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# Assessment of toxic effect of industrial effluent on aquatic life in the River Gagan at Moradabad-India

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## ABSTRACT

*The industrial effluent generally contains heavy metals like Ni, Cr and Cu etc., which are discharge into sewers, drains, fields and into rivers. During present investigation, the toxicity of industrial effluent was investigated using fish "Labeo Rohita" and was found that fish was unable to survive in 10% concentration of the effluent. A very interesting feature of the study was that when the pH of the effluent decreased the toxicity of the effluent increased several times. It also found by the study that among three metals (Ni, Cr and Cu) Chromium is more toxic than other two metals.*

**Keywords**: Industrial Effluents, Heavy Metals, Labeo Rohita Fish, Aquatic Life.

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## INTRODUCTION

On our planet, water is abundantly available, three fourth to earth's surface is covered by water. Water is essential to all forms of life and makes up 50- 97% of the weight of all plats and animals [1]. In urban areas, the careless disposal of industrial effluents and other wastes in rivers & lacks may contribute greatly to the poor quality of river water [2-5]. Most of the rivers in the urban areas of the developing countries are the ends of effluents discharged from the industries. African countries and Asian countries experiencing rapid industrial growth and this is making environmental conservation a difficult task [6]

Moradabad is a B-class city of Uttar Pradesh, having urban population more than 3.7 million and has seen rapid industrialization during last few decades. The city is full of brass, steel & glass cottage industries. A paper industry, some electroplating plants & other small-scale industries situated in Moradabad. The annual turn over of the city is nearly rupees 10,000 million. All these industries are in unorganized sector and thus have unplanned growth leaving to high degree of air, water and soil pollution. The most of the industries are dumping their effluents in two major rivers of the city- Ramganga River & Gagan River. The effluent containing heavy metals is largely the waste by – product of industrial process.

## MATERIALS AND METHODS

The samples collected at two different sites.
***Site-1:*** Untreated Cu, Ni, & Cr effluents were colleted from the industry situated near the Gagan river which continuously discharging effluents into the river. The samples of effluents collected before mixing in the river.

***Site- 2:*** Effluents sample carrying mixed discharge of industries & nearby locality after mixing with river water were collected at site II that is almost 2 kilometer far from the site-1.

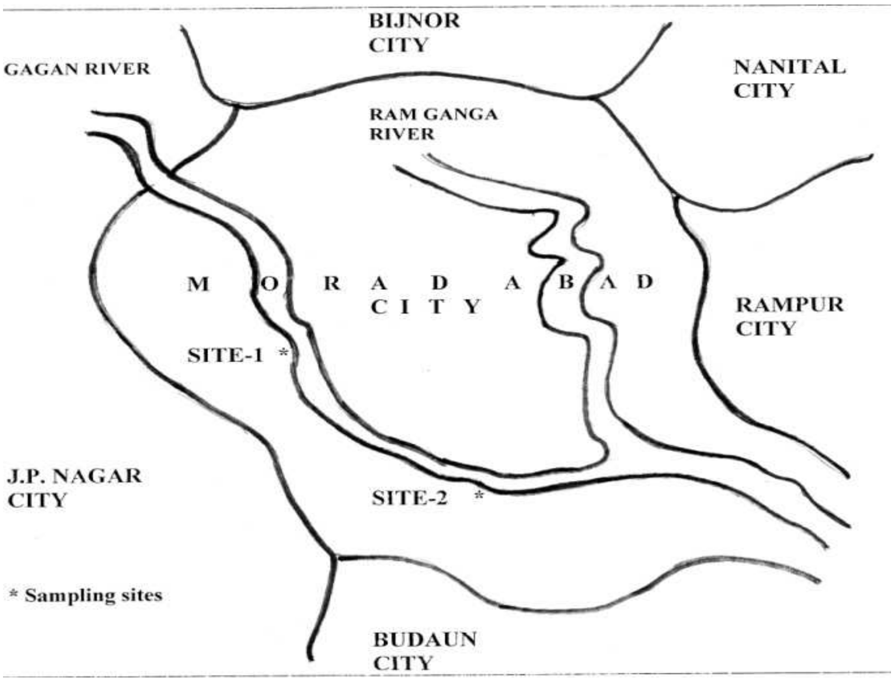


**Fig.1: Map of sampling sit**

Map of sampling sites is shown in Fig. 1. All the samples collected following standard procedure of sampling [8]. The toxicity test were conducted using "Labeo Rohita" (Hamilton) was acclimatized to the laboratory conditions for two weeks using diluents water prepared in the laboratory [9]. The fish fed daily with a commercial food (crude protein 30%, crude lipid 8.0%, ash 8.5%, carbohydrate 45.7%, and moisture 7.8%) at a rate of 2% body wt. per day. The D.O. of the diluents water kept between 4.5-5.0 mg/lit [10]. The pH, hardness, alkalinity, Conductivity, COD of the diluents water kept almost same as that of fresh river water.

Different solution of effluents were prepared with diluents water (100%, 50%, 25%, 10%) and were taken separately in 5 lit capacity glass Jars and acclimatized fish (6 each) were put in all beakers. Before conducting the tests, the fish kept hungry for 24 hrs.

The acclimatized fish also kept in diluents water as control. The test conducted continuously for 96 hrs. The metal (Ni, Cu, and Cr) concentration in effluents analyzed on AAS (Atomic absorption spectrophotometer) and the pH measured directly either in the effluent or in the river using a pH-meter. Table-1 shows a variation in both concentration and pH in sample collected from site-1 and site-2.

