

Assessing the (co)dissemination of virulence and antibiotic resistance genes in resource recovery applications

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Résumé :

The spread of virulence genes (VGs) and antibiotic resistance genes (ARGs) is among the greatest threats to public health. These genes can be released into the environment during the discharge and reuse of treated water. Considering that human, animal, and environmental health are interconnected under the One Health concept, limiting their dissemination into the environment by implementing effective wastewater treatment technologies is a major option for limiting the emergence of virulent/resistant pathogens. Despite research efforts focused on ARGs, the spread of VGs has barely been studied, omitting a huge problem that cannot be separated from antimicrobial resistance.

This project will offer a more comprehensive view of the presence of VGs/ARGs and will assess the fate of VGs in the wastewater treatment (WWT) network, as well as VG/ARG co-occurrence. The impact of reusing treated water for irrigation on VGs dissemination (and their co-occurrence with ARGs) will also be assessed. Research questions related to the fate of VGs and ARGs in the WWT network will be answered: (1) which are the most common VGS/ARGs found in the WWT network, and what are their hotspots? (2) how can WWT plants be operated to minimize the dissemination of VGs/ARGs into the environment? (3) what is the fate of VGs/ARGs in the environment after irrigation with treated water?

To achieve this, we follow a shotgun metagenomic sequencing approach, allowing us to identify the whole collection of known VGs/ARGs present in our samples. Water samples are being collected over time (one sample per week for a duration of two weeks during two distinct seasons) across four WWT plants of diverse scales, encompassing various treatment units and operational conditions. Our primary focus lies on tertiary treatment, the final stage of the WWT network designed specifically for the removal of pathogenic microorganisms. Pot trials will be performed to assess the impact of the reuse of treated water for irrigation.

Axe(s)/Domaine(s) d'applications(s) du réseau/TRL : Axe Risques