Research on new technologies for treating

water fluxes in terms of elimination of micropollutants

Abstract

Currently, as a consequence of anthropogenic activities, many harmful compounds enter the environment, posing a threat to human health even at low concentrations. Among these substances, organic micropollutants such as pesticides, polycyclic aromatic hydrocarbons, flame retardants, pharmaceuticals, personal care products, surfactants, hormones, and polychlorinated biphenyls are highlighted. These compounds are commonly identified in various water matrices due to the insufficient efficiency of their elimination using conventional treatment methods. Therefore, alternative techniques for organic micropollutants removal from the environment need to be explored.

The aim of this study was to assess the degradation rate of organic micropollutants using sonication and other advanced oxidation processes. The research scope initially involved selecting operational parameters of the sonication process and determining factors affecting the method effectiveness. Subsequently, sonication was integrated with other advanced oxidation methods, such as ozone and hydrogen peroxide addition, and the influence of water matrix on the efficiency of these processes was analyzed. Additionally, in the study effect of sand and glass particles addition on micropollutants elimination was also examined. The effectiveness of micropollutant removal was assessed using gas chromatography method, and the toxicological analysis of post-treated samples was performed.

The research indicated that sonication is an effective method for eliminating various organic micropollutants. It was noted that the efficiency of this process was proportional to acoustic power, energy delivered to aqueous solutions, intensity of the ultrasound, acoustic pressure, and treatment time. Furthermore, integrating sonication with other methods increased the decomposition of analyzed micropollutants. The efficiency of processes based on O_3 and H_2O_2 addition depended on the oxidant dose, while in the case of heterogeneous sonocatalysis, it depended on the dose of the applied catalyst. Moreover, it was shown that the chemical composition of solutions subjected to

advanced oxidation processes can significantly influence the removal ratio of micropollutants. Toxicological analysis demonstrated that the use of these processes may lead to the formation of by-products, which can be more toxic than the initial compound, emphasizing the important role of toxicological research as an indirect method for assessing the effectiveness of advanced oxidation processes.