

# Phytoremediation of Lead and Cadmium in Spent Engine Oil Contaminated Medium using Plantlets and Seedlings of *Nauclea diderrichii* (De Wild. & T. Durand) Merrill

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## INTRODUCTION

Pollution is one of the most important problems around the world today in which millions of world inhabitants suffer health problems related to industry and atmospheric pollutants. Recent years have witnessed significant attention being paid to the problems of environmental contamination by wide variety of chemical pollutants including heavy metals (El-Deimerdash and Elagamy 1999).

Environmental pollution by heavy metals is now a global issue that requires attention. Soils contaminated with heavy metals usually lack established vegetation cover due to the toxic effects of the heavy metals (Salt *et al.* 1995).

Spent Engine oil is a product of crude-oil which causes critical pollution in the environment.

Recently, soil contamination with spent engine oil is becoming a challenge owing to the increasing use of this hydrocarbon in engines of power generators, and small and articulated vehicles. This increase in use is resulting in accidental spillage and/or purposeful discharge of spent engine oil on agricultural lands, forests and water sources. Heavy metals such as lead and cadmium are trace elements present in petroleum products which are toxic to both plants and animals. In Trees have a number of attributes which makes them attractive plants for phytoremediation.

## OBJECTIVES

The main objective of the study is to investigate the phytoremediation potentials of *Nauclea diderrichii* grown in tissue culture medium and also as seedlings in soil contaminated with spent engine oil with a view to determining the suitability of these technique and tree species to remediate polluted soils for land reclamation.

Specifically, this study:

1. Determined the survival rate of plantlets under tissue culture medium and seedlings of *N. diderrichii* in varying concentrations of spent engine oil;
2. Investigated the growth performance of *N. diderrichii* plantlets and seedlings in varying amounts of spent engine oil contaminated medium;
3. Assessed phytoextraction process of plantlets and seedlings of *N. diderrichii* for heavy metals.

| Treatment    | No. of Survived Plantlets | % Survival |
|--------------|---------------------------|------------|
| Control      | 5                         | 100        |
| 0.1 ml SEO D | 3                         | 60         |
| 0.2 ml SEO D | 2                         | 40         |
| 0.3 ml SEO D | 1                         | 20         |
| 0.4 ml SEO D | 0                         | 0          |
| 0.1 ml SEO P | 3                         | 60         |
| 0.2 ml SEO P | 2                         | 40         |
| 0.3 ml SEO P | 1                         | 20         |
| 0.4 ml SEO P | 0                         | 0          |

| Treatment    | No. of Survived Seedlings | Survival Rate % |
|--------------|---------------------------|-----------------|
| Control      | 5                         | 100             |
| 50 ml SEO D  | 5                         | 100             |
| 100 ml SEO D | 5                         | 100             |
| 150 ml SEO D | 5                         | 100             |
| 200 ml SEO D | 5                         | 100             |
| 50 ml SEO P  | 5                         | 100             |
| 100 ml SEO P | 5                         | 100             |
| 150 ml SEO P | 5                         | 100             |
| 200 ml SEO P | 5                         | 100             |

Survival rate of *N. diderrichii* Plantlets and Seedlings



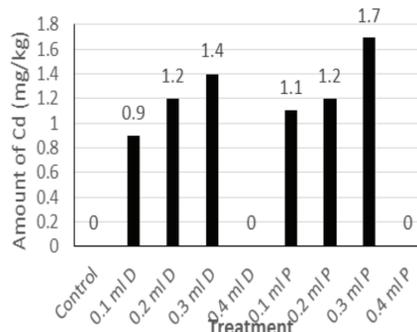
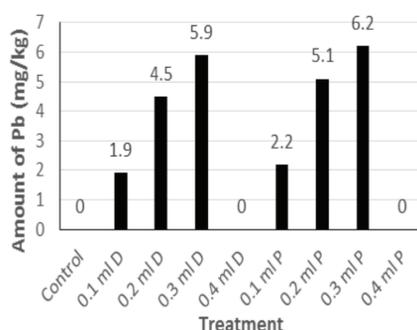
## MAIN RESULTS

Survival rate of plantlets was variable and appeared to be decreased mostly with increase in the quantity of the spent engine oil (SEO) applied into the cultured medium. Survival rate of the seedlings was 100% after growth monitoring for 5 months.

Plant tissue analyses (leaves, stems and roots) showed higher amounts of Pb and Cd in seedlings subjected to vary concentration of SEO compared with tissues obtained from seedlings subjected to uncontaminated soils.

The Pb and Cd content in the tissue of seedlings and plantlets subjected to SEO from petrol engine was higher than those subjected to SEO from diesel engine.

Root of seedlings absorbed more Pb than other parts while Cd was almost evenly distributed to different parts.



Amount of Pb and Cd in Plantlets of *N. diderrichii*

## CONCLUSION

The study revealed that contamination of the soil/ culture medium with spent engine oil from both diesel and petrol engines can lead to a gradual accumulation of heavy metals which have a direct effect on the tissues of the plants grown in such environment.

The higher the concentration of SEO, the higher the amount of Pb and Cd in the plantlets of *N. diderrichii*.

Pb and Cd were easily extracted by seedlings and plantlets of *N. diderrichii* in SEO collected from petrol engine than the SEO collected from diesel engine.

Plantlets and seedlings of *N. diderrichii* has shown ability/ potential to phyto-extract heavy metals from the soil and store them thereby reducing environmental degradation.

| Treatment   | Total Pb (mg/kg)        | Total Cd (mg/kg)       |
|-------------|-------------------------|------------------------|
| Control     | 10.00±0.00 <sup>h</sup> | 1.00±0.00 <sup>e</sup> |
| 50ml D      | 35.00±0.00 <sup>e</sup> | 2.00±0.00 <sup>d</sup> |
| 100ml D     | 40.00±0.00 <sup>d</sup> | 1.00±0.00 <sup>e</sup> |
| 150ml D     | 52.00±0.00 <sup>b</sup> | 4.00±0.00 <sup>c</sup> |
| 200ml D     | 56.00±0.00 <sup>a</sup> | 2.00±0.00 <sup>d</sup> |
| 50ml P      | 56.00±0.00 <sup>a</sup> | 2.00±0.00 <sup>d</sup> |
| 100ml P     | 45.00±0.00 <sup>c</sup> | 5.00±0.00 <sup>b</sup> |
| 150ml P     | 20.00±0.00 <sup>g</sup> | 5.00±0.00 <sup>b</sup> |
| 200ml P     | 29.00±0.00 <sup>f</sup> | 7.00±0.00 <sup>a</sup> |
| <b>Sig.</b> | <b>0.00*</b>            | <b>0.00*</b>           |

Mean Pb and Cd in the seedlings of *N. diderrichii*



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