

Removal of AMR genes and bacteria from wastewater using modular advanced treatment solutions (HOTMATS)



GHANA



Project sector

One Health



JPIAMR partners

Karlsruhe Institute of Technology (KIT), Germany

Norwegian Institute of Water Research (NIVA), Norway

University of Nairobi, Kenya



Timescale

February 2022-
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ICARS funding

250,000 EURO

Context

The environment and water bodies are largely unattended and remain a high priority in National Action Plan (NAP) for antimicrobial resistance (AMR). In Ghana, a particular problem of interest is the fact that wastewater effluents are generally untreated and often discharged into water bodies. The Ministry of Health and its implementing bodies are interested in tailored solutions that can be implemented on the ground in low- and middle-income countries (LMICs) to reduce antibiotic resistant bacteria (ARB) and genes (ARG) in wastewater effluents. This project's collaboration with the Ministry helps to situate it within the national priorities of the Ghana AMR Policy.

Problem

AMR poses a critical health threat with major economic and societal consequences. Globally, AMR dissemination is mainly due to the emission of antibiotic resistant bacteria (ARB), antibiotic resistance genes (ARG), facultative pathogenic bacteria (FPB) and AMR driving substances, contained in human and animal waste, spilling into the environment. Much effort has been spent on unravelling the sources, sinks and transmission pathways of AMR in a number of AMR screening studies globally. The main hotspots of anthropogenic AMR include:

- point-sources, e.g., hospitals, nursing homes, domestic households, the pharmaceutical industry, animal husbandry, and slaughterhouses
- urban wastewater treatment plants (WWTPs)
- other diffusive sources.

The effluents from AMR hotspots are mostly discharged into the public sewage system, which plays an important role as a recipient of potentially harmful and AMR-driving substances as well as ARB & ARGs.

"The project provides a unique opportunity to test state-of-the art technological solutions in varied real-life settings (low-middle-high income countries) simultaneously. This will help provide valuable learnings for better, quicker and context-specific deployment of technological innovation for AMR mitigation."

Jyoti Joshi, Senior Science Advisor, ICARS



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Project overview

This project aims to implement and assess modular advanced solutions for effective and decentralised wastewater treatment at selected point sources of AMR emergence. The applied technologies will primarily target AMR pollution and pathogens in wastewater streams directly at AMR hotspots. This means moving away from 'end-of-pipe' approaches applied at wastewater treatment plants (WWTPs) and address intervention in all three pillars of One Health. The project will help to use an advanced system to destroy antimicrobial resistant bacteria (ARB) and facultative pathogenic bacteria (FPB) in wastewater.

The research team also aims to demonstrate the superiority of the novel pilot-scale treatment systems, as opposed to state-of-the-art solutions, by collecting and treating effluents from AMR hotspots, including a hospital, nursing homes, and a slaughterhouse. This will reduce the risk associated with ARB/FPB spreading from hotspots to the downstream natural environment, and to unburden central WWTPs.

The project will also assess the modalities for technology transfer from high income countries (HICs) to low- and middle-income countries (LMICs) by conducting a willingness to pay study for uptake of decentralised treatment of AMR in LMICs.

Outcomes

- Establish a new technological decentralized and source-orientated approach to contribute to the reduction of the burden of AMR at important sources, i.e., hospitals, nursery homes, slaughterhouse, and major transport pathways.
- Quickly translate research into commercialisation of outputs in the form of intervention technology development, and policy uptake by local (regulators of hospitals, nursery homes, food production) and regional/governmental authorities
- Combine the scientific and interdisciplinary competences and data across our international consortium, as well as knowledge transfer to LIMCs.
- Create a new hub for sharing knowledge, data and technology between researchers, stakeholders (hospitals, WWTPs, food industry) and authorities, to strengthen the cooperation between EU and non-EU countries.

