

Chemical Pollution in Mediterranean Iberian River Basins: Ecotoxicological risk assessment and effects on the aquatic ecosystems

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The extensive and intensive use of chemicals in our developed, highly technological society includes more than 100,000 chemical substances. Significant scientific evidence has led to the recognition that their improper use and release may result in undesirable and harmful side-effects on both the human and ecosystem health. To cope with them, appropriate risk assessment processes and related prioritization schemes have been developed in order to provide the necessary scientific background for regulatory procedures.

In this context, the aims of this study were to perform an environmental risk assessment for 200 organicmicropollutants including both regulated and emerging contaminants (pesticides, alkylphenols, pharmaceuticals, hormones, personal care products, perfluorinated compounds and various industrial organic chemicals) monitored in four rivers located in the Mediterranean side of the Iberian Peninsula, namely, the Ebro, Llobregat, Júcar and Guadalquivir rivers; (b) to prioritize them for each of the four river basins studied, taking into account their observed concentration levels together with their ecotoxicological potential; (c) to assess the ecotoxicological risk and explore the possible relationship between the chemical and ecological status in the studied basins .

For this purpose, the toxic units (TU) approach was used to assess the risk of individual compounds based on the measured concentrations of the chemical in each river and its ecotoxicological potential (EC50 values for algae, *Daphnia* sp. and fish) and the concentration addition model (CA) to assess the site-specific risk. A prioritization approach was developed for each compound and indicator species, taking into account both their distribution and intensity in each river basin. The dataset included more than 200 emerging and priority compounds measured at 77 sampling sites along four river basins studied. The toxic units (TU) approach was used to assess the risk of individual compounds and the concentration addition model (CA) to assess the site-specific risk. The link between chemical pollution and aquatic macroinvertebrate communities in situ was examined by using four biological indexes; SPEAR (“Species at Risk Index”) as the indicator of the decline of sensitive species in relation to general organic (SPEARorganic) and pesticides (SPEARpesticides) pollution; and Shannon and Margalef biodiversity indexes.

The results of the study suggested that organic chemicals posed the risk of acute effects at 42% of

the sampling sites and the risk of chronic effects at all the sites. Metals posed the acute risk at 44% of the sites. The main drivers of the risk were pesticides and metals. However, several emerging contaminants (e.g. the antidepressant drug sertraline and the disinfectant triclosan) were contributing to the chronic effects risk. The decline of sensitive macroinvertebrate taxa expressed in terms of SPEAR index was correlated with the increase of toxic stress related to organic compounds. Biodiversity indexes were negatively correlated with the metals and the urban land use type in the catchment.

References

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