

Long-term effects of Graywater Irrigation on Soil Quality

Masoud N. Azar¹ and Sybil Sharvelle,

Department of Civil and Environmental Engineering, Colorado State University, Fort Collins, Colorado

Mary Stromberger

Department of Soil and Crop Sciences, Colorado State University, Fort Collins, Colorado

Abstract. As water supply becomes more limited throughout the world, there is a growing interest for innovative approaches to water resources sustainability. One approach that is gaining popularity is household graywater reuse for residential landscape irrigation. However, the application of graywater for irrigation may result in increased levels of emerging contaminant and pathogens, negative impacts to soil quality, or potential groundwater contamination with chemical constituents present in graywater. In addition, limited scientific data is available on the fate of graywater chemical and microbiological constituents and for the safe operation of graywater irrigation systems. The objective of this research project is to elucidate information on the fate of graywater constituents and their long-term potential impacts on soil quality, as a result of its application for residential landscape irrigation. Soil samples have been collected at households with existing graywater irrigation systems which have been in place for more than 5 years in the states of Colorado, California, and Texas. Soil samples have been collected in an area irrigated with graywater as well as a control area with analogous soil and landscaping that has been irrigated with fresh water. Soil cores were taken to a depth of 1 m at depths of 0-15 cm, 15-30 cm, and 30-100 cm separately for quantification of antimicrobials, surfactants, and pathogen indicator organisms. Total coliforms, *E. coli*, *Enterococci*, and *Clostridium perfringens* have been quantified in soil samples. Early results indicate that areas irrigated with graywater may not have more pathogen indicators than areas irrigated with fresh water. Infiltration tests were conducted to evaluate the effect of graywater irrigation on soil infiltration capacity. Results indicate that graywater irrigation may actually increase rate of infiltration of water into soils and that long-term irrigation with graywater will not result in reduced infiltration capacity. Widely used surfactants including soap, linear alkyl benzene sulfonates, alcohol ethoxylates, and alcohol ether sulfates will be quantified by liquid chromatography-mass spectrometry in soil samples. In addition, common antimicrobials in personal care products, triclosan and triclocarban, will be monitored by liquid chromatography-mass spectrometry. Results from this study will provide guidance to decision makers, water agencies, regulators, product manufactures and consumers so that safe graywater irrigation systems can be installed and operated for household landscape irrigation.

Keywords: Graywater, water reuse, landscape irrigation, surfactants, antimicrobials, microbial characteristic, infiltration.

¹ Phone (970) 491-8314; e-mail: masazar@engr.colostate.edu