**Table 1: Site wise estimation of Cu, Ni & Cr metals in industrial effluents mixing in Gagan river (mg/lit)**

| S.No. | Metal | Site-1 (At the discharging source) | Site-2 (After mixing in river) |
|---|---|---|---|
| 1. | Copper(Cu) | 42.0 | 0.478 |
| 2. | Nickel(Ni) | 12.0 | 0.122 |
| 3. | Chromium(Cr) | 19.0 | 0.329 |

## RESULTS AND DISCUSSION

The findings of all the experiments summarized in Table 2. In case of Cr, it is clear from the table that all the six fishes died immediately after their transfer to the effluents. Even in case of 10% concentration of effluents sample, no fish survived after 24 hrs. It clearly indicates the toxicity of Cr metal.

In the present investigation, it observed that survival is 70% after 24 hrs, 50% after 48 hrs and no survival after 96 hrs in undiluted sample containing Ni metal ion and it established that Ni has lesser toxicity than Cr. However, 50% of survival observed at 50% concentration at 96 hrs. 80% survival after 96 hrs in undiluted sample containing Cu metal ion observed during the investigation established that Cu has very less toxic effect as compared to Ni & Cr.

Ni, Cr & Cu when mixed in 1:1:1 ratio shows a synergetic toxic effect. There was no survival immediately after transfer of fish at 100% concentration and 50% survival at 50% concentration. There was no survival in case 25% concentration & 10% concentration after 48 hrs of transfer of the fishes to the effluent, 70% survival observed after 48 hrs of transfer of fishes to the river water effluent collected from the site-2. This river water has very small concentration of Ni, Cr & Cu but still showing severe toxic effect as only 2% survival observed after 96 hrs.

**Table 2: Survival rates of fishes at various concentrations at different pH**

| S.No. | Solution | Concentration % | pH | No. of fish survived at different time interval | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | **0** | **12** | **24** | **48** | **96** |
| 1. | Diluents water | 100 | 8.5 | ** | ** | ** | ** | ** |
| 2. | Copper effluent (42 mg/lit) | 100 | 8.5 | ** | ** | ** | ** | 5 |
| | | 50 | | ** | ** | ** | ** | 5 |
| | | 25 | | ** | ** | ** | ** | ** |
| | | 10 | | ** | ** | ** | ** | ** |
| | | 1 | | ** | ** | ** | ** | ** |
| 3. | Nickel effluent (12 mg/lit) | 100 | 8.5 | ** | ** | 4 | 3 | None |
| | | 50 | | ** | ** | 5 | 5 | 3 |
| | | 25 | | ** | ** | ** | 4 | 4 |
| | | 10 | | ** | ** | ** | ** | 5 |
| | | 1 | | ** | ** | ** | ** | 5 |
| 4. | Chromium effluent (19 mg/lit) | 100 | 8.5 | None | | | | |
| | | 50 | | 5 | None | | | |
| | | 25 | | ** | 5 | None | | |
| | | 10 | | ** | ** | None | | |
| | | 1 | | ** | ** | 4 | 3 | 2 |
| 5. | Copper, Nickel & Chromium effluent (1:1:1) | 100 | 8.5 | None | | | | |
| | | 50 | | 3 | None | | | |
| | | 25 | | ** | 4 | 2 | None | |
| | | 10 | | ** | ** | 4 | None | |
| | | 1 | | ** | ** | ** | 5 | 5 |
| 6. | Copper effluent | 100 | | ** | ** | ** | 5 | 4 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | (0.478mg/lit) | 50 | 5.5 | ** | ** | ** | ** | 5 |
| | | 25 | | ** | ** | ** | ** | ** |
| | | 10 | | ** | ** | ** | ** | ** |
| | | 1 | | ** | ** | ** | ** | ** |
| 7. | Nickel effluent (0.122mg/lit) | 100 | 5.5 | ** | 4 | 4 | 3 | None |
| | | 50 | | ** | ** | 5 | 4 | 2 |
| | | 25 | | ** | ** | 4 | 4 | 3 |
| | | 10 | | ** | ** | ** | 5 | 5 |
| | | 1 | | ** | ** | ** | ** | 5 |
| 8. | Chromium effluent (0.329mg/lit) | 100 | 5.5 | None | | | | |
| | | 50 | | None | | | | |
| | | 25 | | 4 | 2 | None | | |
| | | 10 | | ** | 4 | None | | |
| | | 1 | | ** | 5 | 3 | 2 | 2 |
| 9. | Copper, Nickel & Chromium effluent (1:1:1) | 100 | 5.5 | None | | | | |
| | | 50 | | None | | | | |
| | | 25 | | ** | 3 | 2 | None | |
| | | 10 | | ** | 4 | 2 | None | |
| | | 1 | | ** | 4 | 4 | 3 | 2 |
| 10. | River water containing effluent | 100 | 5.5 | ** | ** | 5 | 3 | 1 |

***All survived*

## CONCLUSIONS

It is evident from the present investigation that among three metals Cr is more toxic and but when all the three metal effluents mixed in 1:1:1 ratio the toxicity of other two metals (Ni & Cu) increased served times (Table-2). As all the above metals are present in industrial waste and continuously accumulated in river water, pollute the water severely and have toxic effect an aquatic life.

The above results also shows that the Cr toxicity in enhanced at lower pH- 5.5 [Table-2]. This result is in agreement with the already established toxicity [11] who reported that high Cr accumulation occurred at lower pH- 6.5 that of high pH- 7.8. It also established by the present investigation that as the pH decreases the toxicity of all the metal increases. The decrease in the pH of river water indicate that it is not only contaminated by heavy metal effluents also there are several other polluted material like sewage waste, municipal waste & other local water decreasing the pH of river water & it increases the accumulation of heavy metal in aquatic life. The only solution of the problem is that Governments must do some honest and concrete efforts to stop this exercise of mixing untreated industrial effluents 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 mix these effluents in the rivers.

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