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LUMIEAU-STRA — Lutte contre les micropolluants dans les eaux urbaines à Strasbourg

Evaluation of innovative tools for micropollutant research in both urban and industrial waters

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Context

- ✓ Search for micropollutants and sources is complex, heavy in terms of instrumentation and expensive
- ✓ It involves the implementation of measurement campaigns with reference methods adapted to the problems of sites configuration and flow variations, and looking for micropollutants (volumes needed for analysis, sampling precautions to avoid contaminations, samples representativeness)
- ✓ Simpler research tools as a first approach that will subsequently limit the number of measurement campaigns implementing the reference method
- ✓ Research tools are still poorly applied for urban and industrial wastewater but some of them are well known and implemented on river waters or marine waters

Fig 1: Complex implementation of reference method in the network

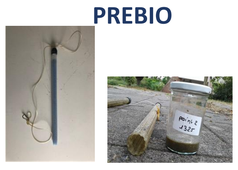
Objectives

The aim of this study was to:

- ✓ Evaluate the implementation of these tools in the field
- ✓ Evaluate the capability to identify and to quantify a list of substances
- ✓ Evaluate the advantages and limits of these tools versus the reference method

Tools and method

This table describes the characteristics of the tools tested

Innovative Tools	**CFIS** 	Continuous flow and integrative sampler (CFIS) Pre-filtered water circulation in cell housing sorbents Accumulation of substances on sorbents Analysis of sorbents → **concentration in discharge** Two sorbents evaluated: ✓ Stir Bar Sorptive Extraction (SBSE) rods ✓ Activated Carbon (CA) cartridges Deployment time: 4 days (accumulation kinetics of substances) Substances: depending on the affinity of the sorbents
	PREBIO 	Cylindrical tube with a foam sleeve having characteristics adapted to development of biofilm Total immersion in water to be investigated Deployment time: 1 month **Concentration of substances in biofilm** Substances: Multi-families of substances
Reference Tool	**Automatic sampler**  **reference method**	Flow-dependent automatic sampling Deployment time: 24 hours Collection of a volume of around 10/15 liters **Concentration and flux of substances in the discharge** Substances: multi-families of substances

Sites and field implementation

- ✓ Deployment between 2017 and 2019 in different areas of the urban and industrial wastewater network of the Eurometropolis of Strasbourg
  - Domestic zone (Zone 4)
  - Mixed zone, influenced by different types of pollution sources (Zone 1 and 3)
  - Industrial zone (Zone 2)
- ✓ Several sampling points per zone
- ✓ Total:
  - 9 points: Reference method
  - 12 points: PREBIO
  - 5 points: CFIS-with sorbant SBSE
  - 3 points: CFIS- with sorbant CA

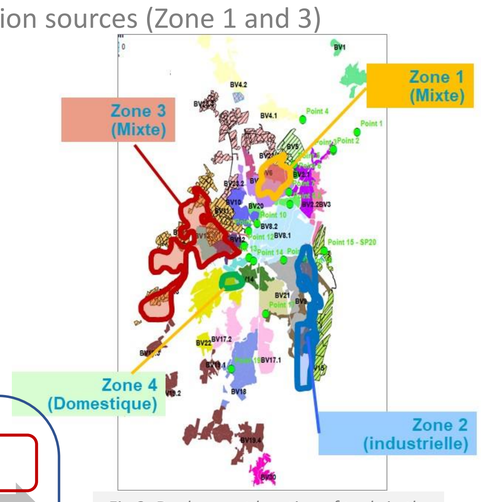


Fig 2: Deployment location of tools in the urban and industrial wastewater network of Eurometropolis of Strasbourg

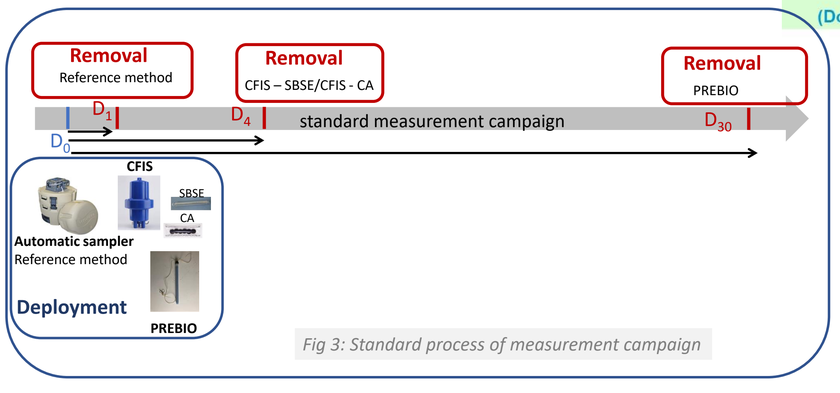


Fig 3: Standard process of measurement campaign

Results

Data evaluation was carried out by comparison of innovative tools and reference method

