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Occurrence and fate of pharmaceuticals and personal care products in Taiwan's aquatic environment

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ABSTRACT

Pharmaceuticals and personal care products (PPCPs) have raised considerable concern around the world due to their potential toxicity for ecological system and human health. PPCPs are ineffectively removed by conventional wastewater treatment processes and thus occur widely in aqueous environments. This study investigated the occurrence and removal of 28 often-used PPCPs (including selected antibiotics, estrogens, non-steroidal anti-inflammatory drugs, beta-blockers, and lipid regulators) in the primary, secondary and tertiary (ultrafiltration/reverse osmosis (UF/RO)) treatment processes of the Water Resource Recycling Center (WRRC) and surface waters in Taiwan. We have demonstrated 20 target PPCPs in WRRC influents; sulfamethoxazole (1353 ng/L), caffeine (6823 ng/L) and acetaminophen (2716 ng/L) were found at high concentrations. Secondary and chlorination processes showed inefficient removal for PPCPs (12 PPCPs had <80% removal). However, most target compounds were removed effectively (with ~90% removal) in the tertiary process (UF/RO) except for oxytetracycline and caffeine, and the overall removal efficiency by WRRC was >99%. More than 10 compounds were detected in the surveyed surface waters (from reservoirs, river waters and dams). Caffeine had the highest observed concentration (1,813 ng/L) while others were present at <260 ng/L. Sulfamethoxazole, sulfamethazine, sulfadimethoxine and caffeine were detected most frequently (>70%). Some of the PPCPs found originated from discharges from conventional wastewater treatment plants. In conclusion, RO demonstrated good overall performance and could be used to process wastewater to better ensure the health of humans and wildlife.

Keywords: Pharmaceuticals and personal care products; Reverse osmosis; Surface waters; Water reuse

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