بسم الله الرحمن الرحيم

شبكة المعلومـــــات الجامعية

التوثيق الالكتروني والميكروفيلم

شبكة المعلومات الجامعية

جامعة عين شمس

التوثيق الالكتروني والميكروفيلم

﴿ قـــسـم ﴾

نقسم بالله العظيم أن المادة التي تم توثيقها وتسجيلها
علي هذه الأفلام قد اعدت دون آية تغيرات

يجب أن

تحفظ هذه الأفلام بعيداً عن الغبار

في درجة حرارة من 15 – 20 مئوية ورطوبة نسبية من 20-40 %

To be kept away from dust in dry cool place of
15 – 25c and relative humidity 20-40 %

بعض الوثائق الأصلية تالفة

بالرسالة صفحات

لم ترد بالأصـــل

EFFECT OF SOIL CONDITIONERS ON Ni AND Cd EXTRACTABILITY AND CONCENTRATION IN PLANT GROWN IN SOME DESERT SOILS

A Thesis Submitted

To

Faculty of Science, Menoufia University

Presented by

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B.Sc. (Chemistry)

For the Degree of Master of Science

(Inorganic Chemistry)

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NOTE

The present thesis is submitted to Menoufia University in partial fulfillment for the requirements of M.Sc. Degree in Chemistry.

Besides the work carried out in this thesis, the author Soad Fathy Abd El-Rahman Nawito has pursued the following post graduate courses for one year:

- Advanced analytical chemistry.
- Advanced inorganic chemistry.
- Solid state chemistry.
- Electro chemistry.
- Group theory.
- Catalytic chemistry.
- Nuclear chemistry.
- Co-ordination chemistry.
- Quantum chemistry.
- Spectroscopy.
- Statistics.
- Computer science.
- English language.
- Selected topics of inorganic chemistry.

She successfully passed the final examination of these courses.

Head of Chemistry Department

Prof. Dr. S. El-Hamouly

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S.F. Nawito

SUMMARY

Four pot experiments were carried out to study the effect of Ni and Cd and their relation to the soil conditioner, and the growth of barley and sorghum plants grown on two desert soils. Also, the relation between Ni and Cd content in the desert soils and plants, at different growth stages and different metal levels in the soils, were investigated. The effect of Ni and Cd on the previous parameters were studied individual without combination with each other.

Two surface samples (0 - 30 cm depth) of desert soils were collected from Nubaria and Maryut areas. These soils were evaluated from the physical and chemical stand points. Total and chemically extractable Ni and Cd, as well as total soil salinity, soil pH, soluble cations and anions, organic matter content, $CaCO_3$% were determined. Plastic pots with 5 Kg capacity were used under greenhouse condition. In all the four experiments, Ni or Cd was applied before cultivation at the rates of 0, 10, 50 and 100 $mgKg^{-1}$ for Ni and 0, 10, 20 and 30 $mgKg^{-1}$ for Cd. While the levels of the soil conditioner were 0 and 50 g/pot. The pots were first cultivated with barley then with sorghum plants.

Barley samples were collected at three growth stages where grains and straw after harvesting were included. However, three cuts of sorghum plants were collected as well as the roots after the third cut.

Soil samples were taken from each treatment after harvesting of barley and the third cut of sorghum plants.

The dried plant samples were wet ashed with ternary acid mixture of HNO_3, H_2SO_4 and $HClO_4$. Ni and Cd were determined in the digest solution using atomic absorption spectrophotometer Perken Elmer 2380.

For soil analysis, two methods of extraction were used, the total Ni and Cd contents were extracted by aqua regia. The extractable Cd and Ni were evaluated by extraction with EDTA-acetate extractant. The total and extractable levels of Cd and Ni were determined in the digest and extract, respectively, using Atomic Absorption Spectrophotometer.

The obtained results can be summarized as follows:

1- The values of dry matter of barley and sorghum plants showed that, Maryut soil gave higher values than Nubaria soil. Application of the soil conditioner increased the values of dry weight of both barley and sorghum plants at all the growth stages.

2- Application of Cd or Ni to the soils led to negative effects on the dry matter of both barley and sorghum plants. Increasing Cd or Ni application decreased significantly the dry weight of both plants. The resulting data revealed that, Maryut soil resists Cd-contamination than Nubaria soil.

3- Application of soil conditioner improved the dry weights of both barley and sorghum plants, at all Cd and Ni levels for both Nubaria and Maryut soils.

4- The tolerance index of Cd and Ni for both barley and sorghum plants showed unfavourable effects for all Cd and Ni levels. Such effect increased by increasing Cd and Ni levels.

5- Cd and Ni contamination of soils influenced their concentration in sorghum and barley tissues. The metal concentration in plant tissues increased by increasing the applied metal levels. Application of soil conditioner to the soils resulted in a decrease in the Cd and Ni concentration in the plant tissues.

6- The values of Cd and Ni uptake by barley and sorghum plants increased by increasing the applied metal level. The uptake increased also by increasing the growth stage. The lowest value of metal uptake was associated with barley grains as compared to straw. This finding indicated the high accumulation rate of Ni and Cd in barley shoots as compared to grains. On the other hand, the metal (Cd and Ni) uptake by sorghum roots was higher than that of shoots, which indicating the relative immobility and relative precipitation of the metal in roots. Application the soil conditioner decreased the metal uptake by barley and sorghum plants.

7- The values of metal (Cd or Ni) uptake by barley and sorghum plants were positively correlated with the EDTA-extractable metal (Cd or Ni) as well as the total metal content of the soil.

8- Cd uptake by barley and sorghum plants increased by increasing the applied Ni-level. Similarly Ni-uptake by the two plants increased by increasing the level of applied Cd. These were true for both Nubaria and Maryut soils.

9- The values of EDTA extractable Ni and Cd, under different studied treatments for both soil types, increased by increasing the level of metal added. The values associated with Maryut soil were greater than that of Nubaria one. On the other hand, extractable metal decreased by application of soil conditioner.

10- The percent of extractable metal, for both soils, increased by increasing the total metal content in the soil.

1. INTRODUCTION

Soil and water pollution squander the resources that support life. Recently, nickel and cadmium have become serious pollutants that are released in the emission from metal processing operations and the increasing combustion of coal and oil. The application of sludge and certain phosphate fertilizers to soil, also, may be important source of Ni and Cd. It has been reported that, when a soil is regularly treated with Ni and Cd contaminated sludge, the metals accumulate in soil and in some plants that grown on it to levels that hazardous to human. The uptake of Cd by crop plants from sludge treated soil is usually greater than from untreated soil. Under some conditions, where individuals consume only foods grown on cadmium contaminated soil, cadmium can accumulate in human kidney cortex and cause renal tuber disease. Plants differ in their sensitivity to nickel or cadmium toxicity. Oat plant is particularly sensitive to nickel toxicity and the symptoms are sufficiently characteristic for diagnostic purposes.

Several methods are available for determination of nickel and cadmium in soils and plants. Atomic absorption spectrometry is the most widely used. Cottenie et al. (1982) reported a simplified method for extraction of metals from soils using aqua regia. Total soil metals can also be extracted efficiently using niteric acid. Ammonium acetate-EDTA solution can be used to extract nickel and cadmium from soils.