

The Photocatalytic Degradation of 17 β -ethynylestradiol (EE2) and Related Estrogens

Kevin Fleshman '23

Endocrine disrupting chemicals (EDCs) are a group of chemicals that interfere with the function of the endocrine system of humans and wildlife by inhibiting hormonal synthesis and metabolism (L. Barreiros et al 2016). EDCs are becoming an even more imminent issue to the environment because they are introduced to water systems via human excretion and are incompletely removed by wastewater treatment plants (WWTPs), leading to their bioaccumulation in aquatic environments and subsequent entrance into the food chain.

Estrogens of synthetic and natural origin contribute to the EDCs that enter water systems. estradiol (E2) and 17 β -ethynylestradiol (EE2) are two EDCs with higher endocrine disruption potential (Barreiros et al 2016). EE2 is a synthetic estrogen derived from the natural estrogen E2 and mostly used as a birth control (Dimitrakaki et al. 2009). The presence of E2 and EE2 in the environment has been shown to decrease the reproductive fitness and increase of breast and testicular cancer in humans (L. Barreiros et al. 2016). These estrogens have the potential to bioaccumulate and enter the food chain. The European Union added E2 and EE2 to their list of emerging aquatic pollutants included in their Water Framework Directive to address the bioaccumulation of estrogens in water. Photocatalytic degradation is a promising technique for estrogen removal from water systems.

Titanium dioxide (TiO₂) is the most commonly used photocatalyst. However, TiO₂ photocatalysts are being explored with the goal of more rapidly and completely degrading contaminants. A newer photocatalyst is bismuth oxychloride (BiOCl).