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# Purification of Noyyal River by using phytoremediation technology

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## ABSTRACT

***Noyyal River is one of the highest polluting rivers in India and heavy metals present in river water is out of standard level. The effluent water of textile industries and spinning mills present in Trippur district discharged into the Noyyal River which polluted the Noyyal River. Because of this contamination affects the crop yields and human health. But purification of River Noyyal by using physical and chemical methods are highly expensive and complicated. In this study phytoremediation technology used for the purification of Noyyal river. Lesser Indian reedmace (Typha Angustifolia) serve as a phytoremediation plant which helps in the cleaning up of contamination from the polluted river. The test results show that after phytoremediation treatment COD, BOD, cadmium, chromium, lead, zinc, copper and mercury level gradually reduced within 0 to 15 days interval. Lesser Indian reed mace plant easily grows in the banks of the river. If plantation of Lesser Indian reedmace planted in banks of the river which helps on the removal of heavy metals present in the water gradually. From the result, it can be concluded that the phytoremediation technology is suited for purification of Noyyal River.***

***Keywords***— *Noyyal River, Phytoremediation technology, Typha Angustifolia, Lesser Indian reed mace*

## 1. INTRODUCTION

River Noyyal is a small river and major tributary of River Cauvery in Tamil Nadu. It rises from vellingiri hills in the Western Ghats and flows through the Coimbatore, Trippur district and finally draining into the Noyyal in Karur district. The length and width of the river basin are 180 km and 25 km respectively. Noyyal River irrigated 100 villages throughout both sides of the river bank. Tirupur textie industry effluents are directly disposed of in Noyyal River which contains various toxic chemicals and metals. Because of this pollutant mixed in the Noyyal River, it increases the salinity, sodicity content and heavy metals which is a threat to crop yields if used in irrigation and human diseases. So, nowadays the purification of Noyyal River is a very important one.

Phytoremediation is a bioremediation process that uses various types of plants to remove the contamination of water and soil. Phytoaccumulation (or) Phytoextraction is the process of absorption of pollutants by plant roots and stored in leaves and stems. It is the best method for absorbing heavy metals and salinity compared to other physical and chemical method. In this process lesser Indian reed mace (Typha *Angustifolia*) used as a phytoremediation plant in the river by using the floating bed in the river. Lesser Indian Reed mace is a perennial plant breeding in shallow water of pond or river side. In this Phytoremediatoion technology is much cost effective as it doesn't require the procurement of huge equipment.

**Fig. 1: Polluted Noyyal River in Tamil Nadu**

 

## 2. MATERIALS AND METHODS

The water sample is collected from three places in Noyyal River at Orathupalayam, Chinnamuttur and Noyyal. The water sample of the river has been collected in plastic cans and carried to the lab. The temperature of the sample is maintained at 4ºc. The initial characteristics of the river sample were done by the standard methods. After plantation again water samples are collected in the same place at 10 days, 20 days and 30 days range. Finally, the effects of phytoremediation technology in polluted water are calculated. pH meter, a buffer solution of known pH value, turbidity meter, formazin polymer standards, sodium hydroxide titrant, phenolphalein Indicator, Methyl Orange Indicator, manganese sulphate, sodium thiosulphate solution, ferrous ammonium sulphate, ferrain indiacator and hydrogen peroxide was used. For phytoremediation experiments, lesser Indian reed mace was used for absorption of pollutants and heavy metals. Palm tree bark was used as a bed for farming of lesser Indian reed mace.

**Fig. 2: Lesser Indian reed mace**

## 3. EXPERIMENTAL STUDY

### 3.1 Phytoremediation treatment

In the phytoremediation process, the green plants extract, sequest and reduce the toxic pollutants present in the water and soil and stored the pollutants in stem and leaves. *Typha Angustifolia* (lesser Indian reed mace) plants are highly tolerant to toxic heavy metals present in water and soil.

