EXTRACTION OF HEAVY METAL CONCENTRATION IN GANGA RIVER, THROUGH LOTUS AND EDTA

Amrita Srivastava*, Shikha Modi1, Sunil Kumar1

1Department of Environmental Engineering, Jagan Nath University, Jaipur (Raj), India.

ABSTRACT

A preliminary investigation of heavy metal pollution in the Ganga River in Kanpur with the focus on phytoremediation with chemical was conducted. Nelumbo nucifera chosen for treatment due to their wide distribution and apparent ability to accumulate heavy metals in aquatic ecosystems. This process also enhanced by a chemical used that is EDTA known as Chelating agent. In this Experiment this is clear Aquatic Plants are good absorber of heavy Metals from Waste water and some Chemicals also helped in this process.

Keywords: EDTA (ethylenediaminetetraacetic acid), Nelumbo Nucifera (lotus), Chelating agent.

INTRODUCTION

Ganga flows southeast through the Indian states of Uttar Pradesh, Bihar, and West Bengal. In central Bangladesh it is joined by the Brahmaputra and Meghna rivers. Their combined waters (called the Padma River) empty into the Bay of Bengal and form a delta 220 mi (354 km) wide, which is shared by India and Bangladesh. It’s plain is one of the most fertile and densely populated regions in the world [1]. In the Uttarakhand Himalayas, where glacial water flowing from a cave at Gaumukh, is the origin of the Bhogirathi river. Gaumukh has been described as a desolate place at an altitude of about 4,000 meters (13,000 feet). Twenty-three kilometres from Gaumukh, the river reaches Gangotri, the first town on its path. Thousands of visitors come to Gangotri each year, from every part of the world [6]. The river which joins the Alaknanda river at Devprayag also in the Uttarakhand Himalayas, to form the Ganga.

The Ganges alone drains an area of over a million square km with a population of over 407 million. Millions depend on water from the holy river for several things: drinking, bathing, agriculture, industry and other household chores [5].

After flowing 250 kilometres (160 mi) through its narrow Himalayan valley, the Ganges emerges from the mountains at Rishikesh, then debouches onto the Gangetic Plain at the pilgrimage town of Haridwar. At Haridvar, a dam diverts some of its waters into the Ganges Canal, which irrigates the Doab region of Uttar Pradesh, whereas the river, whose course has been roughly southwest until this point, now begins to flow southeast through the plains of northern India.

The Ganges Basin with its fertile soil is instrumental to the agricultural economies of India and Bangladesh. The Ganges and its tributaries provide a perennial source of irrigation to a large area [14]. Chief crops cultivated in the area include rice, sugarcane, lentils, oil seeds, potatoes, and wheat. Along the banks of the river, the presence of swamps and lakes provide a rich growing area for crops such as legumes, chillies, mustard, sesame, sugarcane, and jute. There are also many fishing opportunities to many along the river, though it remains highly polluted. Kanpur, largest leather producing city in the world is situated on the banks of this river [2].

The major polluting industries on the Ganga are the leather industries, especially near Kanpur, which use large amounts of chromium and other toxic chemical waste, and much of it finds its way into the major flow of the Ganga. From the plains to the sea, pharmaceutical companies, electronics plants, textile and paper industries, tanneries, fertilizer manufacturers and oil refineries discharge effluent into the river. This hazardous waste includes hydrochloric acid, mercury and other heavy metals, bleaches and dyes, pesticides, and polychlorinated biphenyls highly toxic compounds that accumulate in animal and human tissue.

The tanning industry discharges different types of waste into the environment, primarily in the form of liquid effluents containing organic matters, chromium, sulphide ammonium and other salts.

*Corresponding Author www.ijesr.org

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The main purpose of this paper is to introduce a method of extraction of heavy metals from the waste water by the help of biological and chemical methods.

**EXPERIMENTAL**

Water samples collected from two sampling sites

1. Industrial Area of Jajmau (a) sample from river bank (b) sample from mid stream.
2. Non Industrial area Bithoor (a) sample from river bank (b) sample from mid stream.

