

Biodegradation of Endoxifen in Wastewater: Isolation and Identification of Bacteria Degraders, Kinetics, and By-Products

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Abstract : Endoxifen is an active metabolite responsible for the effectiveness of tamoxifen, a chemotherapeutic drug widely used for endocrine responsive breast cancer and chemo-preventive long-term treatment. Tamoxifen and endoxifen are not completely metabolized in human body and are actively excreted. As a result, they are released to the water environment via wastewater treatment plants (WWTPs). The presence of tamoxifen in the environment produces negative effects on aquatic lives due to its antiestrogenic activity. Because endoxifen is 30-100 times more potent than tamoxifen itself and also presents antiestrogenic activity, its presence in the water environment could result in even more toxic effects on aquatic lives compared to tamoxifen. Data on actual concentrations of endoxifen in the environment is limited due to recent discovery of endoxifen pharmaceutical activity. However, endoxifen has been detected in hospital and municipal wastewater effluents. The detection of endoxifen in wastewater effluents questions the treatment efficiency of WWTPs. Studies reporting information about endoxifen removal in WWTPs are also scarce. There was a study that used chlorination to eliminate endoxifen in wastewater. However, an inefficient degradation of endoxifen by chlorination and the production of hazardous disinfection by-products were observed. Therefore, there is a need to remove endoxifen from wastewater prior to chlorination in order to reduce the potential release of endoxifen into the environment and its possible effects. The aim of this research is to isolate and identify bacteria strain(s) capable of degrading endoxifen into less hazardous compound(s). For this purpose, bacteria strains from WWTPs were exposed to endoxifen as a sole carbon and nitrogen source for 40 days. Bacteria presenting positive growth were isolated and tested for endoxifen biodegradation. Endoxifen concentration and by-product formation were monitored. The Monod kinetic model was used to determine endoxifen biodegradation rate. Preliminary results of the study suggest that isolated bacteria from WWTPs are able to growth in presence of endoxifen as a sole carbon and nitrogen source. Ongoing work includes identification of these bacteria strains and by-product(s) of endoxifen biodegradation.

Keywords : biodegradation, bacterial degraders, endoxifen, wastewater

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