



Modeling ecotoxicity: a tool in river basins monitoring and management programs

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Urban and Industrial wastewaters can be complex mixtures and substance specific chemical evaluation, as demanded by present legislation, hardly accounts for an evaluation of effects in order to assess their impact in the receiving waters. This is the main motivation for Ecotoxicological evaluation of complex discharges. An EU Life project (LIFE 02 ENV/P/000416 - Evaluation of Ecotoxicity of Municipal and Industrial Wastewaters in the Rio Trancão Basin: www.iambiente.pt/ecoriver) demonstrated the importance and benefits of using Direct Toxicity Assessment for complex effluents aiming to provide adequate discharges licenses.

Within this project, a toxicity model was developed to understand the causes that lead to pollution “spots”, to identify risk zones and epochs, and to verify the significance of mitigation measures, such as scenarios of reduction of emissions.

The developed model was programmed in the modular structure of MOHID Water Modeling System (www.mohid.com) that is being developed by Instituto Superior Técnico of the Lisbon Technical University in the last two decades. This modeling system is being applied in estuaries, rivers and reservoirs to simulate hydrodynamics, sediment transport, water quality and ecology.

MOHID River Network is a 1D physical based model that simulates the fate of products discharged in a basin. Given precipitation and discharge data, the model computes water levels and flow along the drainage network. It simulates toxicity as a conservative property and uses laboratory information to build a transfer function between

concentration and toxicity level. The model also simulates sediment dynamics (transport, erosion and deposition) and absorption/desorption dynamics between substances and sediment transport.

We present the model and the results of toxicity simulation in Trancão River Basin, a small heavily industrialized and densely populated catchment in the northern part of Lisbon. The catchment discharges into the Tagus Estuary, which is one of the largest in Europe. Tagus Estuary presents an overall reasonable water quality, in spite of the existence of some pollution “spots”. That is the case of the mouth of Trancão River.

Results are presented in the form of dynamical risk maps, which show the importance of the hydrological regime in toxicity distribution. Conclusions show that dilution is the principal factor determining river toxicity caused by point discharges, with the more sensitive areas being the upstream reaches. Precipitation events also cause toxicity peaks due to resuspension and mixture of sediments. Quantification of the impact of mitigation measures like pre-dilution, re-location and/or synchronized wastewater discharges are also presented. One conclusion shows that re-location of discharge is the more significant. These results can help establish discharge limits specific to this basin and assess results of mitigation actions. The model is suitable to extrapolate the results of this study to other basins.