# APPLICABILITY OF PHYTOREMEDIATION METHODS TO TREAT CHROMIUM CONTAMINATED WATERS

MASTER OF SCIENCE (BY RESEARCH

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# Abstract

Chromium is a hazardous metal available in both Trivalent (Cr +3)and Hexavalent (Cr+6) forms. Cr+6 is evidently toxic whereas Cr+3 is relatively less hazardous than Cr+6. Cr+6 and Cr+3are extensively used in many industrial processcs and causes industrial heavy metal pollution of surface and ground water. There are iiany already practiced methods to remove Chromium such as Chemical Precipitation and Ion Exchange etc. Very little research has been done.on Phyto- remediation of Cr+6 and Cr +3

Currently there is a growing interest on research on 11 'L' capacity of Ferns to extract heavy metals. The amazing uptake rate of *Pteris vitata* (Br. 'dk fern) gave the initial 'impetus to this study. *Nephrolepis exaltata* or Common Sword Fern is a commonly found hardy invasive fern. It is recorded to be hardy plant with hign moisture and acidity

In this study *N. exaltata* was comparatively assed with few other species for the capability of chromium extraction. *N. exaltata showed a* good uptake rate. Ability of *Nephrolepis exaltata* to extract Cr+3 from an artificial solution was studied in detail separately under 'Hydroponic and Soil water systems. All the experi ments were done in a controlled laboratory environment

*N. Exaltata* showed very high removal rates (about ';1)%) in a Hydroponic medium upto 50 ppmcontamination of T-Cr. The mass balance she-ws that most of the Cr taken up by the plant is retained in the roots (about 75 % or 35uO mg/kg). Little is translocated to above-ground tissues (4% or 120 mg/kg). Therefore \he mechanism of removal is mainly Rizofiltration. The mechanism of uptake may be Bio-sorption or Active uptake by root cells. *N. Exaltata* hardly shows any symptoms of Ph .to-toxic affects upto 50 ppm of Cr +3,and 15 ppm er Cr+6.

But in a Soil water system mass balances show that 1110stof water soluble Cr+3 is sorbed to soil (about 90%). *N. exaltata* is poor- in de-mineral izing, mobilizing and uptake of soil bound Cr +3.Sand has a remarkable capacity to immobilize Cr+3 in water. More research should be done to identify the capacity of sand and gravel to bind chromium.

## DECLARATION

I hereby declare that this submission is my own work and that, to the best of my knowledge and belief, it contains no material previously published or written by another person no material which, to substantial extent, has been accepted for the award of any other degree or diploma of a university or other institute of higher learning, except where an acknowledgement is made in the text.

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Dr. Shiromi Karunarathne
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| | |
|---|---|
| ANOVA | - Analysis of Variation |
| ASTM | - American Standard Testing Methods |
| CW | - Constructed Wetland |
| DO | - Dissolved Oxygen |
| HDPE | - High Density Ply-Ethylene |
| IRZ | - Insitu Reaction Zones |
| MCL | - Maximum Concentration Limit |
| MNA | - Monitored Natural Attenuation |
| NAPL | - Non-Aqueous Phase Liquid |
| PAH | - Poly-Aromatic Hydrocarbons |
| PCB | - Poly-Chlorinated Bi-phenyls |
| PCE | - Poly-Cyclic Ethanes |
| ppm | - Parts Per Million |
| SOM | - Soil Organic Matter |
| T-Cr | - Total Chromium |
| TNT | - Tri-Nitro Toluene |