All water samples were brought to the laboratory and preserved with HNO₃ for the analysis of heavy metals. Water samples were digested with 10ml of concentrated HNO₃ until the solution become transparent. For the estimation of metals 100ml of water sample was digested with concentrated nitric acid (10 ml), cooled and filtered through Whatman No. 42 filter paper. The volume was made up to 10 ml with 0.1N nitric acid. The samples were analyzed by AAS. For the extraction of heavy metals from the water used plant that is Lotus (Nelumbo nucifera) applied in the sample for the 20 days after 20 days sample were analysed and assessed about the reduction of heavy metals by the lotus (phytoremediation process). After this analysis a chelating agent EDTA used for the increasing rate of absorption of heavy metal. 1 gm/l EDTA used in every sample already going on phytoremediation process. After 20 days of addition of chelating agent sample was again analyzed.

**RESULT & DISCUSSION**

The quality of Ganga water in Kanpur is mainly affected by industries residing on the bank of river and other domestic wastes released from the commercial area of Kanpur. Heavy metals released from industries mainly tanneries where it used for the manufacturing of leather goods. Heavy metals seriously injured metabolism of living beings. In many researches it proves that the people residing on the river bank just nearer to industries seriously affected by diseases caused by heavy metals.

Sampling site-

1. Sample from River bank of **Industrial Area** (A1)
2. Sample from mid stream of River **Industrial Area** (B1)
3. Sample from River bank of **Commercial Area** (A2)
4. Sample from mid stream of River of **Commercial Area** (Bithoor) (B2).

<table>
<thead>
<tr>
<th>S.No.</th>
<th>Heavy Metal</th>
<th>Before Absorption (microgram/l)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td><strong>Industrial area</strong></td>
</tr>
<tr>
<td></td>
<td></td>
<td>A1</td>
</tr>
<tr>
<td>1</td>
<td>Zn</td>
<td>210</td>
</tr>
<tr>
<td>2</td>
<td>Pb</td>
<td>690</td>
</tr>
<tr>
<td>3</td>
<td>Cd</td>
<td>32</td>
</tr>
<tr>
<td>4</td>
<td>Cu</td>
<td>110</td>
</tr>
</tbody>
</table>

The chart shows the concentration of heavy metals in Ganga river in Kanpur (U.P. India). The above data also helps to show the difference in concentration of heavy metals from mid stream to river bank of water, there is small difference in mid stream and river bank sample of same sampling site but there is a great fluctuation assessed from the sampling site near industrial area and the sampling site apart from industrial area. This result may be shown because of the waste discharge from the industries is untreated and this may alter the quality of river water.
**Table 2: Heavy Metal Concentration (microgram/l) and treatment with plant Lotus**

<table>
<thead>
<tr>
<th>S.No.</th>
<th>Heavy metal</th>
<th>Industrial Area (River Bank)</th>
<th>Industrial Area (Mid Stream)</th>
<th>Commercial Area (River Bank)</th>
<th>Commercial Area (Mid Stream)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Zn</td>
<td>210</td>
<td>200</td>
<td>225</td>
<td>210</td>
</tr>
<tr>
<td>2</td>
<td>Pb</td>
<td>690</td>
<td>650</td>
<td>700</td>
<td>680</td>
</tr>
<tr>
<td>3</td>
<td>Cd</td>
<td>32</td>
<td>26</td>
<td>36</td>
<td>32</td>
</tr>
<tr>
<td>4</td>
<td>Cu</td>
<td>110</td>
<td>90</td>
<td>115</td>
<td>93</td>
</tr>
</tbody>
</table>

**Fig 1: Heavy metals in Industrial area and commercial area**

**Fig 2: Absorption of Zn by Lotus**
Fig 3: Absorption of Pb by Lotus

Fig 4: Absorption of Cd by Lotus

Fig 5: Absorption of Cu by Lotus
Table 3: Heavy Metal Concentration (microgram/l) and treatment with plant and chemical (Plant used Lotus and chemical used EDTA)

