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THE RESPONSE OF *CHARA* AND *OSCILLATORIA* TO REMOVE Ni (II) IONS FROM INDUSTRIAL WASTE WATER

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ABSTRACT

A blue green algae *Oscilfaloria* sp. and green algae C*hara* sp. have been used in the present study to asses their *ability to* remove Ni (II) ions from effluent having high concentration of Ni and the effect of this metal on dry matter content of the algae. *Oscillatoria*, being blue green algae can efficiently remove/ uptake Ni (II) ions than *Chara* from the industrial waste water. The metal concentration in the effluent and the dry matter content of both the algae are negatively correlated.

INTRODUCTION

Due to recent industrial revolution and developments in the field of science and technology, a large number of chemical compounds have been introduced into the environment. This has increased the occurrence of water pollution problems many fold because of the ultimate disposal of untreated or partially treated effluents and industrial waste into aquatic ecosystem (Agrawal and Kumar 1978, Ahluwalia and Arora 1986)

Algae constitutes a strategic component of aquatic environment, producing oxygen for other aquatic biota and oxidation organic materials present in the effluents/wastes, thereby making the waste water more favorable for use.

The increasing use of Nickel for many purposes makes it a highly relevant metal in connection with water pollution problems. Nickel is considered to be moderately toxic to algae (Skaar et al; 1974). Effluents from electroplating plants normally contain objectionable quantities of copper, lead. zinc, nickel, cadmium, cyanides, oil, grease etc. (Ramaswamy and Somashekar 1982) Physicochemical treatment of these effluents are energy and cost intensive while biological treatment using natural biological population like algae, fungi, bacteria etc are not only cost effective but a vital process to abate pollution.

Some work in this area had been carried out using cyanobacteria like *Anabaena torulosa* and *Anabaena cylindrica* which were proved the most efficient algae to remove Ni (II) ions from waste water (Verma, *et. al*. 1996). Very few reports are available on the uptake abilities of *Oscillatoria* and other algae. Hence we made an effort to check the efficiency of *Oscillatoria* sp. and *Chara* sp. to remove Ni (II) ions from the industrial effluents.

MATERIAL AND METHOD

The alga, *Oscillatoria sps*. was collected in a pure form from roadside ditches in the month of April and was cultured in AA medium (Allen and Arnon , 1955). The other plant, *Chara sps.* was collected and was cultured in an aquaria.

Ni (II) ions removal

The industrial effluent containing Ni (1 1) ions was procured from Elnico electroplating industry. G1DC, vitthal Udhyognagar, Anand. Various physico-chemical parameters of the effluent were analyzed as well as Ni (II) concen-
trations was determined on Atomic Absorption Spectrophotometer (GBC-911XAPHA-AWWA-WPCF, 1981).The effluent contained 50 ppm Ni.Considering this as a stock, i. e.1, 5,10, 30, 40 and 50 ppm were prepared. Healthy filaments of *Oscillatoria* were transferred in flasks containing these concentrations of Ni along with the culture medium. A blank was kept for comparison same method was employed for *Chara* sps.The sets were run for 7 days. After 7 days, the metal ion concentration in both these algae was determined by the difference in the initial and final concentration of Ni on Atomic Absorption spectrophotometer (Verma *et al*., 1996). Another set for both the algae was simultaneously run to determine changes in the dry matter content when they were exposed to varying doses of Ni (II) ions (Kaushik 1987).

RESULTS AND DISCUSSIONS

The physico-chemical characteristics of the effluent is shown in Table. The metal ion concentrations in the medium and changes in dry mass of the algae *Oscillatoria sps*. and *Chara sps*. are shown in **Fig. 2 and 3.**

Table 4 and 5 depict accumulation removal of Ni (II) ions by *Oscillatoria sps* and Chara sps from the effluent.

Oscilltoria sps.

An increase in the %metal ion removal by the algae with increasing metal concentrations in the effluent after 7 days was found. For 1 ppm concentration, % metal removal was 65% and for 5, 10 and 30 ppm they were 64%, 60% and 67% respectively. After that, marked increase in the removal was reported. The algae was able to remove almost 79-80% Ni (11) ions when the concentrations were 40 and 50 ppm. The average removal capacity was about 80%.

Table - 1
Physico-chemical characterisation of the effluent collected from eletroplating industry

Parameter	Value
pH	7.11
Colour	pale green
Conductivity	9.07 ms
Total dissolved solids	5450 mg/L
Alkalinity	650 mg/L
Total hardness	5100 mg/L
Chloride	16152.6 mg/L
Nickel	50 ppm
Copper	2.47 ppm
Zinc	2.25 ppm
Cadmium	Nil
Lead	Nil

Table - 4
Percent removal of Ni (II) ions from the effluent by *Oscillatoria sps.*

Initial conc.of Ni in ppm	Final conc of Ni remained in the medium	% removal after 7 days
control	0.00	0.00
1	0.65	65
5	3.2	64
10	6.00	60
30	20.2	67
40	32.2	80
50	39.85	79.7

Table - 5
Percent removal of Ni(II) ions from the effluents by *Chara sps*.

