Analysis of epoxy resin anti-corrosion coatings with (reactive) pyrolysis gas chromatography/mass spectrometry

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Abstract

Marine coatings, specifically anti-corrosion or antifouling paints, could be the largest source of microplastics in the marine environment, according to new estimates1. However, there is very little environmental data on marine paint particles. One of the reasons is the analytical challenge posed by the heterogeneous composition, density, and structural complexity of these organic coatings.
Previous studies have mainly used optical and spectroscopic (FTIR or RAMAN spectroscopy) methods to identify and quantify individual marine paint particles. Calculating mass balances to investigate the fate of these particles in the marine environment is difficult with these kind of data. In contrast, mass-based data, differentiated by different polymer types, as obtained by thermoanalytical methods, allow these mass balances and thus a verification of the estimated emission amounts.

A first approach of analyzing marine paint particles in environmental samples was recently published by Dibke et al. (2021). Here, different polymers were grouped into clusters, e.g. grouping all BPA containing polymers types, such as epoxy resins, one of the most important polymer types for marine paints, and polycarbonate into a cluster. However, epoxy resins and polycarbonate can be quite different, especially when it comes to polymer quantification, which can lead to an underestimation of epoxy resins.

Therefore, we will take a detailed look at this cluster, with emphasis on epoxy resins. Seventeen different epoxy resins were analyzed by direct and reactive pyrolysis-gas chromatography-mass spectrometry. The pyrograms of epoxy resins showed rather high variability, but mutual pyrolysis products allow reliable identification and differentiation between epoxy resins and polycarbonate. In addition, aspects of quantification, such as product-related responses of quantification markers and the influence of inorganic matrices, will be discussed to achieve the goal of reliable quantification of epoxy resins in water and sediment samples.

1Paruta, P., Pucino, M., Boucher, J. (2022). *Plastic Paints the Environment.* https://www.e-a.earth/_files/ugd/425198_a864877fefd74ade85d85080ae21e029.pdf

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