

Abstract

FLUXES AND SOURCES OF PRIORITY POLLUTANTS IN URBAN WATER ASSOCIATED WITH DIFFERENT LAND USE PATTERN

To meet the objectives of the Water Framework Directive (WFD 2000/60/EC) set by European legislation, most studies have focused on assessing the quality of industrial and treated wastewater discharges... Limited information is available regarding priority substances in stormwater. Stormwater may be discharged untreated into rivers and thus have an impact on the aquatic ecosystem. So, this work focused on the pollution of stormwater in urbanized watersheds with different gradient of urbanization, from residential to dense urban then a comparison with wastewaters was undertaken. This evaluation resulted in the establishment of a list of 88 urban pollutants to be followed in assessing the quality of urban water. Then, an analysis methodology, called "screening" has been developed. It allows measurement of urban pollutants in the particulate and dissolved forms. A concept often absent in the literature but of great importance for managers of sewerage and sewage treatment plants. This work has enabled:

- A detailed urban pollution characterisation (wastewater from separate and combined sewers systems (n = 8), stormwater from separate sewer (n = 20), combined sewers deposits (n = 2) and atmospheric deposition (n = 5)), by studying the occurrence, the distribution between dissolved/particulate fractions, the pollution loads on particles (mg/kg. dw), the event mean concentrations ($\mu\text{g/L}$) and the flow (g/ha active) of the 88 urban pollutants;
- A comparison of the stormwater pollution by priority pollutants at the outlet of three watersheds having different land use pattern;
- An assessment of the atmospheric deposition contribution to the stormwater pollution on a residential suburb watershed;
- The estimate of the dangerousness of stormwater using a simplified approach for assessment of their impact on the receiving environment with or without treatment of the particulate phase;
- An innovative analytical comparison, for the 88 pollutants, done on the same sample by a certified COFRAC laboratory, between the classical procedure (carried out on bulk sample analysis) and our s screening methodology (carried out on both the dissolved and the particulate fractions).

Our results highlight the problem of urban water pollution by 66 chemicals out of 88. Stormwater is contaminated by 12 priority substances and 8 priority hazardous substances of the WFD and 35 other urban pollutants. Pollution is mainly particulate for PAHs, PCBs, organotins and metals, while pollution is distributed between both phases for phthalates, pesticides and alkylphenols. Runoff is the main contributor to pollution at the outlet of storm sewer. The pollutants generated by urban areas are comparable regardless of the land use except for pesticides on the residential site and VOC on the dense urban site, where they are the more abundant. The direct discharge of stormwater requires, for certain substances, a dilution of 10 to 1000 with the receiving waters to meet environmental quality standards. For wastewater, pollutants are in majority, conveyed in both dissolved and particulate forms except for PCBs that are 100% particulate. Finally, analysis of these pollutants on the bulk sample (TSS 71 to 380 mg/L) significantly underestimates the concentrations of these substances in water due to a poor estimation of the particulate fraction.

Keywords: Stormwater, wastewater, runoff, screening, particulate pollution, dissolved pollution, urban pollutants, land use pattern, water regulations, analytical comparison, separate sewer system, combined sewer system, water quality.