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Leaching Potential of Non-steroidal Anti-inflammatory Drugs (NSAIDs) in Soils

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Abstract:

Non-steroidal anti-inflammatory drugs (NSAIDs) deposited in soils as a result of agricultural and landscape irrigation with treated wastewater or land application of biosolids may pollute groundwater. In this study, the leaching potential of NSAIDs in soils was evaluated, and the effect of dissolved salt (CaCl_2 solution), dissolved organic matter (DOM) and polyacrylamide (PAM) on NSAIDs leaching was investigated. Three cropland soils, an Arlington sandy loam (ASL), a Palouse silt loam (PSL), and an Imperial silty clay (ISC) were spiked with four NSAIDs, namely ibuprofen, naproxen, ketoprofen, and diclofenac sodium. The spiked soils were incubated for 24 h followed by 7-day storage in glass flasks, and then packed into stainless steel columns (1.5 cm i.d. \times 12 cm) and leached with deionized water (DIW), 10 mM CaCl_2 , DOM solution (DOC 3.4 mg/L), and PAM solution (1.0 mg/L), respectively, by gravity. The initial concentrations of ibuprofen, naproxen, ketoprofen and diclofenac sodium in the three packed soils were 1.93-2.07, 1.74-2.27, 1.79-2.16, and 1.99-2.13 mg/kg, respectively. Maximum concentrations of the four NSAIDs in column effluents were 1.23, 0.92, 0.69, and 1.12 mg/L, respectively, when the soil was leached with 10 pore volumes of water. Various NSAIDs showed different release patterns in the three soils. DOM and PAM solution did not have any significant impact on the NSAIDs leaching from the test soils; CaCl_2 solution, however, remarkably reduced the NSAIDs leaching in all three soils. The results showed that NSAIDs have a high leaching potential from soil to water, and the mobility of NSAIDs in soil is related to the characteristics of the chemicals and soil properties. Amending soil with DOM or PAM does not significantly affect the leaching behavior of NSAIDs in soil, whereas increasing the salt levels in irrigation water may reduce the leaching potential of the NSAIDs.

Impact Statement:

Wastewater reuse is an important part of the integrated water resources management in the southwest States. This study assesses the potential detrimental effect of Non-steroidal anti-inflammatory drugs (NSAIDs) from wastewater application on groundwater quality. Results showed that the leaching potential of the NSAIDs are relatively high in soils, but proper irrigation management can reduce the leaching potential.

Category: Conservation and Resource Management

Type of Presentation: Poster Presentation