Goldschmidt 2026 Abstract
https://doi.org/10.46427/gold2026.36348

Controlling factors for mixed contaminants transport and fate in the subsurface in a tropical urban environment

JULIANA G. FREITAS[1], ELIZABETH NARANJO[2], TAYNE S.M. SILVA[1], ENRIQUE F.M. SILVA[1], ANDRÉ G.B. MIRANDA[1], IBRAIMA DJALO[1], ALAN JACCOUD[1], WILLEM TAKIYA[1], NEIL THOMSON[3], DÉCIO SEMENSATTO[1], ÉRICA A. SOUZA-SILVA[1] AND RICARDO HIRATA[2]

[1]Universidade Federal de São Paulo
[2]University of São Paulo
[3]University of Waterloo

One of the main threats to groundwater quality in urban environments is contamination by sewage, leading to a complex mixture of pollutants, including conventional (such as nitrate) and emerging contaminants (microplastics – MPs and PFAS, for example). To assess the occurrence, transport and fate of contaminants derived from sewage in a typical urban environment in a tropical region, an extensive field study was conducted in Bauru, Brazil. Surface water, soil and groundwater samples were analyzed for geochemical characterization, conventional and emerging contaminants. The study region has residential and commercial occupation, a phreatic aquifer with depths from 1 to 25m, and two soil types: Oxisol (higher clay presence, rich in iron and aluminum oxides) and Entisol (fine sand). Contaminants were detected in all monitoring points, confirming diffuse contamination sources. Nitrate concentration reached up to 25 mg/L, and PFAS concentrations surpassed 100 ng/L in some wells. Microplastics fibers were detected in all soil samples. Chloride was a good indicator for nitrate distribution, but the same was not observed for PFAS, MPs and pharmaceuticals. Although nitrate and PFAS did not shown a strong direct correlation, in some locations they presented similar vertical distributions. Also, PFAS and MPs had some similarities in their distribution, indicating common sources. These contaminants share some similarities such as tendency to accumulate in the air-water interface. The observed differences are likely associated with different controlling factors for their subsurface transport, or different sources, such as runoff infiltration. MPs transport appeared to be more strongly controlled by the soil pore size distribution. Fibers with smaller width presented higher mobility, reaching greater depths at the saturated zone. For PFAS, the compound chain-length appeared to be one of the main controlling factors. Compounds with the greatest chain lengths identified at the site (PFOA and PFOS) correlated better with chloride than shorter chain compounds. PFAS concentrations in groundwater were higher at acidic pHs, with the exception being the wells with denitrifying conditions. The main pharmaceuticals identified were ciprofloxacin (antibiotic) and ibuprofen. These results confirm that the study area is impacted by a variety of contaminants, and is an example of the problem complexity.