COMPOST REMEDIATION OF HEAVY METALS CONTAMINATED SOILS

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ABSTRACT

The main objective of this study is to evaluate remediation method using compost as heavy metal fixing agent for soil amendments with a view to prevent heavy metals accumulation in soil which may eventually poison the food chain. The physico-chemical parameters of different types of composts and soils used were determined. The percentage removal of heavy metals from soils treated with three different types of compost were also determined and the most effective compost for the removal of the metals was reported.

Three different samples of compost prepared from poultry, cattle and farmyard manures were obtained from the Institute of Agriculture, Animal Health and Production Technology Research, Moor Plantation, Ibadan. These were used as organic amendments or remediating agents for different heavy metal contaminated soils. The composted samples were ground, sieved through a 2 mm mesh, with the physical and chemical characterization of the samples (pH, electrical conductivity, density porosity), carried out using standard analytical methods. Top soil (0-20 cm depth) from sandy and loamy soils were collected, air dried, ground and sieved using a stainless steel sieve of 2 mm mesh. The physico-chemical parameters, pH, percentage ash, percentage nitrogen, percentage carbon, electrical conductivity, bulk density, porosity, heavy metal; Cd, Pb, Zn, Cu and Mn content of the soils were determined prior to spiking with known concentrations of heavy metals. For the remediation study, 1000 ppm each. of mixture of Cd, Mn, Pb, Cu and Zn were prepared and the mixture used to spike 300g of each of the sieved soil samples and homogenized. These spiked soil samples were treated with 0, 10, 20 tons equivalent of each compost, made moist with distilled water, homogenized and incubated at 36^0C for 0, 7, 14, 21, 28, 35 and 42days. The available heavy metal contents were determined from the soil samples at various incubation periods after digestion by adopting the standard AMBIC- 2 extraction method. The extractable metal were determined using Atomic Absorption Spectrophotometry (AAS). The degree of remediation of the soil samples from heavy metal contamination was obtained from the differences in amount of heavy metals available in sample after spiking and those detected after treatment with compost at various incubation periods.

The results showed that background level of Cd, Pb, Cu, and Mn in the soils ranged from 0.02-0.04mg/kg, 0-0.03mg/kg, 5.8-6.9mg/kg and 164.0-176.0 mg/kg respectively. There was progressive removal of the metals from the contaminated soils from the 7^{th} day to the 28^{th} day as chelation of the metals with the organic matter in the compost increased. Composted farmyard manure effectively removed higher quantities of Cu from sandy (7.70 mg/kg) and loamy soil (8.60mg/kg) than the other composted manures. The composted Farmyard manure was the most effective for the removal of Cd and Pb from contaminated sandy and loamy soils and Zn from contaminated sandy soil. Composted cattle manure however showed a better efficiency for the removal of Cu from contaminated loamy soil. Farmyard manure was the most stable compost for the remediation of soils contaminated with all the heavy metals. There were significant differences in the removal of Mn ($F = 33.36$; $p<0/05$), Cd ($F7 = I30.8$; $p<0.05$), Cu ($F=37.05$; $p<0.05$) and Zn ($F = 12.89$; $P<0.05$) using the three different compost during the period of analysis.

The study concluded that the composted farmyard manure was the most effective solid organic material for the remediation of soil contaminated with heavy metals while composted poultry manure was the least effective.