



USDA-CSREES 2007 National Water Quality Conference

Integration of Low-Wattage UV into ReCip® Wetlands Technology for Improved Decentralized Wastewater

Scientists at the Tennessee Valley Authority (TVA) developed and patented a robust, economical and size-scalable wastewater treatment technology known as the ReCip® wetlands. The simplest two-cell system is based on subsurface-flow constructed wetlands technology but with frequent timer-controlled fill-and-drain cycles that provide aeration to microbial biofilms and plant roots and a range of environments, i.e. aerobic, anoxic and anaerobic, that stimulate microbial and chemical conversions of waste stream components. Plants add organic materials to the system and an esthetically pleasing appearance. Installation designs, plantings, and operations are developed to meet the specific needs of a site and its waste-stream. Today the ReCip® wetlands technology is in use nationally and internationally for effective treatment of wastewater from single-family households, condominiums, day use facilities, animal feeding operations and airport deicing facilities. TVA and the American Public Power Association have collaborated to integrate low-wattage ultraviolet light technology (UV) into ReCip® system operations. The new UV light configuration, in reciprocating mode, exposes wastewater to UV radiation generated by low-wattage UV lamps (25-65 watts) six to twenty-four times per day during a treatment cycle. Conventional UV systems treat wastewater during a short duration single-pass episode, and require high wattage lights to achieve a significant pathogen kill rate. With low-wattage UV integration, the ReCip® treatment achieved an overall 4-5 log reduction in pathogen indicator numbers in a septic tank wastewater stream. The fixed-film microbial populations of the ReCip® system are not exposed to the UV light and remain attached to rock substrates where they continue to act on wastewater components. The treated wastewater product of the UV-ReCip® system is clear and odor free with very low levels of suspended solids, BOD5, nitrogen and pathogen indicators. As such, this treated wastewater is suitable for irrigation and other water reuse options.

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