Do microplastics promote the attachment of antimicrobial resistant pathogens?

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Abstract

Microplastics are the most prevalent type of plastic pollutant in the aquatic environment and frequently coexist in environmental compartments with antimicrobial resistant (AMR) bacteria, human pathogens and antimicrobial residues, particularly in faecal contaminated settings. When present in the environment, microplastics become colonised by diverse polymicrobial biofilms known as the 'Plastisphere', which can be distinct from the surrounding environment and natural debris. Microplastic associated communities have also been found to act as an important platform for horizontal gene transfer of AMR genes and there are concerns that plastic particles may enrich and disseminate AMR pathogens, potentially increasing human and animal exposure.

Using both culture- and molecular-based microbiological methods, this research investigated and compared biofilm and free-living bacterial communities following incubation of environmentally aged microplastics and natural or inert substrate controls, inoculated with a natural sewage community. Selective agar plating and qPCR for 16S rRNA and a widely adopted genetic marker for AMR (*intI1*) were used to calculate phenotypic resistance prevalence of faecal coliforms and a community wide resistance prevalence, respectively. *Escherichia coli* phylogenetic groups were also identified using a pre-described PCR protocol, which enabled the generation of a pathogen prevalence within particle and free-living communities. The results from this study suggest that surfaces promote the attachment of AMR and pathogenic bacteria, and the type of surface matters when selecting for these communities. The outcomes from this research will help to gain a better understanding of the risks posed by microplastics and associated AMR bacteria. Given that microplastics are extremely prevalent and persistent, this may have significant consequences on human, animal and environmental health.

Keywords: Microplastic, biofilm, Plastisphere, Escherichia coli, pathogen, antibiotic resistance, AMR.

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