- ✓ Operational evaluation: advantages and limits of innovative tools vs reference method
- ✓ Qualitative evaluation: number of substances quantified or detected per each innovative tool vs reference method
- ✓ Quantitative evaluation: concentration of substances per each innovative tool vs reference method

→ Some results: PREBIO vs reference method

58 substances commonly searched by both tools

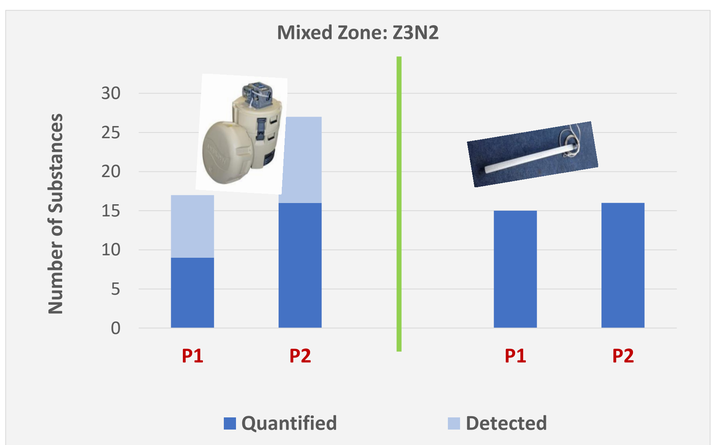


Fig 4: Number of substances quantified and detected (left: Reference method – right: PREBIO)

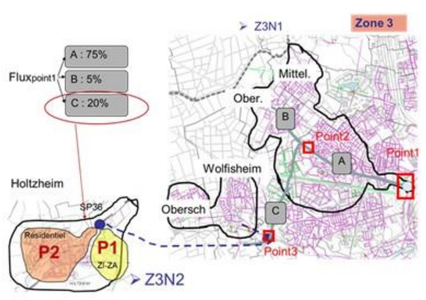


Fig 5: Implementation zone Z3N2 of tools

→ Number of substances found by both tools ➔ same order of magnitude but greater number of quantified substances for PREBIO

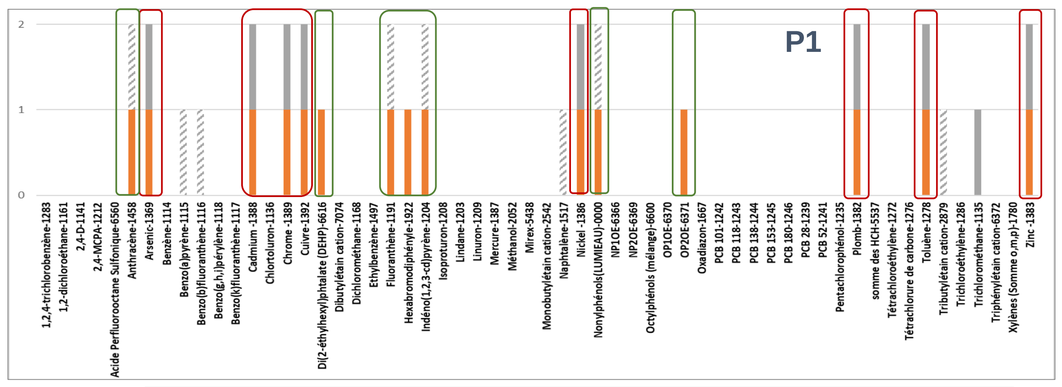


Fig 6: Substances quantified (grey: reference method – orange: PREBIO) and detected (grey and white: reference method)

→Good recovery (metals, toluene)

→Quantification of substances only detected or not detected by the reference method (PAHs, nonylphenols)

→ Some results: CFIS vs reference method

Same results were observed for CFIS-SBSE tool versus reference method but less substances commonly searched and less tests

- ✓ Larger number of substances quantified with the CFIS-SBSE tool
- ✓ Good recovery for substances: nonylphenols, OP1OE, some PCB, some PAH, lindane and HCH
- ✓ Identification of substances not detected per reference method (Alkylphenols)

Conclusion

- ✓ **PREBIO**
  - Better representativeness of the environment studied
  - Less expensive and easier to deploy than the reference method
  - Alternative tool possible for the detection of metals and certain organic substances in situations where semi-quantitative measurements are sufficient
- ✓ **CFIS-SBSE and CFIS-CA**
  - Data convertible to concentration in water
  - First encouraging results for CFIS-SBSE, especially since the list of substances sought within the framework of the LUMIEAU-Stra project is small compared to the capacities of the SBSE tool
- ✓ Report are available under:www.strasbourg.eu/lumieau-stra

Acknowledgements

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