

Metal Impurities in Commercial TSP Fertilizers in Sri Lanka as Analyzed by ICP-OES Method

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Abstract

Triple Super Phosphate (TSP) is one of the fertilizers applied to overcome the phosphorus deficiencies in agricultural soils. Application of TSP fertilizer may be one of the major inputs of metal impurities contaminants to agricultural soils in Sri Lanka. This might result in imbalance structure of trace metals in soils leading to toxicity problem, where these toxic trace metals can enter to the human body easily through the food chain. The present study was focused on determining the metal impurities in commonly used TSP fertilizers in Sri Lanka. Two TSP samples obtained from two Fertilizer Companies (A and B) were selected for the study. Six replicates of each company fertilizers were digested using the method of the Association of Official Agricultural Chemists. The concentration of eleven trace metals (Cr, Mn, Cu, Cd, Pb, Zn, Fe, Ni, Co, Mo and As) in each TSP fertilizers were determined by ICP-OES as an analytical technique. ICP-OES analysis revealed a group of non-lethal metal species, present as impurities. The highest average concentrations were, 4229.30 mg of Fe, 469.16 mg of Mn, 195.34 mg of Zn, 8.73 mg of Ni, 7.78 mg of Cu, 2.36 mg of Co and 1.39 mg of Mo per kg⁻¹ of fertilizer. Considerable amount of toxic heavy metals such as Pb, Cr, As and Cd were detected with average concentrations of 53.93 mg of Pb, 25.56 mg of Cr, 3.19 mg of As, 1.05 mg of Cd per kg⁻¹ of fertilizer, respectively. Trace metal concentrations of two fertilizer companies were compared using two sample t-test ($\alpha = 0.05$). Metal concentrations of Mn, Cu and Zn were significantly higher in company A fertilizer samples than those of the company B. Concentrations of Cr, Cd, Pb, Fe, Co and Mo were significantly lower in company A fertilizer samples than those of the company B. However, there was no significant differences in concentrations of Ni and As content in fertilizer samples of company A and company B. Present study explores that concentration of trace metals in TSP fertilizers were highly varied related to the TSP fertilizer companies. At present, no regulatory limits are available for the maximum amount of trace metals present in TSP fertilizer in Sri Lankan conditions. Protocol or an act to regulate the standard limits of metal impurities present in TSP fertilizers is highly recommended.

Keywords: Arsenic, ICP-OES, Metal impurities, Triple super phosphate

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