Phytoremediation treatment was performed in the middle and banks of the polluted river using palm tree barks. The palm tree barks were floated in the river by using rope and stone as an anchor. Initially, the mixer of river sand and cow dung were spread in the group palm bark. Then healthy Lesser Indian reed mace seeds or crops were planted in the bark. After plantation, the palm tree barks with sapling were safely fixed as a floating bed in the middle of the river.

### 3.2 Experimental setup of Phytoemediation

The four or five dried palm tree barks were tied as a bed by using rope. The 3:1 ratio of river sand and cow dung spread on the bed in the 5 cm thickness. A 50gm of healthy dried lesser Indian reed mace were mixed in the sand mix. The required water is sprinkled above the bed whenever necessarily. The temperature is maintained at $25^0$. After 30 days, the saplings were growing healthy between the heights of 5 cm to 10 cm.

The bed is carefully carried into the river and placed in the middle of the river by the help of stone as an anchor. The same setup is placed in three places such as Chinnamutur, Noyyal and Orathupalayam. The water sample is taken within the time of 5 days, 10 and 15 days and tested in the laboratory. The Noyyal River has been standard limits of TDS, pH and turbidity, ZINC. So, we are only concentrated in the heavy metals present in the river.

**Fig. 3: Flotting bed setup**

## 4. RESULTS AND DISCUSSION

**Table 1: Initial characteristics of Noyyal River**

| S. no. | Parameters | Chinnamutur | Orathu Palayam | Noyyal | Standard permissible limits |
|---|---|---|---|---|---|
| 1 | $P^H$ at 25ºc | 7.10 | 7.70 | 7.30 | 6.5-8.5 |
| 2 | Colour | Light brown | Slight blackish | Light brown | clear |
| 3 | Odour | None | Odorous | odourless | odourless |
| 4 | COD (mg/l) | 26.4 | 42.3 | 21.4 | 10 (WHO) |
| 5 | BOD (mg/l) | 17.9 | 24.57 | 8.47 | 5-(WHO) |

 

| | | | | | |
|---|---|---|---|---|---|
| 6 | Turbidity (NTU) | 3.65 | 4.50 | 3.12 | 2.5 (WHO) |
| 7 | Alkalinity total | 176.54 | 256.65 | 137.60 | 500 (WHO) |
| 8 | TDS (mg/l) | 1865 | 2497 | 1459 | 500 (WHO) |
| 9 | Cadmium (mg/l) | 0.78 | 1.04 | 0.64 | 0.01 (IS: 10500) |
| 10 | Zinc (mg/l) | 2.63 | 2.92 | 2.40 | 5 (IS: 10500) |
| 11 | Copper (mg/l) | 0.89 | 1.29 | 0.628 | 0.05 (IS: 10500) |
| 12 | Mercury (mg/l) | 0.003 | 0.010 | 0.005 | 0.001 (IS: 10500) |
| 13 | Lead (mg/l) | 0.67 | 1.11 | 0.51 | 0.1 (IS: 10500) |
| 14 | Chromium (mg/l) | 1.90 | 2.98 | 1.76 | 0.05 (IS: 10500) |

From this initial characteristics of Noyyal River shows that TDS, COD, BOD, chromium, copper, cadmium, lead and mercury greater than the maximum limits of standard level.

The following charts are given the results of effect on the TDS, COD, BOD, chromium, copper, cadmium, lead and mercury by using phytoremediation technology.

