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Fate of organic micropollutants in the soil of stormwater management structures: interaction of microbial diversity and biodegradation

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The main objective of this work is to study the fate of organic micropollutants in the soils of several stormwater management structures and to observe the interaction between microbial populations and the biodegradation of micropollutants. Three sites were selected to study this future with the following criteria for choosing the soil: the constitution of the soil, the location in relation to runoff, the age of the structure and the vegetation. A physico-chemical and biological characterization of the soils was carried out following sampling campaigns. Biodegradation kinetics under controlled conditions in liquid batches were then carried out in order to compare the biodegradation capacities of bisphenol A (BPA), nonylphenol and octylphenol of native microorganisms extracted from the soils of the combined structures. The results of these kinetics showed different biodegradation efficiencies between the soils of the same site for a micropollutant. Also for the soils of the Vitry site, the biodegradation of BPA varies from 20% to 100%. The percentages of biodegradation are also different between the sites (upstream Dourdan site: biodegradation of 99% of BPA while the valley of Compans site will biodegrade only 54% of BPA). These differences in efficiency should be related to the physico-chemical and microbiological characteristics of the soils studied. Indeed, different enzymatic activities (FDA, dehydrogenase, urease) were noted during the analysis of the campaigns' soils used to determine the biodegradation kinetics of micropollutants. These enzymatic activities associated with functional diversities (obtained by Biolog plates) also demonstrated various microorganisms' communities for each soils. The genetic analysis of these bacterial and fungal communities may explain the biodegradation efficiencies observed during the biodegradation kinetics. Our work provides a better understanding of the evolution over time and space of the effectiveness of structures in the depollution of rainwater with the aim of optimizing their design and management.