Integrating the cocktail effect in environmental footprint based on Life Cycle Assessment

Postdoc internship (fall 2024)

LBE unit, Narbonne INRAE, France

To apply please send a full curriculum vitae, a cover letter, and reference letters (if any) to arnaud.helias@inrae.fr, eric.latrille@inrae.fr, and remi.servien@inrae.fr. The position is open until filled.

General context

The common methodology for calculating individual potential toxicological or ecotoxicological impacts of a given substance, in the Life Cycle Assessment (LCA) framework, is computed, for a dedicated compartment (air, soil, water), by its characterization factor (*i.e.* a measure of its (eco-)toxicity) multiplied by its mass (Munoz et al., 2008). Then, the global impacts suffered by the compartment are simply obtained by the sum of the potential individual effects of each of the substances contained in this compartment. This hypothesis of additivity of the impacts without interactions between substances is an approximation of which we do not know whether it is maximizing or not (Coors et al., 2018). Testing this hypothesis and improving the global computation of the potential impacts by taking into account some interactions would approach this type of modeling for practical use, for example for the environmental display of different consumer products and/or an informed comparison between different scenarios (for example for wastewater treatment ...) (Hélias et al., 2022). In this context, the TAILORED project, funded by the ADEME, proposes to test this hypothesis and to state a proof-of-concept to define a first model that takes into account the cocktail effect for some substances.

Postdoctoral mission and objectives

A set of substances has been chosen by the different members of the project to represent different families of compounds and different ecotoxicity levels. These substances will be tested individually on our model organism, the gammarus, to provide a first set of individual results (Geffard et al., 2010). All the experiments will be carried out by our project partner at the Riverly unit. Then you will define an experimental design to test some mixtures of these substances, that will be used to first test the potential existence of cocktail effects. When cocktail effects are highlighted, the results of the experiments will be used to define a model, in the Life Cycle Assessment framework, that takes it into account. This could be done, for example, by implementing new characterization factors for some mixtures of substances or by weighting directly the individual characterization factors. This is a position where initiative is key. Any new ideas you may have or new ways of approaching this subject will be strongly supported.. Finally, the last objective will be to apply the methodology developed to some study cases on the quality of water impacted by urban and industrial discharges at different points. This will support a new prioritisation of substances during wastewater treatment, not only based on the concentration of compounds but also on their complete ecotoxicity potential impacts (Aemig et al., 2021 ; Servien et al., 2023).

Requirements

We seek a highly motivated postdoctoral fellow for this position. The ideal candidate should possess the following qualifications :

- A PhD in applied mathematics (statistics) or life-cycle assessment ;
- Basic knowledge of programming in either R or Python ;
- Proficiency in the English language ;
- An interest in environmental problems would be advantageous.

Conditions

Length 18 months.

Location LBE unit, Narbonne INRAE, France.

Gross salary Between 2816 € and 3190 € depending on experience.

Scientific advantages Funding to go to 2 different international conferences.

Other advantages 45 days of holidays per year, meals at a preferential rate in the canteen at lunchtime, access to the gym and other sporting activities...

Supervision Arnaud Hélias, Eric Latrille, Rémi Servien.
Contact : arnaud.helias@inrae.fr, eric.latrille@inrae.fr and remi.servien@inrae.fr.

References

1. Munoz, I., José Gómez, M., Molina-Díaz, A ., Huijbregts, M.A.J., Fernández-Alba, A .R., García-Calvo, E., 2008. Ranking potential impacts of priority and emerging pollutants in urban wastewater through life cycle impact assessment. Chemosphere 74, 37–44, doi.
2. Coors, A., Vollmar, P., Sacher, F., Polleichtner, C., Hassold, E., Gildemeister, D., Kühnen, U., 2018. Prospective environmental risk assessment of mixtures in wastewater treatment plant effluents – Theoretical considerations and experimental verification. Water Research, 140, 2018, 56-66, doi.
3. Hélias, A., van der Werf, H.M.G., Soler, LG. et al., 2022. Implementing environmental labelling of food products in France. International Journal of Life Cycle Assessment 27, 926–931, doi.
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