



Anthropogenic impacts on sulfonamide residues and sulfonamide resistant bacteria and genes in Larut and Sangga Besar River, Perak

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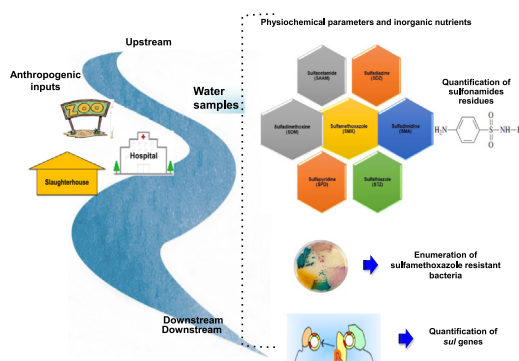
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HIGHLIGHTS

- Sulfadiazine, sulfadimethoxine and sulfamethoxazole were the most frequently detected SAs residues in Larut River.
- *sul1* gene was mainly found in hospital runoff whereas *sul2* in zoo runoff.
- Anthropogenic inputs impacted the levels of SAs residues, SRB and SRGs in Larut River.
- Positive correlation between the PO₄ and SMX^r-bacteria and SMX^r-enteric bacteria

GRAPHICAL ABSTRACT



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ABSTRACT

The environmental reservoirs of sulfonamide (SA) resistome are still poorly understood. We investigated the potential sources and reservoir of SA resistance (SR) in Larut River and Sangga Besar River by measuring the SA residues, sulfamethoxazole resistant (SMX^r) in bacteria and their resistance genes (SRGs). The SA residues measured ranged from lower than quantification limits (LOQ) to 33.13 ng L⁻¹ with sulfadiazine (SDZ), sulfadimethoxine (SDM) and SMX as most detected. Hospital wastewater effluent was detected with the highest SA residues concentration followed by the slaughterhouse and zoo wastewater effluents. The wastewater effluents also harbored the highest abundance of SMX^r-bacteria (10⁷ CFU mL⁻¹) and SRGs (10⁻¹/16S copies mL⁻¹). Pearson correlation showed only positive correlation between the PO₄ and SMX^r-bacteria. In conclusion, wastewater effluents from the zoo, hospital and slaughterhouse could serve as important sources of SA residues that could lead to the consequent emergence of SMX^r-bacteria and SRGs in the river.

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1. Introduction

Antibiotics are used in human medicine and stockbreeding operations to treat infectious diseases and promote growth (Halling-

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