

## Title

Characterization of stormwater micropollutants in the Arcachon Bay – micropollutants occurrence and fluxes, assessment of the efficiency of an infiltration basin for the removal of micropollutants.

## Abstract

Stormwater is known to be a source of micropollutants. Since stormwater have never been investigated on the Arcachon Bay, several objectives in **REMPAR** focused on their study: 1) characterization of the micropollutants footprint in a urbanized stream during dry and rainy weather; 2) assessment of the occurrence and fluxes of micropollutants (pesticides, polycyclic aromatic hydrocarbons and metals) in stormwater at the scale of 3 watersheds, 3) assessment of the effectiveness of an infiltration basin for the removal of micropollutants.

1) The ruisseau du Bourg (township of Gujan-Mestras) was sampled for 3 years (2016-2018) during dry and rainy weather. Dry weather campaigns showed that the trace metal element (TME) footprint displayed a particular profile at the upstream point with higher Cd, Co, Cu, Ni and Zn levels. For PAHs, a concentration gradient increasing from upstream to downstream was observed. Finally, for pesticides with agricultural uses (and no biocidal use according to the regulation EU 528/2012), results showed a decreasing gradient from upstream to downstream. Origin of this gradient could be linked to the presence of an agricultural catchment located upstream. Conversely, pesticides with biocidal uses (according to the regulation EU 528/2012) were little or not found upstream, but downstream, in the urbanized areas of the river.

During rainy weather, the concentrations of TME and PAHs increases sharply immediately downstream a stormwater outlet. Conversely, remote from such outlets, there were no differences except for Cu which appears to be a relevant marker of stormwater runoffs. For pesticides without biocidal uses, only glyphosate and its metabolite AMPA showed increasing concentrations near and remote from stormwater outlets. If all pesticides with biocidal uses displayed increasing concentrations immediately downstream stormwater outlet, only tebuconazole showed systematically increased concentrations near and remote from such outlets. This fungicide appears to be a relevant marker for the monitoring of stormwater runoff.

2) Stormwaters were also investigated at the scale of 3 watersheds. Sampling campaigns were spread out between January 2016 and June 2018. Overall, stormwater contamination profiles were similar for the 3 watersheds, whatever the micropollutants family.

TME footprint was dominated by Al, Fe, Mn and Ti, which origin is probably terrigenous as these are major elements occurring in high levels in the earth's crust. Concentrations measured on the 3 sites of the Arcachon Basin were generally lower than those reported on more urbanized sites at national scale, except for Ti.

PAHs were systematically detected in stormwater at concentrations ranging from less than 100 ng.L<sup>-1</sup> to more than 10 µg.L<sup>-1</sup>. Footprint was similar to that reported on other sites at the national scale; however, given the low rate of urbanization of the watersheds measured concentrations appears to be relatively high. The use of indices to characterize sources indicates that PAHs may have a pyrolytic origin (fuel combustion).

For pesticides, results showed that the herbicide glyphosate and its metabolite AMPA largely dominated the contamination footprint, with median concentrations of 100 ng.L<sup>-1</sup>, and up to the µg.L<sup>-1</sup> for glyphosate. Several pesticides with biocidal use, and especially biocides authorized in building materials (tebuconazole, diuron, carbendazim) were also found with average concentrations ranging from 0.1 ng.L<sup>-1</sup> to 10 ng.L<sup>-1</sup>. Concentrations measured in **REMPAR** were overall lower than those measured on more urbanized sites at the national scale.

Finally, fluxes have been determined for these 3 classes of micropollutants

3) In urban areas, there is an increasing use of infiltration devices for stormwater management; nevertheless questions remains about the accumulation and possible transfer of micropollutants in soil and water table. Within the framework of **REMPAR**, part of the study focused on the transfer of contaminants from intercepted stormwaters in the infiltration basin to groundwater. Samples were taken from two piezometers (one upstream and one downstream the infiltration basin). Continuous conductivity monitoring made it possible to target, in the downstream piezometer, the periods corresponding to the infiltration of stormwater.

Results showed that groundwater, upstream of the infiltration basin, was not exempt from micropollutants and particularly pesticides, such as atrazine metabolites. The infiltration basin intercepts a high part of the contamination, essentially that in particulate form. Nevertheless, another part, which varies depending on the compounds, is transferred to groundwater. Finally, the results suggest that the infiltration basin releases into groundwater a part of the compounds previously intercepted in the sandy soil of the basin; this release may occur continuously over time.

**Key words (thematic and geographical area)**

Arcachon Bay ; Stormwater ; Trace metals ; Polycyclic aromatic hydrocarbons ; Pesticides ; Biocides ; Infiltration basin ; Groundwater.