Occurrence and sources of perfluoroalkyl acids in Italian river basins

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Highlights
- PFIAA concentrations and loads of the main Italian river basins, 40% of Italian area.
- Total concentrations of PFIAA ranged from < LOD to 8 µg L⁻¹.
- The most discharged compounds are PFBS (39%) and PFOA (32%).
- Urban load (0.09 t y⁻¹) is 1% of the total PFIAA load to sea (7.9 t y⁻¹).
- The main PFIAA sources of Italy are two chemical plants (57% of the total load).

Abstract
This paper presents a survey on the occurrence and sources of 11 perfluoroalkyl acids (PFIAA) in the main river basins in Italy, covering about 40% of the Italian surface area and 45% of the Italian population. Total concentrations of PFIAA ranged from < LOD to 8 µg L⁻¹, the highest concentrations being measured in the rivers impacted by industrial discharges. Among the rivers directly flowing into the sea, Brenta, Po and Arno present significant concentrations, while concentrations in Tevere and Adige, which are not impacted by relevant industrial activities, are almost all below the detection limits.

The total estimated PFIAA load of the five rivers was 7.5 t y⁻¹ with the following percentage distribution: 39% PFBS, 32% PFOA, 22% short chain perfluorocarboxylic acids (PFCA), 6% PFOS and 1% long chain PFCA. PFOA and PFOS loads, evaluated in the present work, represent 10% and 2% of the estimated European loads, respectively.

In Italy the most important sources of PFIAA are two chemical plants which produce fluorinated polymers and intermediates, sited in the basin of rivers Po and Brenta, respectively, whose overall emission represents 57% of the total estimated PFIAA load. Both rivers flow into the Adriatic Sea, raising concern for the marine ecosystem also because a significant PFOS load (0.3 t y⁻¹) is still present.

Among the remaining activities, tanneries and textile industries are relevant sources of respectively PFBS and PFOA, together with short chain PFCA. As an example, the total PFIAA load (0.12 t y⁻¹) from the textile district of Prato is equivalent to the estimated domestic emission of the whole population in all the studied basins.