

Workshop „Pharmaceuticals in Soil, Sludge and Slurry” of the German Federal Environment Agency (18th June to 19th June 2013)

TITLE: Biotransformation of ibuprofen in soil.

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ABSTRACT:

Ibuprofen is one of the most commonly consumed non-prescription drug. Although the removal efficiency of ibuprofen in wastewater treatment plants was reported to be high, this pharmaceutical is frequently detected in the biosolids. Application of biosolids in agriculture as fertiliser may introduce this pharmaceutical into soils. Up to date, it is still little known about the fate of ibuprofen in agricultural soils. Available few reports on turnover processes of this pharmaceutical in soil are limited to the general mass balances without any information about the chemical composition of non-extractable residues (NER). Non-extractable residues (NER) formed during biodegradation of organic contaminants in soil are considered to be mainly composed of parent compounds or their primary metabolites with hazardous potential. However, in the case of biodegradable organic compounds, the soil NER may also contain microbial biomass components, for example fatty acids (FA) and amino acids (AA). After cell death, these biomolecules are subsequently incorporated into non-living soil organic matter (SOM) and are stabilised ultimately forming hardly extractable biogenic residues. We investigated the biodegradation of ¹³C₆-ibuprofen in sludge amended soil over 90 days with particular focus on the extent of biogenic residues formation. We analysed the labelled FA and AA in living and non-living SOM fractions. ¹³C-FA and ¹³C-AA amounts in the living SOM fraction decreased in time course, whereas the ¹³C-FA and ¹³C-AA in the non-living SOM remained surprisingly stable after 59 days. The results showed that at the end, nearly all NER were biogenic and contained only harmless biomass compounds. The presented data thus reveal that the formation of biogenic residues has to be taken into account in the case of readily biodegradable organic contaminants like ibuprofen for proper assessment of the environmental risks related to NER formation.