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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 Subramaniam* 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 Pb^{2+} , Cr^{3+} , Cd^{2+} and Cu^{2+} 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 Pb^{2+} , Cr^{3+} , Cd^{2+} and Cu^{2+} were $96 \pm 1\%$, $98 \pm 2\%$, $83 \pm 4\%$ and $94 \pm 2\%$ respectively. The detection limits for Pb^{2+} , Cr^{3+} , Cd^{2+} and Cu^{2+} 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 Pb^{2+} , Cr^{3+} , Cd^{2+} and Cu^{2+} in soft drinks were found to be $0.0056 \pm 0.0011 \text{ mg L}^{-1}$, $0.0416 \pm 0.0024 \text{ mg L}^{-1}$, $0.0025 \pm 0.0002 \text{ mg L}^{-1}$ and $0.7037 \pm 0.0374 \text{ mg L}^{-1}$ respectively. The data revealed that mean levels of Pb^{2+} , Cr^{3+} , Cd^{2+} and Cu^{2+} found in the soft drinks analyzed were within the permissible limits set by CODEX and WHO.

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