

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

## Postdoc internship (beginning 2025)

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](mailto:arnaud.helias@inrae.fr), [eric.latrille@inrae.fr](mailto:eric.latrille@inrae.fr), and [remi.servien@inrae.fr](mailto: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 an ambitious proof-of-concept to define a first model that takes into account the cocktail effect for some substances. To achieve this objective, the different project members have chosen a set of substances to represent different families of compounds and different ecotoxicity levels. These substances have been tested individually on our model organism, the gammarus, to provide a first set of individual results (Geffard et al., 2010). All the experiments have been carried out by our project partner at the Riverly unit. Then an experimental design has been designed to test some mixtures of these substances, that have been thought to test and highlight the potential existence of cocktail effects (*i.e.* an effect that is different from the sum of the individual effects).

### Postdoctoral mission and objectives

The different results of the experiments (for individual substances and mixtures) will be provided to the postdoctoral fellow. The first step will be to highlight the cases when cocktail effects happen. Then, 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. New experiments may also be planned to make the different models more precise. 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 prioritization 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).

The supervising team will strongly support any new ideas you may have or new ways of approaching this subject.

### 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), in life-cycle assessment or in environmental sciences with some data analysis work ;
- 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](mailto:arnaud.helias@inrae.fr), [eric.latrille@inrae.fr](mailto:eric.latrille@inrae.fr) and [remi.servien@inrae.fr](mailto:remi.servien@inrae.fr).

## References

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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](#).
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4. Geffard, O., Xuereb, B., Chaumot, A., Geffard, A., Biagianti, S., Noël, C., Abbaci, K., Garric, J., Charmantier, G. and Charmantier-Daures, M., 2010. Ovarian cycle and embryonic development in *Gammarus fossarum* : Application for reproductive toxicity assessment. *Environmental Toxicology and Chemistry*, 29, 2249-2259. [doi](#).
5. Aemig, Q., Hélias, A., Patureau, D., 2021. Impact assessment of a large panel of organic and inorganic micropollutants released by wastewater treatment plants at the scale of France. *Water Research*, 188, 116524, [doi](#).
6. Servien, R., Bonnot, K., Latrille, E., Hélias, A., and Patureau, D., 2023. Consideration of unmeasured micropollutants released from WWTP for impact estimations. *Science of the Total Environment*, 166313, [doi](#).