Bioaccumulation of trace metals on microplastics: a biofilm-mediated reaction

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Coastal environments are extremely affected by anthropogenic inputs. High concentrations of microplastics (MPs) and trace metals are observed in these areas, increasing the evidence that they represent critical zones. The metal content of MPs of various origins have already been measured [1,2]. However, biofilm-mediated interactions between trace metals and MPs are still poorly resolved. The aim of our work is therefore to explore the interdependencies existing between MPs, the organisms growing at their surface and trace metals in the ecosystem.

As a matter of fact, biofilm growth onto MPs could lead to bioaccumulation mechanisms, susceptible to increase trace metal concentrations at MPs surface. In addition, biofilm growth can modify MPs' density and hydrodynamics, sinking them to deeper water column layers and eventually in sediments.

In the framework of the *Stop alle Plastiche in H20! (SPLASH!)* project (Interreg-Marittimo, 2018-2020), MPs' role as trace metals vectors in 3 Mediterranean harbors (Toulon, Genova, Olbia) was investigated, considering metal concentrations in the biofilm of the collected MPs.

In the extracted biofilm, Fe presented the highest concentrations followed by Cu, Pb, V and Cd. The measured concentrations, when expressed to the corresponding MPs, ranged from 0.49 to 184 µg/g and 2.5 to 959 ng/cm^2, underlining bioaccumulation through biofilm formation. Due to discrepancy among specific surfaces, this hazardous phenomenon may be underestimated. Therefore, experiments in mesocosm and controlled conditions were performed. By regulating particle size, MPs photo-oxidation, trace metals' concentrations, bacterial communities and the kinetics of biofilm formation, the relationships between bacteria-MPs-trace metals were better highlighted.

[1] Ashton *et al* (2010) *Marine Pollution Bulletin* **60**, 2050-55. [2] Holmes *et al* (2012) *Environmental Pollution* **160**, 42-48.