Mixtures of veterinary medicinal compounds in manured soils

N. Tauchnitz[1], D. Gildemeister[2], S. Berkner[2]

[1] University of Leipzig, Institute of Legal Medicine, Postgraduate Study Toxicology and Environment Protection, Johannesallee 28, 04103 Leipzig, Germany, e-mail: nadine.tauchnitz@llfg.mlu.sachsen-anhalt.de
[2] The Federal Environment Agency, Dept. IV 2.2 Pharmaceuticals, Washing and Cleaning Agents, Wörlitzer Platz 1, 06844 Dessau-Roßlau, Germany

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Veterinary drugs, particularly antibiotics, are widely used in high amounts for animal production and may be released to the environment either by direct excretion via urine and faeces of animals or by application of organic fertilizer (e.g. slurry). The environmental risk assessment for registration of veterinary medicines primarily focused on testing single substances. Nevertheless it is more likely that veterinary drug residues occur as a mixture of different chemical compounds in the organic fertilizer with numerous possible interactive effects that could increase the toxicity of the mixture compared to the single substance.

The present study was aimed at estimating the exposure of veterinary drug mixtures by anonymous questionnaire surveys of farmers. For this duplicates of the regular forms on drug application to agricultural animals for one year considering dairy cattle and pig husbandry farms were used as data sources and analysed for different therapeutic classes.

The survey showed a much higher consumption of veterinary drugs in pig husbandry (13 g/animal/year) compared to dairy farming (maximal 6 g/animal/year). Antibiotics were the most commonly consumed veterinary drugs with a share of 82 to 100 %. Altogether a maximum of 16 different therapeutic classes and 42 chemical substances were applied per farm and year.
The assessed predicted environmental concentrations of antibiotics in soil (PEC_{soil}) at application of pig slurry with 590 µg kg^{-1} sulfonamides and 332 µg kg^{-1} tetracyclines exceeded markedly the defined trigger value of 100 µg kg^{-1}. In contrast for cattle slurry markedly lower PEC_{soil} of the less persistent antibiotic class of ß-lactames (maximal 22 µg kg^{-1}) was calculated. Summing up the calculated PEC_{soil} for the single chemical substances resulted in a predicted environmental concentration for the drug mixture ($PEC_{soil(mix)}$) of 1100 µg kg^{-1} for pig slurry suggesting a high probability that environmental relevant mixtures of different veterinary drug compounds may occur in manured soils.