

Zinc and Cadmium Content in Fertilizers Commonly Used in Iran

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INTRODUCTION

Chemical fertilizers are required to maintain crop production at economic levels. However, the heavy metal content of fertilizers can cause soil and food chain contamination. It is therefore necessary to identify heavy metal contents in fertilizers. The N and K fertilizers are relatively free of contaminants (Laegried et al. 1999, McLaughlin et al. 2000) while some trace element and especially P-fertilizers contain high concentrations of Zn and Cd as impurity (McLaughlin et al. 2000).

Zinc deficiency in soil has recently been noticed in agricultural lands in Iran. This has led to extensive research on Zn fertilization during the last 10 years. Accordingly, ZnSO₄ is commonly used as a source of Zn, but there is little information on the quality of fertilizers produced in or imported to Iran. The objective of this study was to evaluate Zn and Cd concentrations in commercial fertilizers used in Iran.

METHODS

A total of 42 fertilizer brands [9 Zn fertilizers, 6 P-fertilizers, 15 completed fertilizers, 5 trace element fertilizers and 7 bio-fertilizers] were randomly collected across the country. Three samples were collected for each fertilizer from different sources including farmers, research centers or local agricultural organizations. Zinc and Cd concentrations in the fertilizers were extracted using a 6 M HNO₃ solution and determined by Atomic Absorption Spectrometry (AAS). Selected fertilizer samples were also extracted using HF-HCl-H₂SO₄ extracts to compare the two digestion methods.

RESULTS AND DISCUSSION

The mean concentration of Zn and Cd in ZnSO₄-fertilizers is shown in Fig. 1. Zinc concentrations in ZnSO₄-fertilizers varied from 0.018 to 50.5 %. In more than half of the fertilizers, Zn content was found to be less than 22 %. On the other hand, the Cd content in these fertilizers ranged from 2.21 to 26.6 mg kg⁻¹. There was a positive relationship between Zn and Cd content in ZnSO₄-fertilizers. This is probably due to the similar geochemical origin of these elements.

Zinc and Cd concentrations in the sampled P-fertilizers ranged from 85 to 1015 and 3.11 to 25.61 mg kg⁻¹, respectively (Fig. 2). The Cd content of the P-fertilizers was below 25 mg kg⁻¹ with one exception.

Great variations were found in Zn and Cd contents of mixed and trace element fertilizers (Table 1). Among micronutrient fertilizers, Fe-sulfate and Mg-sulfate had the lowest and highest impurity of Zn, respectively. The greatest Cd impurity was found in Mn-sulfate fertilizers.

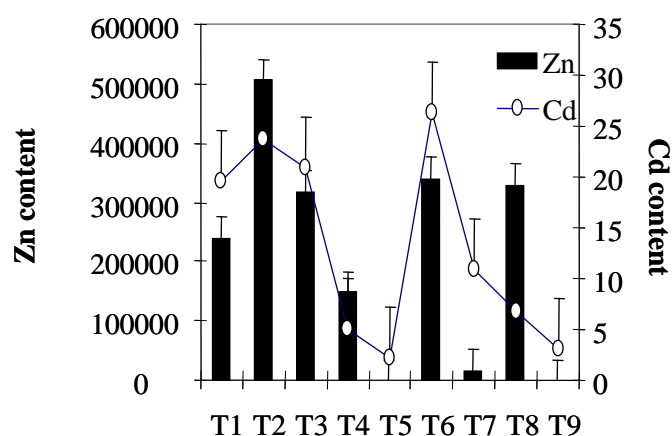


Fig. 1. Zinc and Cd content (mg kg^{-1}) of selected ZnSO_4 -fertilizers commonly used in Iran.

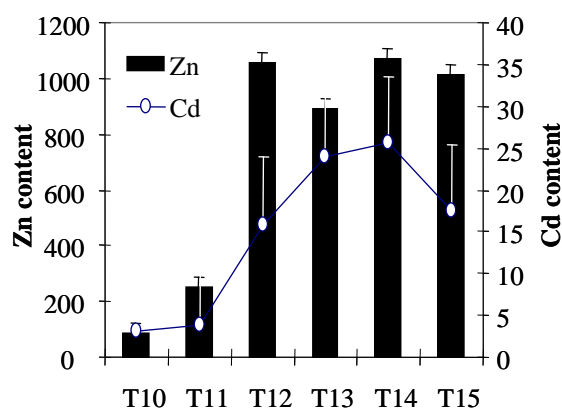


Fig. 2. Zinc and Cd content (mg kg^{-1}) of selected P-fertilizers commonly used in Iran. (T10 and T11: simple superphosphate, T12 and T13: triple superphosphate, T14: ammonium phosphate, T15: ammonium phosphate-sulfate)

Table 1. The range and mean Zn and Cd concentration (mg kg^{-1}) in mixed, micronutrient and biological fertilizers used in Iran.

Fertilizer	Zn	Cd
	Range	Range
Macro Mixed Fertilizers	8050-39500	1.78-15.56
Trace element fertilizers	84-395000	1.11-126.4

CONCLUSION

The results show that most Zn-fertilizers brands have a low Zn and a relatively high Cd content and as a result a low quality for agricultural usage. On the other hand, high levels of Zn and Cd impurities exist in trace element fertilizers. The majority of Cd added to Iranian soils with these fertilizers continues to accumulate in the biological active topsoil. The use of high Cd fertilizers may cause an increased Cd contamination of the food chain. In addition, Zn input through high-Zn fertilizers has to be considered in mass balance models for this micronutrient in the food chain.

REFERENCES

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