A consistent framework for modeling inorganic pesticides: Adaptation of life cycle inventory models to metal-base pesticides

Quantifying over the life cycle of a product or service the chemical emissions to the environment in the life cycle inventory (LCI) phase is typically based on generic assumptions. Regarding the LCI application to agricultural systems the estimation of pesticide emissions is often based on standard emission factors (percentages) or dynamic models base on specific application scenarios that describe only the behavior of organic pesticides. Currently fixed emission factors for pesticides dearth to account for the influence of pesticide-specific function to crop type and application methods. On the other hand the dynamic models need to account for the variability in this interactions in emissions of inorganic pesticides. This lack of appropriate models to estimate emission fractions of inorganic pesticides results in a lower accuracy when accounting for emissions in agriculture, and it will influence the outcomes of the impact profile. The pesticide emission model PestLCI 2.0 is the most advanced currently available inventory model for LCA intended to provide an estimation of organic pesticide emission fractions to the environment. We use this model as starting point for quantifying emission of inorganic pesticides and customize it taking into account the complex chemistry of metals in order to properly reflect the their environmental fate behavior. We identified specific needs for metal-specific pesticides emission modeling looking at the current PestLCI structure and propose an approach for the different metal-related processes and interactions. The proposed framework takes into consideration the speciation of the metals to accurately describe the soil processes (runoff and leaching). The processes involving degradation are assumed not significant for metals and volatilization is only accounted for special cases (i.e. mercury). And finally, a new module of erosion is included in the modified PestLCI model, because the transport of soil particles to which the metals are bound needs to be considered as potential source of emissions to surface water. In conclusion, we provide a starting point to better estimate metal-specific pesticide emission fractions, addressing the issue of inorganic pesticides for inventory analysis in LCA of agricultural systems.

General information
State: Published
Organisations: Department of Management Engineering, Quantitative Sustainability Assessment, IRTA, Food Safety Programme, Institute of Agri-food Research and Technology
Contributors: Peña, N., Anton, A., Fantke, P.
Publication date: 2016

Host publication information
Title of host publication: Setac Europe 22nd LCA Case Study Symposium
Electronic versions:
Pena_2016a.pdf
Source: PublicationPreSubmission
Source-ID: 126891615
Research output: Research - peer-review › Conference abstract in proceedings – Annual report year: 2016