Effect of ionic composition for equilibrium solution on Zinc levels extracted from calcareous soils treated with different source of Zinc

A Dissertation

By

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Abstract

The laboratory experiment was conducted using three types of soils to assess the impact of each of the salt composition, ionic strength of equilibrium solution and added zinc forms in each of the soluble, available and adsorption isotherms of zinc in soil. The ion composition of the soils was modified using drainage water treated with three different salts, namely; $CaCl_2$, $MgCl_2$ and NaCl, the final salinity levels of these prepared solutions adjusted with distilled water to 4 and 8 dS m^{-1} levels of salinity. Soils washing with these prepared solution continued until a state of balance between the solutions used and the soils in which it was indicated from the washing filtrates analysis. Drained soils air dray and crashed to pass 2 mm sieve which was used in the following experiments:

1- Zinc adsorption isotherms:

25 ml of prepared saline waters containing different concentrations of Zn^{2+}(10, 20, 30, 40, 50 and 60 mg Zn L^{-1}) added as $ZnSO_4.7H_2O$ to 5 grams of soil and after the shaking process and left for 24 hours both maximum adsorption capacity (Xm) and bonding energy (k) were calculated according to Langmuir adsorption isotherm. Obtained data indicate as average that Xm values rise from 281 to 293 mg kg^{-1} and k values decrease from 0.040 to 0.017 mg L^{-1} respectively with Ec increase

from 4 to 8 dS m^{-1}. Xm and k values for the different salts indicate an decrease in following order CaCl2> MgCl2> NaCl treatment for Xm and NaCl> MgCl2> CaCl2 treatment for k values.

2- The change in the soluble Zn level with incubation periods:

Soil samples treated with 250 mg Zn kg^{-1} added in different forms ($ZnSO_4$ and Zn-EDTA and Zn-HA) control treatments left without Zn application, then subject to wetting draying cycles for 7, 14, 21, 28 and 35 days. Soluble Zn for each period of incubation extracted by the same saline solution previously used to leach the prepared soils. Results showed that the level of soluble zinc decrease with increase in the incubation period and salinity level from 4 to 8 dS m^{-1}, the level of soluble zinc fell by 35% with increase in the EC from 4 to 8 dS m^{-1}. The effect of chemical composition of equilibrium solutions indicate a higher extractable Zn with NaCl treatments compared with drainage water treated $CaCl_2$ and $MgCl_2$ salts. On other hand; the effect of Zn applied source show a higher extractable soluble Zn with Zn-EDTA treatment compared with $ZnSO_4$ and Zn-HA source for applied Zn. The level of soluble Zn extracted by Zn-EDTA increase respectively by 7.9, 5.9 and 7911% compared with $ZnSO_4$, Zn-HA and control treatments. Results have shown that the level of dissolved zinc was inversely proportional to soil content of carbonate minerals. Available Zn extracted by DTPA from soils treatment with 250 mg Zn kg^{-1} soil and incubated for 35 days showed a 14% decline in Zn availability with increasing salinity from 4 to 8 dS m^{-1}. The extractable available Zn for Zn-EDTA was higher by 47.6, 59.9 and 3311%, respectively compared with $ZnSO_4$, Zn-HA and control treatments. Obtained data indicate that available Zn related mainly to the cation exchange capacity of soils.

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