With a pinch of salt: microplastics and trace elements in sea salts for human consumption

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Are commercial sea salts on the European market contaminated with microplastics or trace elements? And if so, what are the implications for food safety? To give an answer to these questions asked by the Belgian Federal Ministry for Public Health, 18 brands of commercial food graded sea salts were collected from Belgian supermarkets and speciality stores. As sea salts are harvested from seawater, they might contain contaminants present in the marine environment, but also the production and food processing methods may lead to increased concentrations of microplastics and trace elements. Therefore, sea salts from different origins and with varying harvesting, production and processing methods were selected. Microplastics were extracted from the sea salt through a hydrogen peroxide treatment to dissolve the organic matter, and were further identified and quantified after filtering by means of a stereo microscope. Trace elements (As, Cd, Hg, Pb and Br) were determined by Inductive Coupled Plasma Mass Spectrometer (ICP-MS).

The analyses showed a varying contamination of microplastics in the investigated food graded sea salts. The majority of the observed microplastics were categorized as synthetic fibres. The amount of microplastics seemed mainly to be influenced by the brine processing of the sea salts. Traditionally hand harvested sea salts, which are harvested by scraping the salt of the salt pan or marsh without brine washing after crystallisation, contained highest number of microplastics, with a maximum of 180 microplastics/kg salt. Taking into account the advised daily salt consumption, we estimated a maximum uptake of 330 microplastics per year or a daily intake (DI) of 1 microplastic particle through the consumption of sea salt. Microplastics are non-regulated emerging contaminants, with no food safety levels identified yet. Therefore, the potential human health risks posed by (this amount of) microplastics in food items cannot be assessed yet.

The concentrations of trace elements Hg and Cd could not be detected in any of the sea salts (i.e. less than the detection limit of 0.002 mg/kg salt for both elements). On the other hand, the elements As (detection limit: 0.004 mg/kg) and Pb (detection limit: 0.03 mg/kg) were found in most of the investigated sea salts. Concentrations of As were significantly lower than the maximum safety values for food graded salts as given in the Codex Alimentarius (0.5 mg/kg) and Belgian regulation (KB 17/09/1968, 1 mg/kg). Similarly, Pb concentrations were consistently below the maximum allowed level of 2 mg/kg as stated in the Codex Alimentarius of 1995, although 40 % of the samples exceeded the more strict Belgian limit of 0.1 mg Pb/kg. Concentrations of Br amounted to several hundreds of mg/kg in all sea salts, which is consistent with the fact that seawater naturally contains on average 65 mg Br per litre seawater.

As conclusion of this pilot study it can be stated that the current contamination of food graded sea salts with trace elements is not hazardous to public health. However, the higher Pb concentrations partly reflect the presence of this trace element in the marine environment, probably as an effect of human activities. Although the presence of trace elements and the DI of microplastics via sea salt are low, it is important to add these amounts to the overall intake via the complete food basket for further risk assessments.

Keywords: sea salt; microplastics; trace elements; heavy metals; food safety