Leachability of Graywater Constituents after Application for Irrigation

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Abstract. One innovative approach that is gaining popularity to water resources sustainability is household graywater reuse for residential landscape irrigation. However, little is known about the long-term effects of graywater irrigation. Concerns exist in relation to the presence of pathogenic organisms, fate of personal care products, and accumulation of salts. Some of major chemicals in graywater include surfactants, salts and boron, which may accumulate in soil and have negative impact on soil quality and possible groundwater contamination. The objective of this research project was to conduct experiments in a greenhouse to evaluate the potential for groundwater contamination by conducting leachate analysis. Plant health was also evaluated throughout the duration of the experiment. The experiment setup involved the use of thirty-eight custom soil columns with four different plant types. Bermudagrass, tall fescue euonymus and lemon were planted in the soil columns. Half of the soil columns were irrigated with synthetic graywater and the remaining ones were irrigated with freshwater for the duration of fifteen months. The leachate samples were collected and analyzed for boron, sodium adsorption ratio (SAR), nitrate, ammonium, total nitrogen (TN), total dissolved solids (TDS), total organic carbon (TOC), sulfate, electrical conductivity (EC) and surfactants (linear alkylbenzene sulfonate (LAS), alkyl ethoxy sulfate (AES), and alcohol ethoxylate (AE)). Soil samples were also collected from different depths of 0, 25, and 45 cm and analyzed for the same constituents. Analysis of the leachate from the graywater-irrigated pots revealed on average, elevated levels of TOC, TN, nitrate, ammonium, TDS, conductivity, boron and SAR when compared to the concentrations measured in the leachate from the control systems. Results further indicated the accumulation of boron and salts (indicated by SAR) in the graywater systems with a trend of increasing concentrations with time and a subsequent increase in measured leachate concentrations above the input concentration measured in the graywater. However, less impact on soil SAR was observed than soil irrigated with reclaimed wastewater. Less accumulation of surfactants was observed compare to sludge amended soils. Most of the surfactants were accumulated in surface soil samples. While, percentage of surfactants retained in the columns was always above 81%, removal rate decreased over the duration of study.

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