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Abstract

Research on employing advanced oxidation processes (AOPs) for pharmaceuticals removal is gaining interests. However, detrimental effects of background water constituents in complex water matrices are limiting their implementation. In this study, we report red light induced methylene blue photosensitization (MB/Red-light) as a promising alternative for pharmaceuticals removal from wastewater, because of its potential to overcome detrimental effects of background water constituents as experienced in other AOP technologies. In this study, the efficacy of MB/Red-light on degradation of four pharmaceutical compounds, *i.e.* diclofenac (DFN), metoprolol (MTP), propranolol (PRP) and sulfamethoxazole (SFZ), was investigated. The MB/Red-light photosensitization enabled degradation of three model compounds, *i.e.* DFN, PRP and SFZ. Degradation rates followed the order of DFN＞PRP＞SFZ. Singlet oxygen was found to be crucial in pharmaceuticals degradation, and another additional mechanism, *i.e.* a direct reaction with triplet MB, also contributed to DFN degradation. The presence of two DFN degradation mechanisms were confirmed by UV-vis light absorbance spectra measurement as well as the identification of degradation products by LC-MS/MS. Effects of three common back ground water constituents were examined to assess the applicability