

Résistance aux antibiotiques dans des eaux urbaines péri-hospitalières considérées dans un continuum hydrologique

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Abstract : Aquatic ecosystems subjected to anthropic pressures are places of rapid evolution of microbial communities. They are likely hotspots for emergence of infectious disease agents resistant to antibiotics. The city of Montpellier is located in a small watershed that undergoes brutal rainfall episodes and strong demographic pressures. A hospital is located in a runoff area including two small urban rivers originating from karstic groundwater few kilometers upstream. The aim of the study is to explore bacterial communities in urban rivers flowing near hospital settings in order to evaluate the influence of runoffs on antibiotics resistance in the bacterial communities. Bacterial communities are also described in upstream karstic aquifers. An introductory section presents the methods available for studying antimicrobial resistance in environment and then reviews comprehensively bibliography on antibiotics resistance in urban runoffs. This part supports the experimental strategies. The method developed herein, called community Inhibitory Concentration (c-IC) determination is combined to taxonomic richness description to provide a tool that gives a rapid snapshot of resistant bacterial communities in aquatic environments. A strategy derived from c-IC approach allows the exploration of bacterial resistance in the urban hydrologic system near the hospital and in karstic aquifers. The collected microbiological data has been completed by hydrological, hydrogeological, climatic and physico-chemical data. The impact of very low concentration of antibiotics on the bacterial community structure in various water bodies was demonstrated and appeared as an indicator of the vulnerability of ecosystems to antimicrobial pressures. The taxonomic repertory of the urban river communities was described and its dynamics was compared to environmental conditions. Hospital vicinity significantly increase the prevalence of resistant bacteria compared to a similar urban area remote from hospital. Diverse clinically relevant cephalosporins and carbapenems resistant bacteria have been isolated. Surprisingly, a NDM-producing *Escherichia coli*, which is a highly resistant and emerging pathogen was reported for the first time in a French River. The clone was detected in two independent sampling showing its persistence. The blaNDM-5 gene and its surrounding sequences were described on a transferable IncX3 plasmid, indicating possible genetic transfer to other bacteria. The antimicrobial resistance in karst groundwater varied in time and space and was hardly compared with that described in related rivers. In urban settings, water quality and infectious risk is generally assessed on sewers and wastewater treatment plants effluents. This study shows that runoff waters in urbanized area contribute to the emergence and dissemination of antimicrobial resistance. Considering the worrisome epidemiology of infectious diseases, it urges to decipher all environmental reservoirs for resistant bacteria in order to complete knowledges about the epidemiological cycle of antimicrobial resistance and try to break or slow down it.

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