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Accumulation and degradation of plastic pollutants and diisopropyl-naphthalenes during composting of organic household waste

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Composting of household and urban organic waste received much attention by municipal authorities due to its utility in the recycling and volume reduction of waste. According with the waste management plan of the Spanish Government (*Plan Nacional Integrado de Residuos 2007-2015, PNIR*), in Spain, the 45-53% of the solid urban waste are composed by food or gardening residues and most of these waste is processed in 65 composting plants that generated 720.000 tons of compost in 2006. This compost is used mainly for agriculture and gardening. Following this effort, the market of small units for homebrew compost using household waste increased in parallel with the ecological education of the public and now is a widespread practice. In spite, little attention has been received the molecular composition of compost (Spaccini and Piccolo, 2007). Also, the non-beneficial effects of application of compost on the soil quality or incorporation of contaminants to farm products is still not very well understood. In this sense, González-Vila et al (1999) noted the increase of phthalate esters in juice of tomatoes growth in compost-amended soils, together with changes in the lipid composition, suggesting a potential risk in the use of compost in the food industry.

Following this line of evidence and the potential use of composting units as a model of concentration and early diagenesis of terpene biomarkers, the study of the organic solvent extractable fraction of compost, generated using household units, was carried out. For this study, a small compost unit (1,5 m³) situated in an urban environment was filled exclusively with food and gardening residues free of paper, plastic or non-compostable debris during five years. Yearly, samples of compost were extracted in dichloromethane/methanol 3:1 and analyzed by gas chromatography/mass spectrometry (GC-MS)

Results and conclusion

The main single components of the extractable fraction of compost (mean 29.6% of total compost) is constituted by plant lipids, n-alkanes and plastic contaminants. The plastic contaminants found are dominated by phthalate esters, followed by 2,4-ditertbutylphenol and bisphenol A. Other relevant

anthropogenic compounds found are the diisopropyl-naphthalene isomers (DIPNs). The DIPNs could be accumulated in compost from the food residues, as consequence of migration from cardboard or paper packages (George et al. 2010; Sturaro et al., 1994). DIPNs and phthalates are effectively degraded during compost maturation: 15.4% of total extract after 1 year, 0.9 % after 5 years with only phthalates remaining. On the contrary, bisphenol A show resistance to degradation with accumulation on compost (0.1% of total extract after 1 year, 0.59% after 5 years).

Further study is necessary in order to understand the fate of organic pollutants during composting and to evaluate possible risks of the use of poorly matured composts in agriculture.

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