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Ph.D. Thesis

“FATE OF BISPHENOL A IN MARINE ENVIRONMENT”

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Ph.D. Thesis Abstract

Bisphenol A (BPA) is an emerging contaminant, classified as endocrine-disruptor, broadly present in the aquatic environment, both in fresh and marine waters. Its wide distribution, which is supposed to increase in the future years, poses a serious threat to both environmental quality and human health. It is therefore extremely important to understand the mechanisms responsible for its transport and fate in natural aquatic systems, which is affected, among others, by multiple degradation and bioaccumulation processes, and by the interaction with natural matrices, mainly natural organic matter (NOM). NOM, a ubiquitous component of marine environments, is known to significantly affect the speciation, bioavailability, and bioaccumulation pathways of pollutants. Recent studies have demonstrated that NOM can also significantly influence the fate of BPA by affecting its speciation, mobility and toxicity. Consequently, accurately detecting and predicting BPA concentrations in natural waters, and thus performing a correct risk assessment, is extremely challenging. Crucially, the molecular mechanisms driving BPA/NOM interactions remain largely unexplored.

This thesis, carried out in cooperation between the University of Naples Federico II and the Stazione Zoologica Anton Dohrn, with the collaboration of the Institute of Agrophysics - Polish Academy of Sciences, is aimed to address this issue through a multidisciplinary approach. It integrates literature reviews, the development of innovative analytical methodologies, *in vivo* experimental investigations, and the environmental engineering characterization of NOM from different aquatic systems, with a particular focus on its interactions with BPA.

The thesis, in fact, contains an extended and critical review on the occurrence and fate of BPA in marine systems, with specific focus on its bioaccumulation and interactions with NOM, and a second review which investigates the interaction of NOM from different environmental compartments with emerging organic contaminants using fluorescence techniques.

In addition, it presents a new analytical method for the detection of BPA in the mussel *Mytilus galloprovincialis*, to monitor BPA accumulation in model marine organisms. This method, opportunely calibrated and validated, is proved to be more sensitive, faster, and cheaper than conventional ones. The proposed technique allows for the quantification of the contaminant's bioaccumulation at different concentrations and exposure times. Integrating BPA quantification and histological analyses the presented research study highlights the variability of tissue-level responses and confirms the potential risk of biomagnification along the trophic chain.

Moreover, this thesis focuses on the characterisation of NOM originating from two different environmental compartments (wastewater treatment plant effluent and seawater) using advanced spectroscopic methods, and investigates the mechanisms of interaction between NOM and BPA.

Overall, the results shed light on two fundamental pathways that govern the fate of BPA in the marine environment: bioaccumulation in organisms and interactions with NOM. The combination of these dynamics not only highlights the intrinsic difficulties of studying contaminants in the marine environment, but also underlines the importance of developing novel methodological tools to improve the assessment of the persistence, mobility and potential ecotoxicological impact of BPA and NOM/BPA complexes in different environments.