

FATE AND SIGNIFICANCE OF PHTHALATES AND BISPHENOL A IN LIQUID BY-PRODUCTS GENERATED DURING MUNICIPAL SOLID WASTE MECHANICAL-BIOLOGICAL PRETREATMENT AND DISPOSAL

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ABSTRACT

During last decades a significant change of the household consumption pattern, increased the usage of plastic, paper and cardboard from the food and beverages. The products addressed herein usually contain phthalates (PAEs) and bisphenol A (BPA), which are suspected to pose the endocrine-disrupting effects. Since PAEs and BPA meet the need of a wide variety of markets, next they enter the waste stream and undergo different kind of treatments. Currently municipal solid waste plants (MSWPs) are usually equipped with sorting and composting units for mechanical-biological pre-treatment of residual (mixed) solid waste prior to landfilling. Thus, the liquid by-products, besides landfill prisms, are also generated by sorting and composting processes. The aim of this study was to characterize liquid by-products generated at MSWPs, serving municipal and rural area (northern Poland). Samples were collected for the four years from the sorting (SUs) and composting (CUs) units as well as from the landfill prisms (LPs) and were tested for the presence of BPA and selected PAEs (DMP - dimethyl phthalate, DEP - diethyl phthalate, DnBP - di-n-butyl phthalate, DEHA - bis-2-ethylhexyl adipate, BBzP - benzyl butyl phthalate, DEHP - bis(2-ethylhexyl) phthalate, DnOP - di-n-octyl phthalate). To find potential relations between parameters in the data sets the correlation matrix, principal component analysis (PCA) and hierarchical cluster analysis (HCA) were performed.

According to the obtained data, the incidence and concentrations of PAEs and BPA were highly dependent on the sampling point. In the technological wastewater generated by SUs, low molecular weight phthalates as DMP and DEP, were detected with the highest frequency, what was connected with their easier release from the mother products than higher molecular weight PAEs. In case of composting and landfilling, the presence/absence of PAEs and BPA, besides leaching was connected also with the susceptibility of the tested compounds to the biodegradation. But regardless the sampling point, the elevated concentrations of total PAEs were caused mainly by presence of DEHP (up to 536.4 $\mu\text{g/L}$ in landfill leaches, and up to 8,206 $\mu\text{g/L}$ and 612.5 $\mu\text{g/L}$ in technological wastewater generated by SUs and CUs respectively). It is of special concern, since DEHP is considered as possibly carcinogenic to humans (IARC, 1987) and pointed as hazardous among priority substances in the field of EU water policy (Directive 2013/39/EU). Also BPA was detected in high concentrations especially in landfill leachates (up to 8,052 $\mu\text{g/L}$) and technological wastewaters generated by composting units (up to 1795 $\mu\text{g/L}$).

Obtained data imply that untreated liquid by-products from MSWPs, especially, to date poorly recognised, technological wastewaters generated by SU and CU, are potentially significant sources of PAEs and BPA for the aquatic environment, with concentrations several times higher than those reported in municipal wastewaters. Thus the monitoring data are

extremely valuable for understanding those micropollutants release at MSWPs and will help to prioritize chemicals of concern in liquid by-products treatment technology.

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