

Session: Biofilm ecology and ecotoxicology

Biofilm ecology: structure, dynamics, actors and factors in a stress world

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Biofilms in the environment develop on different substrata, organic and inorganic, and this may determine shifts in their structure, function, and interaction with the environment. In terms of structure this includes determining the biomass accrual of the different microbial groups and their respective diversity, thickness, EPS (extracellular polymeric substances) content, carbon-to-nitrogen molar ratio, among others. In terms of function this includes both autotrophic and heterotrophic activity and the capability to use distinct organic and inorganic matter. In terms of their interaction with the environment, this refers to the relationship and connection to the surrounding conditions and the available resources (i.e. nutrients and organic matter). The main environmental conditions modulating microbial biofilm structure and metabolism include temperature, organic and inorganic matter availability, oxygen, pH and water availability. The later is crucial and can act as a bottleneck, being some humidity crucial to maintain the biofilm alive. Studies about the effect of drought have shown that biofilm metabolism decreases while drying, and that the prokaryote community shifts to a more drought-resistant one. Also a sediment biofilm submitted to a long-drought period showed a clear increase of polysaccharides in EPS which may increase the biofilm water holding capacity and the inhabiting microbes resistance to desiccation. Long drought periods determine microbial metabolic energy allocated to EPS production instead of other functions such as organic matter degradation capabilities that appear clearly reduced. In sediment biofilms and in the biofilm developing on decomposing plant material, fungi appeared more resistant to drought than prokaryotes. In contrast, studies about drought effect on biofilms developing on large inorganic substrata (i.e. cobbles/rocks) show in general lower resistance of prokaryote activity to desiccation than those developing on sediment. In addition to drought, many aquatic ecosystems, especially in arid and semi-arid regions are exposed to extreme salinity, which represents a further stress to the microbial biofilm structure and function. Intense drought together with high salinity further reduce the water available to biofilm organisms and determine great microbial energy allocated to resistance strategies that may limit and/or delay microbial metabolic response to rewetting. For instance, biofilms in semi-arid and hypersaline systems showed low functional diversity and high EPS content. These observed biofilm responses to stressors may be modulated by its specific structure and function and thus probably being substrata-dependent. We know that biofilms play a key role in the ecosystem ecology but many open questions related to their responses and survival limits to crucial stress factors are still unsolved.