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Fate Of Polycyclic Musks In Wastewater Treatment Plants

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Synthetic musks are found in consumer products in varying amounts. After use, synthetic musks go down-the-drain into the sewer system and then reach wastewater treatment plants (WWTPs). In this study, mass flows and fate of two synthetic, polycyclic musks, 1,3,4,6,7,8-hexahydro-4,6,6,7,8,8-hexamethylcyclopenta[1,2-b]pyran (HHCB) and 7-acetyl-1,1,3,4,4,6-hexamethyl-1,2,3,4-tetrahydronaphthalene (AHTN), along with HHCB-lactone, the oxidation product of HHCB, were examined in two WWTPs. Wastewater and sludge samples were collected at different stages of the treatment process for analysis. HHCB, AHTN, and HHCB-lactone were found in all wastewater samples at concentrations in the ranges of 57.6 – 1230 ng/L, 18.2 – 244 ng/L, and 316 – 4000 ng/L, respectively. The highest concentrations for all compounds were found in sludge samples. Sludge samples contained HHCB at 7.23 -108 mg/kg dry weight, AHTN at 0.809 – 16.8 mg/kg dry weight, and HHCB-lactone at 3.16 – 22.0 mg/kg dry weight. This is the first study to report HHCB-lactone concentrations in WWTPs from the United States. Concentrations of HHCB-lactone increased following the treatment and HHCB-lactone was the dominant compound found in the effluent from all WWTPs. Concentrations of HHCB, AHTN, and HHCB-lactone were positively correlated with each other in influent from the treatment plants, suggesting the existence of a similar sources for the three compounds. Based on the daily flow rates and mean concentrations of HHCB, AHTN and HHCB-lactone in effluent, a WWTP typical of those studied here, is expected to release 19.8, 6.38, and 158 g/day, respectively. Partitioning of HHCB, AHTN, and HHCB-lactone to sludge is the major removal mechanism for polycyclic musks in WWTPs.