Occurrence and removal of steroidal estrogens in Centre Eastern Tunisia municipal sewage treatment plant

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ABSTRACT

Occurrence and removal efficiencies of both natural estrogens, estrone (E1), 17β-estradiol (E2) and estriol (E3), and a synthetic estrogen, 17α-ethinylestradiol (EE2), were investigated in sewage treatment plant in Centre Eastern Tunisia employing simple activated sludge process. Concentrations of target estrogens were determined in both wastewater and sludge phases by gas chromatography coupled with mass spectrometer. Among the estrogens studied, E3 was found as the dominant compound detected in wastewater samples with average concentration up to 300 ± 4 ng/L in influent and up to 36 ± 2 in effluent. High aqueous phase removals (>85%) were achieved for E3, while only low to moderate removals for E1, E2, and EE2 (<75%). Based on the mass balance analysis, sorption onto sludge played a dominant role in the removal of estrogens in warm season, especially for E1 and E2 (69.5 and 66.3%, respectively), while biological degradation played a significant role in hot season (≥61%).

Keywords: Activated sludge; Estrogens; Gas chromatography–mass spectrometry (GC–MS); Sewage treatment plant

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