

Abstract (w j. angielskim)

Aquatic ecosystems are currently exposed to stressors associated with ongoing climate change, including rising temperatures and acidification of the aquatic environment. Anthropogenic substances, including emerging contaminants such as pharmaceuticals, also pose a significant threat to the natural environment. These compounds enter natural waters mainly because of their incomplete removal in conventional wastewater treatment plants. Due to their biological activity, pharmaceuticals may affect non-target organisms even at low concentrations.

Their toxicity may be modified by changes in water temperature and pH, as summarized in the literature review included in this doctoral dissertation. In the case of ionizable pharmaceuticals, pH affects their ionic form and bioavailability, particularly when the pKa of a compound is close to the pH of natural waters. Examples include some sulfonamides, a class of antibiotics among the pharmaceuticals most frequently detected in environmental water samples. Another group commonly detected in the environment at concentrations ranging from ng L^{-1} to $\mu\text{g L}^{-1}$ is non-steroidal anti-inflammatory drugs (NSAIDs).

Therefore, this doctoral dissertation aimed to assess the importance of pH, test medium composition, and the source and preparation procedure of test organisms in shaping the outcomes of acute and chronic toxicity tests of sulfamethoxazole (SMX) and diclofenac (DCF) in reference organisms, as well as in the interpretation of tests based on the guidelines of the Organisation for Economic Co-operation and Development (OECD).

The research began with studies conducted under environmentally relevant conditions, which indicated the potential for DCF bioaccumulation in *Daphnia* sp. inhabiting a wastewater treatment plant. Targeted analysis of NSAIDs using ultra-high-performance liquid chromatography coupled with tandem mass spectrometry (UHPLC–MS/MS) confirmed the presence of DCF in daphnids, while field observations indicated that their populations could persist in an environment chronically exposed to a mixture of contaminants. These studies provided a basis for subsequent laboratory experiments.

To assess the effect of reduced pH on pharmaceutical toxicity and evaluate the applicability of tests based on OECD guidelines, a series of short- and long-term ecotoxicity tests was conducted according to OECD 202, OECD 211, and OECD 221. The reference organisms *Daphnia magna* and *Lemna minor* were used. The scope of the dissertation also included an analysis of how test conditions, including culture medium composition, the stability of physicochemical parameters, and the source and preparation procedure of test organisms, affected the ecotoxicological results.

Acute SMX toxicity to *L. minor*, assessed based on growth inhibition, increased with decreasing pH. Acidification increased the proportion of the neutral form of SMX, which is more bioavailable to the plant. In the case of DCF, acidification increased its chronic toxicity and affected reproductive endpoints, including the time to first brood production. Importantly, the results indicated that reduced pH may also modify the biological response of the test organism and, consequently, its sensitivity to the contaminant. Test medium type and the source and preparation procedure of test organisms were also associated with differences in DCF toxicity to *D. magna* in the OECD 202 test. Differences in these factors were associated with statistically significant variation in EC_{50} values.

The results indicate that OECD tests are fundamental tools for assessing ecotoxicity. However, when applied to ionizable pharmaceuticals, their interpretation should account for the effects of variable environmental conditions on both the properties of the tested compounds and the responses of aquatic organisms. Particular attention should be paid to monitoring and reporting pH, as this parameter affects not only the ionic form of pharmaceuticals but also the biological responses and sensitivity of the test organisms. A reliable assessment also requires detailed reporting of the culture history of test organisms and comprehensive characterization of the test medium, including its ionic composition. In conclusion, the findings of this doctoral dissertation highlight the need to consider variability in environmental and methodological conditions, as well as the source and preparation procedure of test organisms, when interpreting and reporting the results of tests based on OECD guidelines. This approach may contribute to a more robust environmental risk assessment of pharmaceuticals under a changing climate.