

Soil Risk Assessment on the Usage of Molasses-Based Distillery Effluent for Paddy Irrigation: Heavy Metals Content

Abstract

Heavy metal contamination in the soil is becoming a serious issue for food safety and human health. This study aims to quantify the concentration of cadmium (Cd), chromium (Cr), and lead (Pb) in paddy soil before and after irrigation with molasses-based distillery effluent in Perlis, Malaysia. Samples of effluent together with soil samples from two sampling plots were collected and analyzed using an inductively coupled plasma mass spectrometry (ICP-MS). It was found that the heavy metals in the effluent used for irrigation did not exceed the standard limit given by the Department of Environment (DOE) of Malaysia and the Food and Agriculture Organization (FAO) Standards for irrigation. Cr concentration was 0.01 mg/L, while Cd and Pb were not detected. The concentrations of heavy metals for the selected elements in paddy soil were also below the critical soil concentration enforced by the New York State Department of Environmental Conservation for normal soil. The heavy metal concentration's contamination level was assessed by using the geoaccumulation index (I_{geo}) and the obtained data showed that all the selected elements can be classified as class 0 (uncontaminated). The results also showed that the I_{geo} before paddy planting was already high, and it might be due to anthropogenic activities. Pollution Load Index (PLI) values of all the soil samples were uncontaminated as the result showed PLI < 1. The study's findings support the assertion that the soil samples were not significantly contaminated with the studied heavy metals before and after irrigation with molasses-based distillery effluent.

Keywords

Geoaccumulation Index; Heavy metals; Paddy soil; Pollution Load Index; Risk assessment