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Using wastewater as a tool to monitor induced dietary intake changes

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Historically oriented towards illicit drugs consumption, before being extended to disease prevalence using pharmaceuticals products as proxy, wastewater based epidemiology is always on the run of finding new biomarkers to broaden the range of topics it covers. In this sense, one of the latest emerging fields is the evaluation of dietary intake, as it is deemed to be a clear reflect of a population well-being.

Despite the diversity of analytical methods developed for organic compounds measurement in wastewater, food biomarkers still represent a challenge since most of the proposed compounds are small molecules that degrades quickly in sewer conditions [1].

In order to improve the global comprehension over their dynamics, the present work propose to evaluate the ability of some plant-based foods markers to respond to a change of uses artificially induced by a mobilization of a group of citizens within a specified catchment (~135k residents). This change of uses was co-constructed with the Parisian citizens (i.e. non-discriminant, affordable, etc.) and asked residents to eat more fruits and vegetables during one week.

Using a comprehensive overview of the sewer system through its connectivity, a delimited catchment have been isolated based on the corresponding input zone and sampled through time-composite sampling. Citizen mobilization was guaranteed through several information meeting and presence on local food market with flyer distribution. The local primary school was also involved in this study through scientific activities with the children and with the support of the school canteen, with the hypothesis that these actions irradiated in the neighbourhood. This action takes place in three distinct weeks in February and March 2024, the first one serving as a reference condition before the second week identified as the period of practice change and the last one after the action (i.e. potentially return to the base level). Monitoring was carried out on a day-to-day basis. Samples will be analysed using LC-MS² for quantification of the targeted compounds but will also be injected in a LC-IMS-Q-TOF for high-resolution mass spectrometry screening in order to compare the obtained fingerprints, and suspect screenings looking for specific dietary intake markers.

The assessed objectives of this action were plurals:

- sensitivity of some explorative tracers to a change of uses over a defined time span
- citizens mobilisation around a scientific adventure
- a potential change in the wastewater composition observed through HRMS fingerprint

Data are currently under acquisition and treatment in order to assess the successfulness of the operation (e.g. significant variations in compound loads) but first results seems very promising.

This work is proposed as a proof of concept of the use of wastewater as a tool of mediation in the science-society dialogue, using the wastewater-based epidemiology approach.

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References

[1] P.M. Choi et al., Do food and stress biomarkers work for wastewater-based epidemiology? A critical evaluation, *Science of The Total Environment*, (2020) <https://doi.org/10.1016/j.scitotenv.2020.139654>