Pre-concentration and determination of trace amounts of heavy metals in beverages marketed in Sri Lanka using naturally occurring clay

K S Weeraratne, J M P I Jayathilaka, S S Subramanium* and R C L De Silva
Department of Chemistry, Faculty of Science, University of Kelaniya, Kelaniya

Heavy metal contamination has become a matter of public health concern, but contamination of fruit juices and soft drinks by heavy metals has not received much attention in Sri Lanka. In this study, a simple, sensitive and accurate pre-concentration method was developed for the determination of trace levels of several heavy metal ions Pb²⁺, Cr³⁺, Cd²⁺ and Cu²⁺ in some beverages marketed in Sri Lanka using naturally occurring clay from Pannala and Mabima areas as the pre-concentration medium. The procedure was based on the retention of the analytes on a Na⁺ homoionic clay bed and then elution from the clay material with a concentrated solution of NaCl. The samples eluted were then analyzed using flame atomic absorption spectrometry. The effect of the presence of organic matter in the clay on the pre-concentration was investigated. Non-digested Mabima clay proved to be a better adsorption and pre-concentration medium than Pannala clay. The percentage recoveries for Pb²⁺, Cr³⁺, Cd²⁺ and Cu²⁺ were 96 ± 1%, 98 ± 2%, 93 ± 4% and 94 ± 2% respectively. The detection limits for Pb²⁺, Cr³⁺, Cd²⁺ and Cu²⁺ were 0.0010 mg L⁻¹, 0.0050 mg L⁻¹, 0.0040 mg L⁻¹, 0.0002 mg L⁻¹ and 0.0010 mg L⁻¹ respectively. The developed method was applied for the determination of trace metal ions in beverage samples marketed in Sri Lanka using non-digested Mabima clay. The mean levels of Pb²⁺, Cr³⁺, Cd²⁺ and Cu²⁺ in soft drinks were found to be 0.0056 ± 0.0011 mg L⁻¹, 0.0415 ± 0.024 mg L⁻¹, 0.0025 ± 0.0002 mg L⁻¹ and 0.7037 ± 0.0374 mg L⁻¹ respectively. The data revealed that mean levels of Pb²⁺, Cr³⁺, Cd²⁺ and Cu²⁺ found in the soft drinks analyzed were within the permissible limits set by CODEX and WHO.

Keywords: Pre-concentration, clay, beverages, heavy metals, FAAS