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Micropollutants and boron isotopes as tracers of the presence of domestic wastewater effluents in surface and groundwaters

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The origins of contamination of water resources are often multiple, including for a single chemical element or molecule. For instance, AMPA in both surface and groundwater can originate from agricultural practices as a degradation product of Glyphosate, but also from wastewater effluents as a degradation product of phosphonates.
The discrimination of the origins and vectors of contamination in the environment is both an environmental and societal issue in order to define an integrated water resources management at the catchment or water body scale by implementing appropriate measures to effectively struggle against pollution.
The objective of this study is to define a methodology for the identification of a "domestic wastewater" contamination within surface waters and groundwater. As there is no ideal tracer, i.e. conservative, persistent in the different water compartments, present in quantity above the detection limit and originating from a single type of pollution source, we propose a multi-tracer approach (chemical and isotopic) to identify and validate the relevance of foreseen tracers, in order to overcome this limitation.
Among the relevant tracers of wastewater, the following may be used for their intrinsic or combined discriminant power: 1) organic effluent tracers: nitrogen contents and isotopic ratios of nitrogen and oxygen of nitrates; 2) tracer of detergents: boron contents and boron isotopes; 3) pharmaceuticals tracers: e.g. carbamazepine, ibuprofen, paracetamol, gadolinium anomaly; 4) life-style tracers: e.g. caffeine. The originality of the study relies on small capacities wastewater treatment plants without tertiary treatment process.
Results from different sampling campaigns on a catchment impacted both by diffuse agricultural pollution and punctual wastewater inputs are presented. Investigations concern wastewater effluents resulting from different type of treatment plants, surface and groundwater. Potential combination of suitable tracers is discussed combining micropollutants and isotopic signatures.