Study of the colonization of environmental plastic pellets by marine bacteria and E. coli

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Abstract

Microorganisms can easily colonize the surface of plastics in the aquatic environments providing a novel means of dispersion. It has been already observed that potential pathogens can be attached becoming a reservoir for, for example, faecal bacteria, such as *Escherichia coli*, or for antibiotic resistance genes (ARGs). The objective of this study was to evaluate the colonization and persistence of *E. coli* in the biofilm adhered to plastic pellets and the presence of ARGs. We implemented five mesocosms in 25 L of seawater with a concentration of _˜106 marine bacteria/ml and with a mixture of plastic pellets (80% polyethylene and 20% polypropylene) between 2-5 mm obtained from a beach. We added a concentration of 104 cfu/ml of a mixture of 3 environmental strains of *E. coli*. The abundance of marine bacteria and *E. coli* in the water and pellets was analyzed using cultivable methods and molecular techniques (qPCR), as well as epifluorescence and scanning microscopy (SEM). The results show that the biofilm was mainly composed of marine bacteria (7.29·105 gc/mm2), however *E. coli* can attach to it during the first days reaching a maximum concentration of 2.1·103 CFU/mm2. It can persist with cultivable methods up to 12 days, meanwhile the DNA was detected at least up to 26 days (9.97·100 gc/mm2). SEM and fluorescence images corroborated the colonization of MPs. ARGs were also detected in the biofilm mainly *sul*1 and *bla*TEM. A relationship between *bla*TEM and *E. coli* was identified. The results suggest a pattern of persistence of viable *E. coli* in pellets for 12 days, during which they can be transported with the currents. Thus, anticipating the increase in plastics in the marine environment, its potential health risk should be assessed.

Keywords: plastics, faecal pollution, E. coli, biofilm, antibiotic resistance genes

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