Initial conc.of Ni in ppm	Final conc of Ni remained in the medium	% removal after 7 days
control	0.00	0.00
1	0.74	26
5	2.7	46
10	2.8	72
30	12.56	58
40	20.69	48
50	38.62	23

The dry weight of the algae showed gradual decline as the concentration of Ni (11) ions increased. *Chara sps*: Ni (11) ion removal by this alga did not show positive relationship with increasing metal concentrations. For I ppm, the % metal removal was 26% and they were 46%, 72%, 58%, 48% and 23% for 5, 10, 30 and 50 ppm Ni (11) concentrations 72%.

A negative co relationship between the metal ion concentrations and dry weight of the algae was reported. As the concentrations of metal ion increased, the dry weight of the algae decreased. The average removal of Ni (11) ions for *Oscillaioria sps.* was 69% while mat for *Chara sps.* was only 45% after 7 days.

Verma, *et. al.* (1996) observed about 87% Ni metal accumulation by *Anabaena torulosa*. In *Phaiodactyium tricornutum*, a rapid uptake removal of Ni had been observed for first 10 hours (Skaar, *et. al.* 1974). They investigated a linear relationship between Nickel uptake by the algal cells and the concentrations of metal in the medium. They postulated that it might be phosphate that might have involved in the extracellular component which was responsible for rapid uptake of Ni.

However, the % removal of Ni with increasing metal concentrations differs in *Chara and Oscillatoria* . In this relation Baker (1981) suggested that uptake removal, translocation and accumulation differed among different plants, so as in algae.

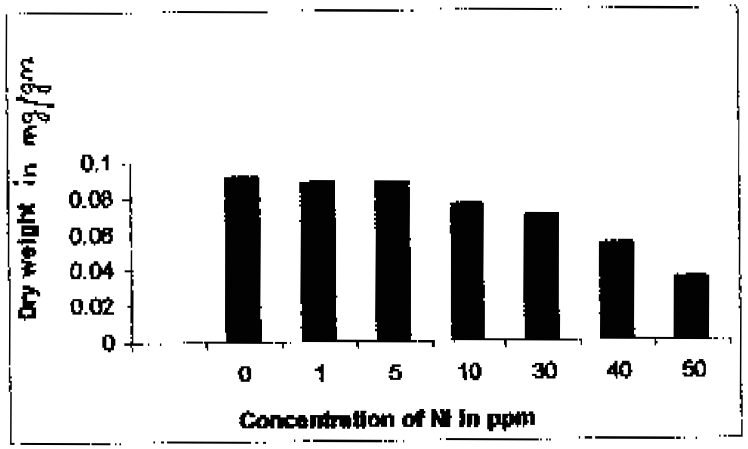

Fig. 1 - Effect of Ni on dry weight of *Oscillatoria*

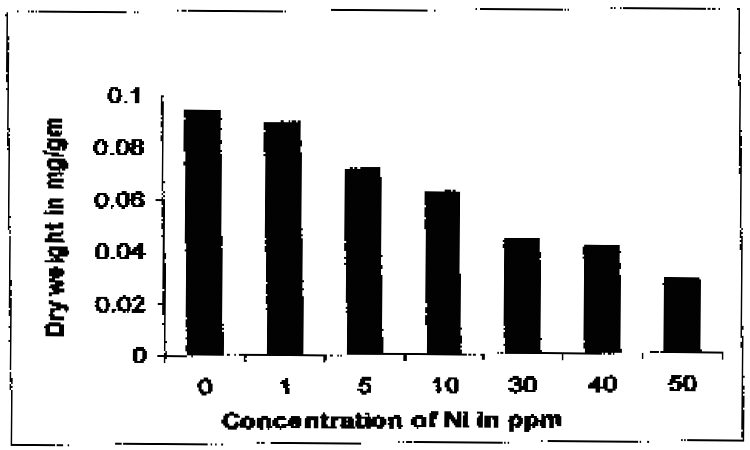

Fig. 2 - Effect of Ni on dry weight of *Chara*

Chudhary and Sastry (1988) in their study on Ni uptake by *Closterium moniliferum* reported about 25% removal of the ions by the alga. They concluded that the metal accumulation was initiated by absorption onto the algal cells followed by a slow diffusion into the cells by a passive transport mechanism. A similar mechanism might have operated in die present study. *Oscillatoria* can remove Ni ions more efficiently from the industrial wastes than *Chara*. In this context, Subramanian and Uma (1996)suggested that cyanobacteria are more advantageous in pollution control and the use of them for bioremediation is the most economical and ecofriendly approach. This is because most gaseous and liquid pollutants are metabolized by cyanobacteria fairly rapidly bring down their lev els in the atmosphere and effluents.

Cell counts, net photosynthesis, respiration rates, chlorophyll and pigment content, dry matter content etc. are some of the biological variables used to measure biological inhibition due to metal exposure (Sorentino, 1979). In both the algae studied, the decrease in dry matter content as compared to control, may be attributed to the inhibitory effects of Ni with its increasing concentrations. This is because most of the heavy metals interact with and bind themselves to biological maeromolecules which eventually disrupt other physiological process leading to the death of the organism (Eichom, 1974). Hence, dry matter content measurement proved to be efficient method for assessing toxicity of the tested metal.

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