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Antimicrobial resistance in urban water

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Abstract

Aquatic hydrosystems subjected to anthropogenic pressures are likely hotspots for selection and emergence of antibiotic resistant bacteria. Considering the worrisome epidemiology of infectious diseases, there is an urgent need to identify all environmental reservoirs of resistant bacteria and resistance genes to complete our knowledge of the epidemiological cycle and of the dynamics of urban antibiotic resistance.

The city of Montpellier is located in a small watershed that undergoes brutal rainfall episodes and strong demographic pressures. The University hospital is located downtown on a small urban river canalized under the hospital buildings. The aim of the study is to explore antibacterial resistance of these bacterial communities of the river running in the vicinity of the hospital. Urban and hospital effluents are unlikely to contaminate the river because they are fully collected in a wastewater treatment plant that is geographically unrelated to the studied watershed.

A strategy derived from c-IC (community Inhibitory concentration) approach [1] allowed the exploration of bacterial resistance in the urban hydrologic system. The taxonomic repertory of the urban river resistant communities was described and its dynamics was followed depending on environmental conditions. Resistant bacteria were isolated and resistance genes were characterized.

Amoxicillin, cefotaxime, ceftazidime and ofloxacin resistant communities were correlated to each other and were related to seasonal variations (higher resistance rate observed in cold seasons particularly for cephalosporins). Finally, hospital vicinity significantly increase the prevalence of resistant bacteria. Moreover, diverse clinically relevant cephalosporins and carbapenems resistant bacteria were isolated and characterized. As an example, surprisingly, a NDM₅-producing *Escherichia coli* was isolated and reported for the first time in a French river [2].

The detection of considerable quantities of B-lactams resistant bacteria within urban environment without being connected to wastewater suggested that, in addition to effluents, urban activities can impact the freshwater environment by urban runoffs.

References

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