

Workshop „Pharmaceuticals in Soil, Sludge and Slurry” of the German Federal Environment Agency (18th June to 19th June 2013)

TITLE: Crop irrigation with treated wastewater: Uptake of pharmaceuticals by crops, fate and processes in arable soils

Benny Chefetz, Moshe Shenker, Oshri Borgman, Ran Yakir, Tomer Malchi, Myha Goldstein and Evelyn Colon de Mello

Department of Soil and Water Sciences, Faculty of Agriculture, Food and Environment, The Hebrew University of Jerusalem, Rehovot, Israel

CONTACT: chefetz@agri.huji.ac.il

Abstract:

Due to water scarcity in the Middle East, reclaimed wastewater is essential water source to maintain productive agriculture. Irrigation with reclaimed wastewater accounts for 50% of total irrigation water in Israel. This unique situation of intensive irrigation with reclaimed wastewater and sludge application containing residues and active pharmaceutical and personal care products (PPCPs) provides an excellent opportunity to study the long-term exposure effects of these compounds in soils. The long-term introduction of PPCPs to arable land may affect the agro-ecosystem in various aspects which are not known to date.

PPCPs were detected in crops irrigated with treated effluents. Higher concentrations of PPCPs were detected in leaves versus roots and fruits. This is related to the mechanism of uptake and translocation. PPCPs concentrations in fruits and leaves were negatively correlated with the level of organic matter in the growing medium. Some PPCPs were detected in the soil's profile at the end of the growing season. Carbamazepine is highly persistent in soil ($t_{1/2}$ of several years), whereas the other investigated PPCPs exhibited much lower persistency ($t_{1/2}$ of days-weeks).

Column-leaching experiments revealed that composted biosolids generally increase the retardation of PPCPs. However, treated effluents increased the mobility of weakly acidic PPCPs in the biosolids-amended soil columns. Experiments conducted with an environmentally relevant PPCPs concentration (1 ug/L) indicated a higher degree of irreversible sorption and low leachability as compared to higher PPCP concentrations.

This study emphasizes the potential uptake of active pharmaceutical compounds by crops in organic-matter-poor soils irrigated with reclaimed wastewater and highlights the potential risks associated with this agricultural practice.