (waste)[2].

This waste is providing a good business opportunity to the people living in slums on the banks of Ramganga River. They used to collect this waste from industries at free of cost and grind it in grinding mills and convert it in the dust powder. Then they used to wash it a number of times in the river Ramganga and collect the metal in powdered form as the other part containing certain chemicals, metals and its salts dissolved in water. By doing so, they are severely polluting the river water and hence converting the water unfit for the survival of water animals [6].

A number of investigators (Sinha et al., 1995; Sinha et al., 2004; Prajapati et al., 2004; Kumar et al., 2010)[7,8] attempted before to check the quality of water but nobody tried to report the impact of washing waste on aquatic life in the river. In the present study, an assessment of the toxic effect of washing of brass & steel industries waste on aquatic life in Ramganga River have been investigated.

MATERIALS AND METHODOLOGY

The people who were washing this waste in the river and the concentration of copper, nickel, zinc, chromium, collect industrial waste in powdered form and iron, analyzed on AAS (Atomic Absorption Spectrophotometer, GBC make). All the samples safely collected as per standard procedure of sampling (APHA, 1995; Cahill 1769)[1].

The toxic test were conducted using fish and fish was acclimatized to the laboratory conditions for 5 days using diluents water prepared in the laboratory (Copperdhal,1976) the pH, hardness, temperature and conductivity of the diluents water was kept nearly the same as that of fresh river water [3]. Different metal concentrations adjusted with diluents water (100%, 50%, 25%, 10%, 1%) were taken separately in glass beaker (2Lit.) and acclimatized fish (4 each) were put in all the beakers. Before conducting the test, the fishes kept hungry for 48 hrs. The D.O. of all the diluents was kept around 5 mg/lit. and the tests were conducted continuously for 96 hrs (BIS Standards 1987) the solution containing metals Ni (4.4 mg/lit.) , Cr (2.3 mg/lit.), Cu (10.4 mg/lit.), Zn (20.3 mg/lit.) & Fe (16.4 mg/lit.) were investigate separately and in combination (1:1:1:1:1)[4].

RESULT AND DISCUSSION

The Ni, Cr, Cu, Zn, & Fe concentrations analyzed on AAS, which were 10.4 mg/lit, 4.4 mg/lit, 20.3 mg/lit, 2.3 mg/lit, 16.4 mg/lit. The attached Table 1 shows that in case of Cu, 50% survival after 96 hrs at 100% concentration.

In case of Ni, all the fishes died after 96 hrs and even at 10%, concentration there was no sign of survival. There was no major effect observed due to Zn, as nearly 75% of survival chances were there at 100% concentration. The survival is 25% after 96 hrs at 100% concentration shows that Fe is more toxic than Zn, which shows 75% survival chances after 96 hrs but it observed that Cr has most toxic effect in all the five metal, as there is no survival after 48 hrs. The above results clearly indicate the toxicity of these metals. However, 100% survival after 96 hrs in 1% concentration also observed. Cu, Zn, Ni, Cr, & Fe when mixed in (1:1:1:1:1) ratio shows a synergetic toxic effect. There was no survival of fishes at 100% & 50% concentration after 24 hrs. The survival was 25% in case of 50% concentration after 12hrs and even at 25%, concentration the survival was only 50% after 24 hrs.

Generally, brass industry waste contains Cu & Zn whereas steel industry contains Cr & Ni. An interesting feature of the above study is that the combined effect of Cu & Zn is less as

compared to Ni & Cr, which clearly indicate that steel industry waste has more toxic effect on aquatic life than brass industry waste

CONCLUSION

The above results show that out of five metal ions Cr & Ni are more toxic than Cu, Zn, Fe but when all the five metal solutions mix in (1:1:1:1:1) ratio toxicity of other metals was increased by 7 to 8 times. As all the above metals are present in industrial waste and continuously accumulated in river water, pollute the water severely and have toxic effect on aquatic life. The only solution of the problem is that Governments must do some honest and concrete efforts to stop this exercise of dumping and washing waste in rivers, and these industries should develop better R&D activities so that to adopt some different processes to minimize the waste production and ensure not to dump these waste materials in the rivers.

Table: Survival rates of fishes at various concentrations

S. No.	Metal Solution	Concentration %	No. of fish survived at different time interval(Hrs)				
			0	12	24	48	96
1.	Diluents water	100	--	--	--	--	--
2.	Cu Solution(10.4mg/lit)	100	--	--	--	3	2
		50	--	--	--	--	3
		25	--	--	--	--	--
		10	--	--	--	--	--
		1	--	--	--	--	--
3.	Ni Solution(4.4mg/lit)	100	--	--	3	1	None
		50	--	--	--	3	1
		25	--	--	--	--	3
		10	--	--	--	--	3
		1	--	--	--	--	--
4.	Zn Solution(20.3mg/lit)	100	--	--	3	3	3
		50	--	--	--	--	3
		25	--	--	--	--	--
		10	--	--	--	--	--
		1	--	--	--	--	--
5.	Cr Solution(2.3mg/lit)	100	--	--	2	None	None
		50	--	3	2	2	None
		25	--	--	--	2	2
		10	--	--	--	--	--
		1	--	--	--	--	--
6.	Fe Solution(16.4mg/lit)	100	--	--	--	3	1
		50	--	--	--	3	3
		25	--	--	--	--	--
		10	--	--	--	--	--
		1	--	--	--	--	--
7.	Ni , Cr , Cu, Zn , & Fe Solution (1:1:1:1:1)	100	--	2	None	None	None
		50	--	1	None	None	None
		25	--	--	2	2	1
		10	--	--	--	3	3
		1	--	--	--	--	--

- (--) means all survived.

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