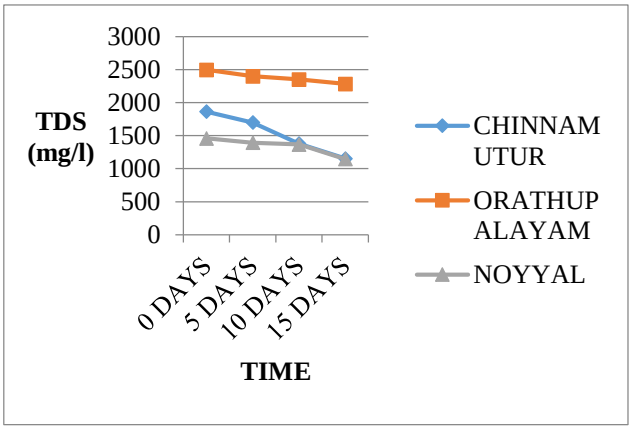


**Fig. 4: Effect Of TDS on phytoremediation treatment**

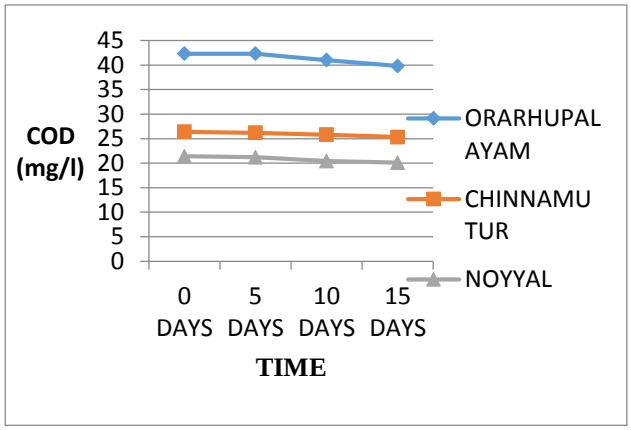


**Fig. 5: Effect of COD on phytoremediation treatment**

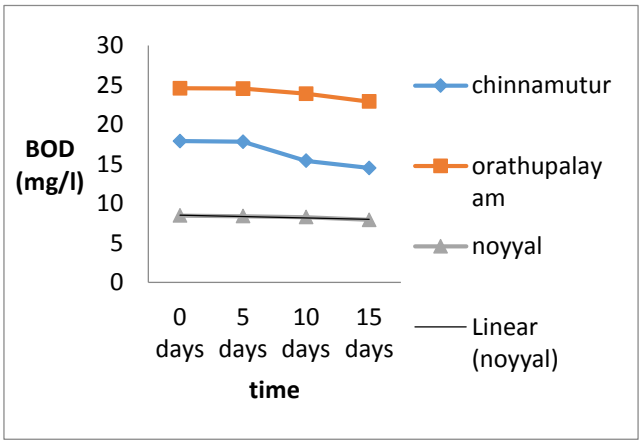


**Fig. 6: Effect Of BOD on phytoremediation treatment**

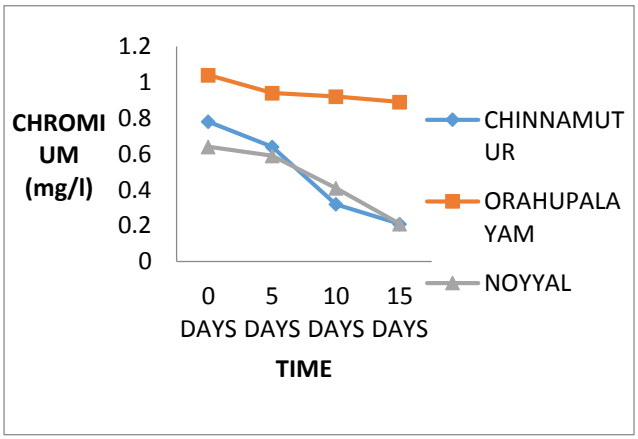


**Fig. 7: Effect of Cr on phytoremediation treatment**

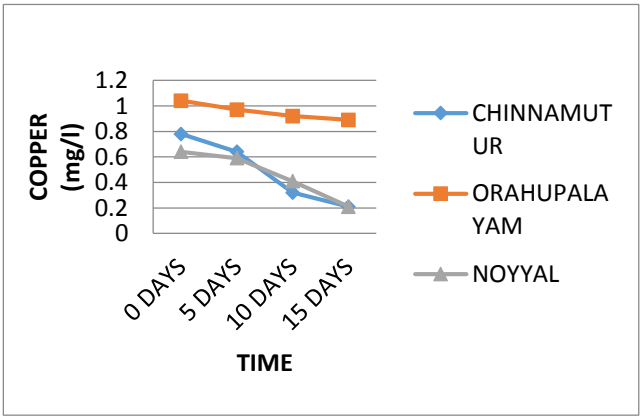


**Fig. 8: Effect Of Cu on phytoremediation treatment**

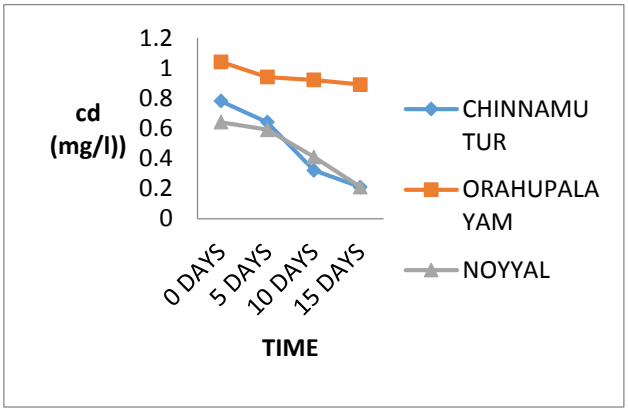


**Fig. 9: Effect Of Cd on phytoremediation treatment**

 

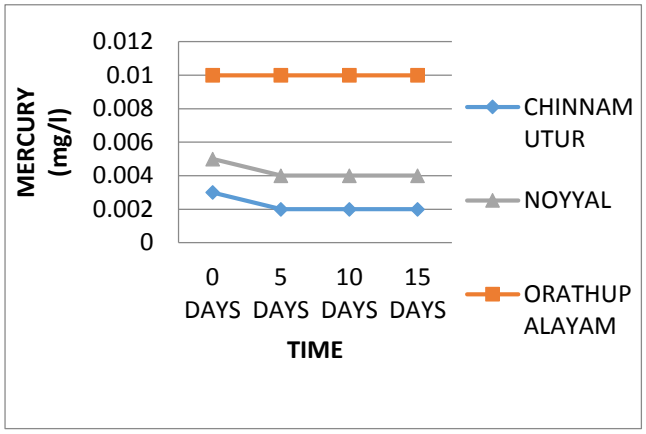


**Fig. 10: Effect Of Hg on phytoremediation treatment**

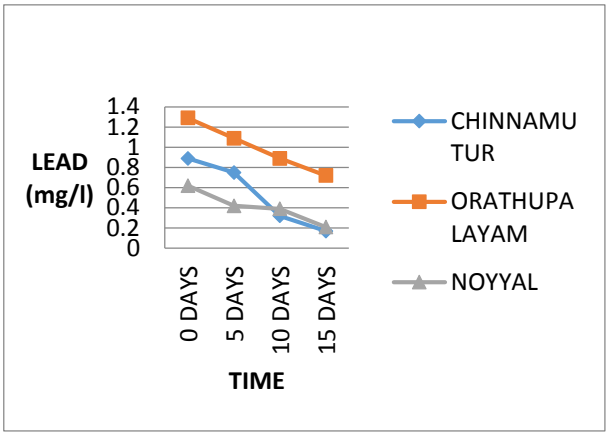


**Fig. 11: Effect Of Pb on phytoremediation treatment**

From the chart values, it is found that COD, BOD, chromium, copper, cadmium, lead and mercury are gradually reduced by using in this technology

## 5. CONCLUSION

Based on the experimental and analytical investigation, the following conclusions were made:

- The results obtained from the present laboratory tests reveal that the phytoremediation technology by using Lesser Indian reed mace can gradually reduce the polluted Noyyal River. The test results show that after treatment COD, BOD, cadmium, chromium, lead, zinc, copper and mercury level gradually reduced within 0 to 15 days interval.
- Lesser Indian reed mace plant easily grows in banks of the river. If plantation of Lesser Indian reed mace planted in banks of the river which helps on the removal of heavy metals present in the water gradually. From the result, it can be concluded that the phytoremediation technology is suited for purification of Noyyal River.

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