The 1st International Conference on New Ideas in Agriculture
Islamic Azad University Khorasgan Branch
26-27 Jan. 2014, Isfahan, Iran

DETERMINATION OF HEAVY METALS(CD, ZN, CU) CONTAMINATED KAOLIN SOIL BY DIODE LASERS IRADDIATION

Maryam Marashi Aliabadi, Adeleh Granmayeh Rad*
Department of soil science, Science and Research Branch, Islamic Azad University, Tehran, Iran
marashi@srbiau.ac.ir
Department of Physics, Faculty of Sciences, Roudehen Branch, Islamic Azad University, Roudehen, Iran
*Corresponding Author: granmayeh@riau.ac.ir

INTRODUCTION: Soil and water are the final recipients of wasteful and unwanted compounds, resulting from human activities. Heavy metals released from industrial activities, plants and automobile exhausts are dispersed in the air and by rain or other factors, return to the soil and underground water. These two precious resources may be contaminated by natural phenomena such as a neighboring of a mine, mother materials or heavy metals in the water-bed [1].

MATERIALS AND METHODS: This study was designed experimentally, using existing tables and information about the pollution levels of cadmium, zinc and copper, as well as the maximum allowable presence of mg heavy metal per kg of dry soil. To measure the concentration of cadmium, zinc and copper pollutants, heavy textured soil types were chosen. The allowable concentration of Cd is 1-5 mg/kg, Cu concentration is 50-100 mg/kg and Zn concentration is 200-500 mg/kg. Therefore in this study a 0-100mg/kg Cd concentration level, a 0-500mg/kg Zn concentration level and a 0-500mg/kg Cu Concentration level, were used. Only soil samples not contaminated with Cd, Zn, Cu, or any other toxic elements were selected. Then the soil samples were contaminated with these concentrations in three replicates each, and were poured into containers with a height of 10 cm. To contaminate the soil, the required amount of Cadmium, Zinc and Copper Sulfate for a specific amount of soil were measured, added in a soluble form to one kilogram of soil and completely mixed to prepare a homogenous foundation. Then the contaminated soil was watered until its saturation limit and left alone for about one week, to make the possible interactions of pollutants and contamination of soil genesis and pollution conditions more natural. After this time, a soil sample from the contaminated containers and a control soil sample (uncontaminated soil), were taken. To extract the solution of Cd, Cu and Zn, 10 g of air-dried soil were weighed and poured into 250 ml glass containers with lids, and based on the concentration of the standard soluble; 50 ml of distilled water was added and left aside for one day. In the next step, the samples were shaken with a speed of 300 rpm for 24 hours. Next, the samples were passed through a 42 Whatman filter paper. After stirring the samples, the output power of the irradiated laser beam was measured using a power meter. The applied lasers are a 120 mw, 532 nm, green diode laser and a 100 mw, 632 nm red diode laser.. In the last step, by comparing the graphs created by the contaminated soil samples and the control soil samples, it is possible to measure the levels of pollutants in the soil. This study was conducted using a randomized block design with 13 treatments and 3 treatments with concentrations of heavy metals (Cd, Zn, Cu) and one soil treatment in 3 replications.

RESULTS AND DISCUSSION

1) kaolin soil contaminated with cadmium

According to results when red and green lasers are beamed through the Cadmium contaminated water, the decrease in output power is of a minimum of 8 mw and a maximum of 15 mw when using a red diode laser and a minimum of 15mw and a maximum of 20 mw when using a green diode laser. Therefore the green laser beam is more absorbed in the Cadmium contaminated water that the red laser beam. Although when using soil samples, the decrease in output power has been similarly 100%. The absorption level of both green and red lasers in cadmium polluted soil extracts did not show any significant amount.

Keywords: Heavy metals, Kaolin soil, Diode lasers