Occurrence and Analysis of Selected Pharmaceuticals and Metabolites as Contaminants Present in Waste Waters, Sludge and Sediments

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Abstract Large amounts of pharmaceutical compounds from a wide spectrum of medicinal classes are prescribed in human medical care and are used in veterinary medicine worldwide. So far, therapeutically active compounds have not generally been seen as potentially toxic substances, therefore, unlike many other anthropogenic pollutants, pharmaceuticals have not been subjected to detailed research regarding their possible adverse environmental effects.

The most important ways that drugs enter the environment are through the waste effluents of manufacturing processes, excreta, the disposal of unused or expired drug products, and from accidental spills during manufacturing or distribution. In addition to the unaltered administered compounds many metabolites can be present in measurable quantities in sewage, effluents from sewage treatment plants (STPs), receiving waters and ground waters, and even in drinking waters, since the removal of many compounds and their metabolites in the STPs is not complete.

Literature on the environmental analysis and occurrence of drugs has addressed only a very small percentage of these compounds, hence very little information about the fate and potential effects of drugs in the environment is available. Today, the technique of choice for analysis of these groups of substances is liquid chromatography coupled to mass spectrometry (LC-MS) and tandem mass spectrometry (LC-MS-MS). In the last decades, this technique has made impressive progress that has made possible the analysis of many environmental pollutants in a faster, more convenient, and more sensitive way. In some cases the analysis of compounds that could not be determined before has become possible.

Keywords Pharmaceuticals · Drugs · Wastewaters · Sediments · LC-MS and LC-MS-MS analysis
1 Introduction

Unlike many other anthropogenic pollutants, pharmaceuticals have not been subjected to detailed research regarding their possible adverse environmental effects. Until recently, therapeutically active compounds were not generally seen as potentially toxic substances, probably as the amount of pharmaceuticals and their bioactive metabolites being introduced into the environment is low. However, their continuous environmental input may lead to a high long-term concentration and promote continual but unnoticed adverse effects on aquatic and terrestrial organisms. Therefore, effects can accumulate so slowly that changes remain undetected until they become irreversible.