Session: Biofilm ecology and ecotoxicology

Microplastic-associated biofilms in lentic ecosystems: biodiversity, structure and possible implication for freshwater ecosystems

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Microplastics (MPs), plastic particles with an upper size limit of five millimetres, are considered a potential threat to ecosystem and human health and activities. Although attention and efforts have been made to elucidate the direct effects of MPs on animal and plant life, the indirect effects of MPs pollution, including the effects of MPs as vehicle for microbial dispersal among environments remain unclear. During transport by water flow, microplastics (MPs) can be colonised by free-living microorganisms, able to adhere to plastic surfaces with the formation of biofilms, frequently referred to as 'plastisphere'. Studies on marine plastic-associated biofilms have demonstrated that plastisphere constitute a peculiar micro-ecosystem different from the planktonic communities. Despite the well-documented widespread presence of MPs also in freshwater ecosystems, studies on plastisphere in these environments are still rare.

This study investigated prokaryotic and eukaryotic microbiome composition and structure of microbial biofilms attached to MPs sampled from four lakes located in northern and central Italy, by using 16S rRNA and 18S rRNA genes high throughput sequencing and Fluorescence In Situ Hybridization combined with Confocal Laser Scanning Microscopy.

MP-associated biofilms in the studied lentic ecosystems resulted to be complex communities comprising of both bacterial and eukaryotic microorganisms belonging to different trophic levels. Noteworthy, despite the significant impact of the sampling site on the plastisphere composition, biofilm communities shared a core microbiome, constituted by known bacterial and eukaryotic biofilm formers. Indeed, clear differences were found in taxon composition among biofilm and planktonic communities. In respect to the bacterial and eukaryotic composition of plastisphere, geographic location was found to affect it, while taxon composition did not substantially differ between polymers types. According to the obtained results, environmental water condition seems to be the main driver of plastisphere microbial community selection, thus shaping the colonization patterns on MPs.

Results will be discussed also evaluating the possible implications of floating MPs microbial colonization for freshwater ecosystems, including the potential risk for public and ecosystem health, linked to the possible dispersal of harmful, parasitic and/or pathogenic organisms among environments.