Characterizing the potential effects of a complex textile industry contamination on structure, function and nutritional quality of phototrophic biofilms: the case study of the Cleurie River

Chloé Bonnineau, Sarah Chéron, Morgane Jean, Landry Ughetto, Nicolas Creusot, Mélissa Eon, Nicolas Mazzella, Antoine Tourret, Soizic Morin, Simon Devin, et al.

Title: Characterizing the potential effects of a complex textile industry contamination on structure, function and nutritional quality of phototrophic biofilms: the case study of the Cleurie River.

Chloé Bonnineau[4,5], Sarah Chéron[1,2], Morgane Jean[1], Landry Ughetto, Nicolas Creusot, Mélissa Eon, Nicolas Mazzella, Antoine Tourret, Soizic Morin[5], Simon Devin[1,2], Vincent Felten[1,2], Martin Laviale[1,2]

[1] Université de Lorraine, CNRS, LIEC, F-57000 Metz, France
[2] LTER-"Zone Atelier Moselle", Metz, France
[4] INRAE, UR RiverLy, Lyon-Villeurbanne, France
[5] INRAE, UR EABX, Cestas, France

Topic*:*

- Impact of contaminants on microbial diversity and function
- **Microorganisms as a tool for environmental risk assessment**

Keywords (3 to 5)
pesticides, glyphosate, periphyton, trophic chain

Abstract (300 mots max)

The Cleurie River (France) is a forested headwater stream contaminated by industrial activities (textiles). The cocktail of contaminants is characterized by high concentrations of glyphosate and AMPA as well as a high load of dissolved organic matter dominated by optical brighteners. This type of complex contamination, close to environmental quality standards, chronic and episodic, is usually poorly reflected by the bioindicators currently implemented within the European Water Framework Directive. This apparent contradiction feeds an environmental controversy involving end-users of the river, stakeholders and industrialists,

In this context, we investigated the effects of such contamination on phototrophic biofilms, a pivotal ecological player in this ecosystem. The objectives were (1) to evaluate the structure and function of phototrophic biofilms *in situ*, along the pollution gradient, (2) to establish causal relationship between the main contaminants of La Cleurie and biofilms structure and function in controlled experiment and (3) to estimate indirect effects of this contamination by evaluating its impact on the quality of the biofilm as a food resource for consumers.

To do so, biofilms were collected during a seasonal *in-situ* monitoring in the Cleurie river and several controlled lab-experiments. Glyphosate was found to have little effects on photosynthesis or heterotrophic activities of biofilms after 4 weeks of exposure to 0.1 to 150 µg L^{-1}, nevertheless the microbial metabolome was modified in response to exposure. Further experiments highlighted the strong decrease in green algae cell density in phototrophic biofilms exposed to environmental concentrations of an optical brightener for 4 weeks. Exposure to those contaminants also led to changes in lipid profiles of biofilms potentially altering its nutritional quality. Therefore, those biofilms were provided as a food resource to a model consumer (*Gammarus fossarum*) whose life history traits were estimated (survival, growth) to estimate indirect effects of those contaminants on the food chain.

These results will be further used within the framework of a broader interdisciplinary approach aiming at studying the circulation of scientific knowledge between the different actors (researchers, end-users, stakeholders…) involved in this controversy.