Abstract

Monitoring the fate and presence of pharmaceuticals in aquatic and terrestrial environments has become extremely important due to society's developing ecological awareness. Antimicrobial agents (AMs) deserve special attention due to the correlation between the rapid increase in drug resistance of bacteria connected with growth of their consumption and occurrence in the environment. Most often, monitoring covers selected pollutants regulated by law or being of public interest. The commonly used targeted analysis is insufficient for an objective assessment of the state of the environment because it can only be applied to a limited number of compounds for which a reference standard is available. Moreover, AMs are transformed under the influence of environmental factors, creating transformation products (TPs) with unknown structures and properties. **The doctoral thesis aimed to develop new analytical methods that are useful in analyzing the occurrence of selected AMs and their TPs in environmental samples.** Determination of the distribution of AMs and their TPs in environmental samples is possible using liquid chromatography coupled to a tandem mass spectrometer (LC-MS/MS). The application of various scanning modes of tandem mass spectrometer permits screening and non-targeted analysis of a wide range of contaminants in the sample. Based on the available reports on pharmaceutical consumption in Europe, 22 AMs from 7 drug classes (sulfonamides, tetracyclines, fluoroquinolones, macrolides, β-lactams, lincosamides, and glycopeptides) were selected. The dissertation is based on nine peer-reviewed publications in international scientific journals. As a result of the literature review, the AMs most frequently used in medicine and veterinary medicine were selected. Their extraction and determination methods using LC-MS/MS were developed for various environmental samples (water, soil, plant tissues). The developed procedures were used in monitoring studies of the prevalence of selected AMs in the aquatic environment and soil in the Silesian Voivodeship. Two primary sources of AMs in the environment were identified – wastewater treatment plants and animal fertilizers – and their ability to accumulate and persist in environmental conditions was assessed. The research was extended to include NTA to identify TPs and propose paths for their transformation. Finally, it was found that currently used wastewater treatment methods are not sufficient to fully remove AMs from wastewater and surface water, so two alternative water treatment methods were proposed (photocatalysis and phytoremediation).