
Characterization of three plastic forms: plasticconcrete, plastimetal and plastisessiles (Talk)

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Abstract

”Plastic forms”, such as plastiglomerates, pyroplastics, plasticrusts, anthropoquinas and plastitars, occur on coasts worldwide. These plastic forms derive from geochemical or -physical interactions including heat-induced plastic fusion with rocks, incomplete plastic combustion, plastic abrasion on rocks, plastic inclusion in sediment deposits and plastic agglomeration with crude oil. Thereby, such interactions can heavily influence the environmental fate of the affected plastic. This study discovered, characterized and discussed three novel plastic forms on Helgoland island, North Sea. All plastics were verified using state-of-the-art Fourier-transform infrared (FTIR) spectroscopy. ”Plasticconcrete” consisted of polyethylene (PE) and polypropylene (PP) fibers hardened in man-made concrete. ”Plastimetal” included PE fibers rusted with metal. Therefore, these two are the first plastic forms each consisting of two man-made materials. ”Plastisessiles” consisted of PE fibers firmly attached to benthic substrates by common sessile organisms (oysters, polychaetes) showing that plastic forms not only derive from human- or environment-mediated interactions but also from biological interactions between invertebrates and plastic. All plastic forms (bulk density ≥ 1.4 g/cm³) sunk during floating tests and hardly changed their positions during a 13-day field experiment and 153- to 306-day field monitorings, indicating their local formation, limited mobility and longevity. Still, experimentally detached plastic fibers floated, confirming that the formation of these plastic forms influences the fate of plastic fibers in the environment. Moreover, our field experiment showed that plasticconcrete got buried in beach sand under stormy conditions indicating that onshore waves and winds drive plasticconcrete deposition in coastal sediments. We also provide first records of plasticconcrete on Mallorca island (Mediterranean Sea) and plastimetal on Hikoshima island (Sea of Japan) showing that these plastic forms are no local phenomena. Thereby, our study contributes to the growing knowledge of plastic forms that is essential to understand the role and fate of these emerging pollutants in coastal environments worldwide.

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Keywords: plastiglomerate, pyroplastic, plasticrusts, anthropoquinas, plastitar, emerging plastic pollutants