ABSTRACT

Numerous studies in recent years have clearly indicated that drug residues entering the aquatic environment can pose a serious threat to biota. Among the pharmaceuticals that are commonly found in water bodies, non-steroidal anti-inflammatory drugs (NSAIDs) are of particular note, with diclofenac being the most important representative. In addition to parent compounds, pharmaceutical transformation products may also pose a threat to the environment, but in this case the scale of the problem is yet to be estimated.

The main objective of the present study was to evaluate the effects of diclofenac and its main transformation product, 4-OH diclofenac, on marine invertebrates, using *Mytilus trossulus* as a model species. To accomplish this, markers from different levels of biological organization depicting the physiological and biochemical effects of the two compounds were used during the study. Another objective was to estimate the bioconcentration factor of diclofenac and its metabolite in *M. trossulus* tissues. In addition to determining the bioconcentration capacity of the two compounds, the absorption kinetics of the tested compounds were analyzed during the experimental studies and the mass balance was determined taking into account the concentrations of the analytes in both the mussel tissues, water, and biofilm. An additional objective of the present work was to determine the stability of both tested compounds in a long- term test simulating conditions present in the bottom zone of the Baltic Sea. The purpose of this thesis was also to collect available literature data on pharmaceutical contaminants, including NSAIDs, in the aquatic environment, in particular, their concentrations recorded in various components of ecosystems and their toxic effects on living organisms.

The studies conducted in this work confirmed that both diclofenac and 4-OH diclofenac are taken up by *M. trossulus* mussels and accumulated in their tissues. However, the bioconcentration factor (BCF) values obtained indicate that this process occurs to a small extent. Moreover, thanks to the results obtained, it was confirmed that these compounds can be metabolized and then excreted by the mussels. It was also shown that diclofenac and 4-OH diclofenac have toxic effects on *M. trossulus*, which in the case of diclofenac can be observed already at concentrations regularly recorded in the marine environment. The analyses conducted confirmed that histological markers can be a useful tool in assessing the effects of pharmaceuticals on aquatic organisms. Diclofenac was also shown to have significantly higher stability in bottom seawater in the presence of sediment than its metabolite, 4-OH diclofenac, and to biodegrade in sediment to 5-OH diclofenac.

Keywords:
Pharmaceutical compounds, NSAIDs, diclofenac, metabolites, toxicity, bioconcentration, mussels