

PRE-PRODUCTION PLASTIC PELLETS AS A TRANSPORT MEDIUM OF MERCURY ALONG THE EASTERN ADRIATIC COAST (CROATIA)

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Abstract

Plastic pellets are sampled (2014-2015) on six beaches along eastern Adriatic coast, from the island of Mljet in the south east to Kvarner Bay in the north east. In the same direction adsorbed mercury on the sampled pellets decreased. Quantities of plastic pellets on the beaches of southern and central Adriatic coast are higher than in northern part. Mercury was found to accumulate on plastic pellets from the surrounding coastal sea water by a factor up to 10000.

Keywords: Mercury, Beach, North Adriatic Sea, South Adriatic Sea, Plastics

Pre-production plastic pellets or plastic resin pellets or simply nurdles are small granules (most commonly polyethylene or polypropylene) cylindrical or a disc shaped with a diameter of a few millimetres. These plastic pellets are industrial raw material which is to be transported to different plastic production sites where are made by re-melting and molding into the final products (1).



Fig. 1. Map of the study area

Surprisingly large amounts of these virgin plastic pellets end up in marine environment during manufacturing and transportation. On some beaches where sampling is performed, Island of Mljet and Island of Rava, in one cubic meter of marine debris it was found more than 100.000 and more than 300.000 pieces of plastic pellets, respectively. The fact that the sampling sites are mainly away from industrial activities and serious anthropogenic impact, means that the plastic pellets as an important segment of overall flowing marine litter are stranded on the beaches carried by the sea currents and winds.

Pellets were collected on the beaches from the high tide line and berm zone of each beach using stainless steel tweezers. In laboratory all samples were cleaned to remove extraneous material. After cleaning and drying the thirty pieces of pellets per sample were digested in a mixture of nitric and perchloric acid following the six hours UV irradiation. Mercury was measured using CV AAS method. The detection limit of 0.005 ng L^{-1} for seawater and $0.001 \text{ } \mu\text{g g}^{-1}$ for solid samples was estimated based on $3 \times \text{SD}$ of a blank measurement.

The concentrations of mercury on beached plastic pellets decreased from the south-east to north-west: Island of Mljet, inlet Grabova $0.015 \text{ } \mu\text{g g}^{-1}$, Šibenik Bay, Martinska $0.009 \text{ } \mu\text{g g}^{-1}$, Island of Rava, $0.005 \text{ } \mu\text{g g}^{-1}$, Kvarner Bay, inlet Brestova $0.003 \text{ } \mu\text{g g}^{-1}$. There was only one exception to the sample taken in the vicinity of former chlor alkali plant located at the shore of Kaštela Bay. The concentration of mercury on these pellets was up to $2 \text{ } \mu\text{g g}^{-1}$.

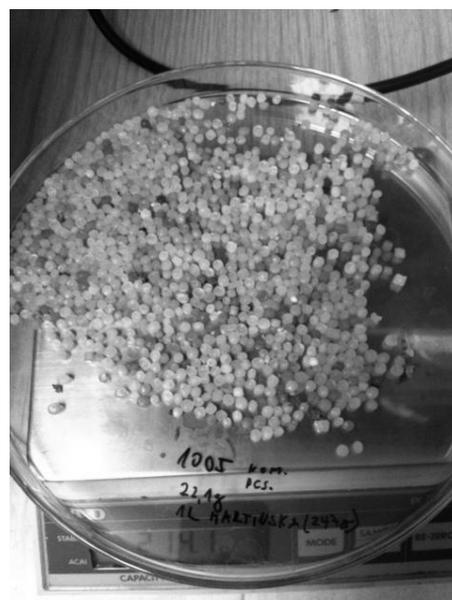


Fig. 2. Plastic pellets from Šibenik-Martinska coastal area

The question is why the concentration of adsorbed mercury on plastic pellets decreasing from south-east to north-west direction? After recently widely performed sampling and measurements of various species of mercury in sea water along eastern Adriatic coast these authors have found that average concentration of the total mercury are higher in the south than in Northern Adriatic Sea. On other hand countless islands and well developed mainland coast of southern and central Adriatic Sea are natural scavengers of floating litter which continuously in large quantities floated from Greece, Italy and especially Albania (2). Major and local sea currents with winds changes keep floating litter including plastic pellets enough time at sea for mercury adsorption processes.

References

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