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ABSTRACT

Over the last two decades, large quantities of products, such as medicines, disinfectants, and personal care products, have been released into surface waters and wastewater treatment facilities by the pharmaceutical and chemical industries which have come to the attention of scientists with regard to their impacts on life in lakes, rivers, and groundwater. Among various types of treatment processes, ultrasonic (US) treatment process was used in this study to investigate the effect catalysts and removal of selected pharmaceutical's (PhACs) compounds (ibuprofen (IBP) and sulfamethoxazole (SMX)). Carbon nanomaterials (CNMs) have become candidates for numerous applications in nanocomposites, microelectric devices, sensors, energy storage, microelectronics, biomedicines, and mechanical resonators. However, a key challenge is how to enhance the dispersion and stabilization of CNMs in water. The stabilization and dispersion of target CNMs was reviewed to address the effects of water quality conditions (pH, ionic strength, and temperature), natural/synthetic dispersing agents, and the effects of ultrasonication, acidification, and/or UV irradiation on dispersion and stabilization. Sonocatalytic degradation experiments were carried out to determine the removal effects on IBP and SMX in the presence of various types of catalysts including single walled carbon nanotubes (SWNTs), glass beads, and two fly ashes (Belews Creek fly ash and Wateree Station fly ash). In addition, the removal of the IBP/SMX and the production of hydrogen peroxide H_2O2 was measured in the absence and the presence of the mentioned catalysts under different conditions; pH (3.5, 7, and 9.5), frequency (28, 580, and 1000 kHz), temperature (15, 25, 35, and 55°C) and power intensity (0.045, 0.09, 0.135, and 0.18 WmL^{-1}). Furthermore, the adsorption analysis between these pharmaceuticals and SWNTs was performed by molecular modeling and validated with the

experimental results. Overall, the sonocatalytic degradation of IBP and SMX fitted pseudo first-order rate kinetics and the synergistic indices of all the reactions were determined to compare the efficiency of the catalysts.