

C9 - A mathematical model to estimate the volume of grey water of pesticide mixtures ¹

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This study presents a model to estimate the grey water footprint of crops by calculating the volume of water necessary to dilute the pesticide mixtures in freshwater. In this approach, the grey water footprint is calculated from the toxicological end point of each pesticide component of the mixture, rather than the maximum acceptable concentration of pesticide in water. This approach considers concentration of the pesticide in water which affects 50% of the organism's populations (EC50s), the half maximal effective concentration. Together with these toxicological parameters, the first order kinetics soil degradation and linear soil sorption has been considered. The model requires short-term toxicity data from aquatic organisms (algae, daphnids and fish) based on EC50 values, soil pesticide half-life and soil sorption coefficient values and does not require maximum pesticide residue limits in water as established for water quality standards. The lixiviation rate and runoff rate of each pesticide in the mixture was estimated by attenuation factor and by Soilfug model, respectively. The usefulness of the proposed model was illustrated by estimating the volume of grey water required to dilute the seventeen most widely used herbicides in the agricultural system of sugarcane crops in Brazil in 2011/2012. The grey water footprint corresponding to each herbicide considered in this study varied between $4.20 \times 10^6 \text{ m}^3 \text{ yr}^{-1}$ (carfentrazone) and $1.20 \times 10^{12} \text{ m}^3 \text{ yr}^{-1}$ (ametryn) and the grey water footprint of the mixture of herbicides was $2.36 \times 10^{12} \text{ m}^3 \text{ yr}^{-1}$ in 2011/2012. These results establish the ranking position of each herbicide in the composition of the grey water footprint of mixture of herbicides.

¹Joint work with: R. A. A. Pazianotto; A. J. B. Luiz; A. H. N. Maia; C. M. Jonsson.



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