Abstract

The continuous advance in industry, general intensification of processes and urbanisation inevitably leads to production of new substances each year, collectively referred to as emerging pollutants (EPs). As the mass production of EPs increases, the demand for wastewater treatment plants also dramatically increases. The inadequacy of conventional tretament plants in removing EPs, such as pharmaceuticals, pesticides, personal care products, and others, results in the presence of these substances in surface and groundwater at significant concentrations. The often negative or unclear impact of EPs to the environment furhter emphasizes the urgency of this issue and requires a corresponding response. Photocatalysis belongs to the co-called advanced oxidation processes, key techniques for ensuring effective wastewater treatment. This thesis is focused on the photocatalytic degradation of tetracycline, trimethoprim and sulfamethoxazole, three common antibiotics frequently found in wastewater. Graphitic carbon nitride, a promising material in research of fotocatalytic degradation, was used as a photocatalyst and was activated by visible light emitted from a mercury xenon lamp. Experiments were conducted in batch setup and in microphotoreactor to compare the efficiency of both systems. Rhodamine B was used in reference experiment as a controll material. The analysis of rhodamine B samples was performed spectrophotometrically, and products from antibiotic samples were separated by HPLC and detected using diode array detector and mass spectrometer. The results confirmed the ability of both systems to degrade the studied substances, but microphotoreactor demonstrated greater efficiency with shorter exposure times, as demonstrated by comparing the specific reaction rates of both systems for all studied substances, Subsequently, suitable degradation pathways or schemes were identified. The compiled kinetic model in the MATLAB describes the transformations of antibiotics into products of photocatalytic degradation by providing approximate kinetic constants of individiual reactions. The obtained results offer insights for practical applications of photocalatytic dergadation of pharmaceuticals. Specifically, these findings can be applied to optimize processes with the aim of improving efficiency and reducing the time required for wastewater treatment.