<table>
<thead>
<tr>
<th>S.No.</th>
<th>Heavy metal</th>
<th>Industrial Area (River Bank)</th>
<th>Industrial Area (River Bank)</th>
<th>Commercial Area (River Bank)</th>
<th>Commercial Area (Mid Stream)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>A1 Absorption Before</td>
<td>A10 After using</td>
<td>A10 Absorption (Lotus)</td>
<td>EDTA After using</td>
</tr>
<tr>
<td>1</td>
<td>Zn</td>
<td>210</td>
<td>200</td>
<td>195</td>
<td>225</td>
</tr>
<tr>
<td>2</td>
<td>Pb</td>
<td>690</td>
<td>700</td>
<td>600</td>
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<td>36</td>
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<td>32</td>
</tr>
<tr>
<td>4</td>
<td>Cu</td>
<td>110</td>
<td>115</td>
<td>80</td>
<td>85</td>
</tr>
</tbody>
</table>

Fig 6: Absorption of Zn by EDTA
Fig 7: Absorption of Pb by EDTA

Fig 8: Absorption of Cd by Lotus
The above data shows the different concentration of heavy metal in Industrial area and commercial area. This above data also shows the rate of absorption of plant applied in both industrial sample water as well as the commercial water sample in next step a chemical used which is known as a chelating agent that is EDTA, here we have seen EDTA with plant increase the rate of absorption reaction. This is a positive response for the waste water treatment process.

Table 4: Average (samples collected from River bank and mid stream in both sampling site): C=n samples from river bank+ mid stream

<table>
<thead>
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<th>S.No</th>
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<th>Industrial Area</th>
<th>Commercial Area</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Before Absorption</td>
<td>After Absorption (by Lotus)</td>
</tr>
<tr>
<td>1</td>
<td>Zn</td>
<td>217</td>
<td>205</td>
</tr>
<tr>
<td>2</td>
<td>Pb</td>
<td>695</td>
<td>675</td>
</tr>
<tr>
<td>3</td>
<td>Cd</td>
<td>34</td>
<td>29</td>
</tr>
<tr>
<td>4</td>
<td>Cu</td>
<td>113</td>
<td>91</td>
</tr>
</tbody>
</table>
The above diagram shows the concentration of heavy metal present in the samples taken from Industrial area of Kanpur and Commercial area of Kanpur and both samples are treated by Nilocbo nucifera (Lotus) in first step which shows a great response in absorption of heavy metals. Lotus is an ornamental plant and also used for the worship of god but it shows a great response in absorption of lead from the water sample the performance of lotus is also increased whenever it applied with a chemical that is EDTA it works just as a chelating agent and also increases the rate of absorption. EDTA is one of them it helps to increase the rate of absorption of heavy metals in waste water so that with the help of this experiment we conclude that ornamental plants having great efficiency for heavy metal extraction if industries plants such kind of plants in their waste disposal sites its very effective the extraction of heavy metals from the waste released from the industries as well as it gives a great look to the industries.

Above result shows the industries lying in to Kanpur is very much responsible for the heavy metal concentration found in Ganga river water. There is also difference found in concentration of metal from river bank to mid stream but this is not very much excessive this assessed difference is very much nominal. Heavy metals in water cause many serious biochemical problems in human being.

This experiment was done for the better extraction of heavy metals by the help of plant into the water as well as soil also here the result shows ornamental plants having great capability to metal extraction from the waste water. Some chemicals are used as a chelating agent they also increase the rate of reaction EDTA is one of them it works just as a chelating agent and also increases the rate of absorption of heavy metals in waste water so that with the help of this experiment we conclude that ornamental plants having great efficiency for heavy metal extraction if industries plants such kind of plants in their waste disposal sites its very effective the extraction of heavy metals from the waste released from the industries as well as it gives a great look to the industries.

Here the Ornamental plant used that is lotus and lotus is a aquatic plant it mostly used in the worship and having a bushy characters. The bushes of lotus having spaces and these spaces helps to plant for transportation of material such as food and water whenever it applied in waste water these bushes also translocate the Heavy Metal and when EDTA applied in the sample the rate of absorption increases and translocation of heavy metal increased from there normal rate.
REFERENCES


