Is plastic a sink or source for pollutants?

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In the last decade, more and more types of contaminants, both plastic related as environmental pollutants, have been discovered on plastic debris in the marine environment. However, a systematic overview of all types of organic compounds present on plastic debris is still lacking until date. Therefore a global qualitative screening of contaminants was performed on 4 types of marine litter and 3 types of beach pellets. The screening with GC-MS revealed the presence of 7 types of compounds which can be environmental or plastic related. Beach pellets were also analysed quantitatively with a validated method using GC-MS for PAHs and GC-ECD for PCBs. A concentration range of 1076 – 3007ng.g^{-1} plastic for Σ16 EPA-PAHs and a concentration range of 31 – 236ng.g^{-1} plastic for Σ7 OSPAR-PCBs were found on different types of beach pellets. Blanc PE and PS pellets, analysed separately, showed the presence of considerable amounts of PAHs, with a concentration of individual PAHs up to 428ng.g^{-1} plastic for phenanthrene. A detailed literature study revealed that not only the plastic related compounds but also PAHs, alkylated phenyl benzenes and oxygen containing aliphatic compounds can be at least partially sourced back to plastic. This shows the importance of plastic as a source for pollutants, rather than a sink. A comparison of the individual PAHs and PCBs concentration profiles of 3 types of matrices (sediment, mussels and beach pellets) along the Belgian coast, showed the pattern of PAHs of sediment and beach pellets is quite resembling but differed to pattern in mussels. The pattern of PCBs on beach pellets is distinct of the patterns in mussels and sediment. The high diversity of organic pollutants and their degradation products, which may be released into the marine environment by plastic debris, pose a high risk to the environment. More detailed risk assessments are necessary to understand the effect of the increasing amount of plastics introduced into the marine environment.

References

Gauquie J., L. Devriese, J. Robbens, and B. De Witte. (submitted). Plastic: a source or sink for pollutants? Qualitative screening and quantitative measurements on different types of marine debris. Mar. Poll. Bull.