FINAL REPORT ON THE EXPERIMENTAL MONITORING OF VEGETATED PARKING LOTS

ABSTRACT

This work presents the evaluation of the capacity of permeable car parks to reduce micropollutants from rainwater runoff on urban roads. This retention capacity was estimated by calculating criteria on water flows reduction and micropollutants concentrations and masses reduction. Different spatial scales were considered in this work. A monitoring of lysimetric parking lots (13.26 m²) was carried out to evaluate the water retention capacity of different permeable car parks, vegetated or not. The instrumentation of two car parks, one reference car park (a "classic" asphalt car park) and a 630 m² vegetated car park, made it possible to study its potential to reduce the flow of water and micropollutants. Column tests were then carried out to test innovative solutions (addition of organic matter and addition of a water retention mat) to improve the performance of these car parks.

With regard to the retention of micropollutants, the observations made on the ECOVEGETAL® Mousses car park show that for Zn, Phen, DMP and DEHP, total and dissolved concentrations are lowered for all events. For the "heavy" PAHs (Fluo, Pyr, BaA, Chry, BaP, BkF, BPer, IP and BbF), the reduction in concentrations is better in the particulate phase. Certain compounds - As, Cr, Mo, Sr, V, BPA and NP1EC - the higher total and dissolved concentrations at the outlet of the vegetated parking lot indicate an emission of these pollutants by the constituent materials. Finally, for other contaminants, the efficiency is more variable and better on the particulate phase. The study of innovative solutions confirmed the emission of contaminants by the structure of the parking lot (only Fe, Mn, Ti, Cd, Ni, PAHs and BPA do not seem to be emitted) whereas the contribution of organic matter seems to increase Na, K, Mg, Ca, Cu, Mo, Ba, DEHP and OP1EO concentrations and the addition of the water retention mat seems to favour the emission of organic pollutants: PAHs, OP1EO, NP1EC, NP1EO and NP2EO due to the presence of synthetic fibers. However, it appears that the masses of pollutants are largely reduced with the permeable car park. The mass reduction is between 60 and 100% of the annual masses. Only potassium is not retained. Observation of the mass reductions on the columns shows that for the conventional structure, ECOVEGETAL® Mousses, Na, K, NP1EC and DMP are not reduced. With the addition of organic matter, it is observed that Na, K, Sr, BPA, NP1EC NP1EO, NP2EO and DNP are not removed. On the other hand, the addition of a water retention mat allows the removal of almost all the contaminants analysed.

These results underline the importance of the reduction of water flows by vegetated parking lots in the retention of micropollutants. ECOVEGETAL® Mousses is in fact capable of retaining almost 91% of annual rainfall, although with inter-event variability. Monitoring of lysimetric parking lot shows that permeable car parks, vegetated or not, are effective in reducing between 33% and 88% of the annual rainwater and that this effectiveness increases with substrate thickness and more intensive vegetation. Water infiltration into the soil underlying the parking lot structure also appears to increase water retention.

This study therefore shows that these permeable parking lot are effective in controlling urban road runoff and managing the associated micropollutants.

- **KEYWORDS**

Urban stormwater, road runoff, micropollutants, sustainable urban drainage systems, biofiltration, horizontal sand filter, Ile-de-France, trace metals, polycyclic aromatic hydrocarbons, phthalates, alkylphenols, bisphenol-A.