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Geospatial Analysis And Quantification Of Bioaccumulated Pollutants In Fresh Milk

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Abstract

Heavy metals are recognized as non-biodegradable and persistent pollutants released into the water bodies from industries, mining, and agricultural runoff. It not only deteriorates the water quality but also pollutes the soil which further affects plant, animal, and human health. Once it enters the environment it is very difficult to remove. It is common practice in developing countries to use untreated wastewater for irrigation purposes due to a limited water resource. Heavy metals present in untreated industrial wastewater intercalate into the soil where they bio-accumulate in the different parts of plants, that are used as a source of food and fodder. Keeping in this view, the present study is designed to quantify the concentration of heavy metals in fresh milk collected from peri-urban areas of Multan, Pakistan. A total of 80 samples including water, soil, plant, and fresh milk were collected from the five different locations in Multan. The three sites were from urban areas (New Multan, Vehari Chowkh, and Samejabad), and the two sites were from peri-urban areas (Tatty pur and Khandar Wala). The collected samples were prepared using the wet digestion method. Atomic absorption spectroscopy was used for the determination of the concentration of lead, chromium, and cadmium in water, soil, Plant, and fresh milk. The result showed that a high concentration of cadmium in milk at New Multan Milk Site 3 (0.11mg/L) and water at Samejabad site 1 (0.118mg/L) which is above the WHO permissible limit for milk (0.0026µg/g) and water (0.005mg/L). The concentration of chromium in milk is at Samejabad Milk site 2 (0.182mg/L), and water at New Multan Water Site 2 (0.235mg/L) is also above the permissible limit of chromium for milk (0.05mg/L) and water (0.1mg/L). The concentration of lead in milk at Samejabad Milk Site 3 (1.982mg/L) and lead in water at Vehari chowk water site 4 (0.38mg/L) is higher than the permissible limit of lead for milk (0.02 mg/kg) and water (0. 05mg/L). Furthermore, the concentration of cadmium and lead is high in plants used as fodder while the concentration of lead in soil is also above the WHO permissible limit. The geospatial analysis i.e., kriging and Inverse Distance weighted were applied to interpolate lead, cadmium, and chromium in water, soil, plant, and fresh milk. The interpolation of data using kriging and Inverse distance weighted showed that water, soil containing lead, plants containing cadmium and lead, milk containing heavy metals were prevalent sources of metal. It might be possible that water is consumed by animals and fodder grown using canal water is the main source of metal bioaccumulation in milk.

Keywords: *Lead: Cadmium: Chromium: Fresh milk*