ABSTRACT

Contaminants of emerging concern (CECs) - pesticides, hormones, pharmaceuticals drugs – are introduced in the environment, and due to their low removal efficiency in conventional wastewater treatment technologies they are found at low concentrations and can impact the environment and human health. Advanced treatment is required to deal with CECs, in special for Municipal Wastewater Treatment Plants (MWWTP), a hotspot for the release of CECs in the environment. Advanced Oxidative Processes (AOPs) are indicated for the treatment of water contaminated with recalcitrant compounds by hydroxyl and other ROS (reactive oxygen species) generation. In this context, considering the high potential of AOP for advanced wastewater treatment using the low-cost RPR (Raceway Pond Reactor) and harnessing solar light as a sustainable source of energy widely available in Brazil, this work proposed the application of the solar modified neutral photo-Fenton with Fe^{3+}-EDDS complex (1:2) in RPR for removal of CECs and disinfection in different secondary effluents. This work initially presents a detailed literature review on this simultaneous treatment of CECs and disinfection with the use of a bibliometric and systemic review methodology, that allowed to identify the highlights, obstacles, and opportunities to work on this topic. Results showed that most published papers segregate disinfection and CECs results, while the most investigated secondary effluents originate from CAS (conventional activated sludge) treatment. In Brazil, for example, different biological secondary treatments are applied, including facultative ponds, anaerobic reactors, and biological filters. Following, an aluminum surface applied in the bottom of the reactor was investigated. Secondary effluent and natural water were spiked with a mixture of six CECs (acetaminophen, caffeine, carbamazepine, diclofenac, sulfamethoxazole, and trimethoprim) at different initial concentrations (20 and 100 μg L^{-1}), as well as a total of 60 contaminants was determined in the secondary effluent (25 ± 5 μg L^{-1}). The aluminum surface improved the overall efficiency of the reaction, enabling similar efficiencies with lower catalyst dose requirement (0.054 mM and 0.1 mM of Fe^{3+}) at higher liquid depth (15 cm), and caffeine was the most resistant in all treatment conditions. The evaluation of different matrixes showed the influence of natural organic matter and turbidity as main factors on reaction efficiency and treatment time, rather than the inorganic content. Finally, a secondary effluent from a UASB-TF (Up flow Anaerobic Sludge Blanket + Trickling filter) system was treated in similar conditions (0.1 mm-Fe, 1.47 mM H_2O_2, 10 cm) and achieved a high removal of CECs (86 %) as well disinfection was achieved (2.47±0.78 log unit's removal for total coliforms and 2.53 log unit's removal for *E. coli*).

Keywords: CECs, disinfection, photo-Fenton, AOP, solar reactors, RPR.