Toxicity assessment of freshwater aquatic sediments: proposing the European amphipod Gammarus fossarum for the development of new standardised bioassays

Cécile Luc-Rey*[1,2], Anthony G.e. Mathiron[2], Benoit J.d. Ferrari[3], Hélène Budzinski[4], Pierre-Louis Hombert[2], Nicolas Delorme[1], Olivier Geffard[1], and Guilllaume Jubeaux[2]

[1]RiverLy - Fonctionnement des hydrosystèmes – Institut national de recherche pour l'agriculture, l'alimentation et l'environnement (INRAE) – France

[2]BIOMAE - Biomonitoring Aquatic Environment – INRAE - Laboratoire Partenarial Associé – France

[3]Swiss Centre for Applied Ecotoxicology (Centre Ecotox), EPFL-ENAC-IIE-GE – Suisse

[4]Environnements et Paléoenvironnements OCéaniques – Bordeaux INP ; CNRS ; Université de Bordeaux ; Ecole Pratique des Hautes Etudes – France

Résumé

Sediments are habitat and food sources for many species but are also a reservoir for various contaminants, posing toxicity issues for resident species and complicating management practices such as dredging. Evaluating sediment quality is therefore essential and is based mainly on priority contaminant measurements and by comparing their concentration with sediment quality criteria (SGC) such as TEC (Threshold Effect Concentration) and PEC (Predicted Effect Concentration). However, these thresholds rely on laboratory toxicity data and they are only available for no emerging chemical compounds such as metals, PAHs (Polycyclic Aromatic Hydrocarbons) or PCBs (Polychlorinated Biphenyls). Introducing biological tools is a way of integrating all contaminants. For example, acute and chronic standardized assays with the amphipod *Hyalella azteca* are widely used. In France and Europe, among main amphipod species there is *Gammarus fossarum* for which standardized methods for quantifying toxicity markers are available and already used for water quality assessment. The main goal of my thesis is to develop standardised bioassays to assess sediments toxicity using the European amphipod *G. fossarum.* At a first step, we aim to study effects of confounding abiotic factors (granulometry and carbon organic content) on biological response levels, then to propose a protocol and strategy to interpret results. The second step concerns the application of protocols on dozens of field-collected sediments to validate their relevance and to propose threshold values for each biological marker. The aim of this proposal is to present you the methodology and results obtained for the first step. French Water Agencies extract each year around eight hundred sediments from a large variety of stations to proceed to chemical and physical analyses, available on a national database (naïades, https://naiades.eaufrance.fr/). Based on SGC, we selected thirty stations for the non or low contamination of their sediment and with a wide range of granulometry and carbon organic content to be representative of French sediments. Then, we exposed gammarids (males and females) to each sediment under control laboratory conditions for assessing their effects on survival, feeding rates and reproduction. We finally proposed an index toxicity corrected by confounding parameters to allow accurate interpretation of results in term of toxic effects.

*Intervenant

Mots-Clés: Amphipod, natural sediment, toxicity, bioassays, ecotoxicity, Gammarus fossarum