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2s2: Food safety and risks is a circular system

A STRATEGY TO DETERMINE THE FATE OF ACTIVE CHEMICAL COMPOUNDS IN SOIL; APPLIED TO ANTIMICROBIALLY ACTIVE SUBSTANCES

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Chemical contaminants end up in agricultural soils after manure application as a result of disease treatment in animal husbandry (e.g. veterinary drugs), crop production (e.g. biocides) or through irrigation using contaminated surface water (e.g. biotoxins). When further implementing the concepts of a circular biobased economy, other waste streams might also contribute to soil exposure. Therefore, data on the fate of chemical substances in the environment is mandatory input for risk assessment in perspective of a more circular biobased economy. Such fate studies include a persistence study to determine a half-life value and a mobility study. It is recognized that not only the native substance should be considered, but that also degradation products should be included that might exert a similar effect as the native substance. We report a tiered fate study strategy that starts with a persistence study. For non-persistent substances a study is performed to determine if degradation products have a similar effect as the native compound. If so, a procedure using high resolution mass spectrometry is suggested to identify the potentially active degradation products. Based on the outcomes, substances are divided into three categories: (I) persistent, (II) degradable to inactive products or (III) degradable to active products. Even though the priority is with category I and III, for all substances and possible degradation products a mobility study is proposed. The fate strategy is successfully applied to ten antimicrobially active substances originating from the tetracyclines, sulfonamides, diaminopyrimidines, fluoroquinolones, macrolides and lincosamides in 40 different soils. The fluoroquinolones, tetracyclines and trimethoprim were relatively persistent. However persistence of trimethoprim was heavily influenced by the type of soil. The sulfonamides, macrolides and lincomycin (the latter also depending on soil type) degraded relatively quickly. Tylosin A proved to degrade to antimicrobially active degradation products which were tentatively identified as tylosin C, tylosin A acid, tylosin B acid and tylosin C acid. The strategy proposed in this study is an easy and efficient way to determine the fate of chemical compounds in soil which can be used as input for translocation models and together with input on the antibiotic usage data, excretion models, persistence data in manure and manure distribution data, the spatial distribution of antibiotics over agricultural soils can be predicted. Additionally, the applied strategy can easily be applied to other substances.

Keywords: Fate study, soil, persistence, mobility, contaminants, risk assessment, antibiotics