Emerging Contaminant Issues in Recycled Water for Turf and Landscapes

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The scarcity of water, worsened by urbanization and/or climate changes, places an enormous pressure on water supply in arid and semi-arid regions. This scarcity, when combined with the need for disposing of large volumes of treated wastewater (also intensified by urbanization), makes the reuse of municipal treated wastewater an economically and environmentally critical option. At present, the majority of treated wastewater flows into surface streams or oceans without any economic or environmental benefit.

The reuse of treated wastewater, or "recycled water", is expected to play an increasingly important part in American Southwest. California presently recycles about 650,000 acre-feet of water per year. Future reuse activity in California is estimated to reach 2 million acre-feet per year by 2020 and 3 million acre-feet per year by 2030. The use of recycled water may take several forms, including surface spreading and subsurface injection to recharge groundwater storage, and irrigation of landscapes, golf courses and agricultural crops. Currently 18% of the reuse in California is for landscape and golf course irrigation. Many economical, technological, and societal factors contribute to the slow adoption of recycled water for irrigation. In addition to the need for managing salinity and nutrients, a new limiting factor is the widespread public perception and concern about so-called "chemicals of emerging concern" (CECs) in the recycled water. CECs encompass many classes of chemicals, including especially pharmaceuticals and personal care products (PPCPs).

Human PPCPs contains thousands of active ingredients within tens of thousands of products. The occurrence and effects of PPCPs in the environment has attracted worldwide attention in the research community and hence there is a fairly good understanding about the levels of PPCPs in recycled water. Many pharmaceuticals used in human medical care are not completely absorbed in the human body, and are instead excreted, often unchanged from their original forms. On the other hand, current wastewater treatment plants were not specifically designed to remove PPCPs from the waste stream. Consequently, many PPCPs are found to be present in recycled water at concentrations from ng/L (ppt) to low µg/L (ppb). Therefore, when recycled water is used for irrigation, the plant-soil system is adminstered with PPCPs at trace levels. For golf courses and lawns, a question begging for answers is: Would the PPCPs contaminate groundwater when recycled water is used for irrigation?

Researchers at UC Riverside concluded a study last summer using the lysimetered plots at UCR's Turf Research Facility. Sandy loam and loamy sand plots were irrigated solely with recycled water for 6 months at 100% or 130% ETo. The leachate was collected and analyzed for the appearance of 15 PPCPs. Up to 5 compounds were detected in the leachate. After correcting for the leaching fraction, only less than 5% of the input PPCPs traveled below the 90-cm depth and accumulated in the leachate. These results suggested that turfgrass acted as an effective "biofilter" and efficiently removed most of PPCPs entering the system.