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Model for Dermal and Inhalation Exposure Assessment of Pesticide Application on Agricultural Products in Colombia

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Abstract

This study presents a modeling approach to be included in a risk assessment framework for pesticide use in the agricultural production in developing countries. The model has two parts: the inhalation and the dermal exposure assessment. Firstly, the conceptual framework of the new proposed model is explained after a multi-criteria analysis of the existing methodologies. Then, the model itself is presented which consist of the estimation of dermal and inhalable exposure concentrations, studying the routes and pathways followed by the pesticides after they are sprayed. Four application techniques are studied in different environmental conditions: i) handed-pressurized (outdoors), ii) motor-pressurized (outdoors and greenhouses), iii) tractorized (outdoors), and iv) aerial (outdoors). The data for the model development is collected by doing surveys in three different regions in Colombia dedicated to potato, flowers and banana crops and by performing experiments quantifying the distribution of the pesticide in the human body. The experimental methodologies used to get this information are the whole body dosimetry and the button personal inhalable aerosol sampler. The tracer fluorescein is used as surrogate of pesticides. The final result is a mathematical tool that identifies the sensitive factors during the pesticide application which are suitable of being improved to mitigate the human exposure. This model is crucial for the risk assessment scheme in farming systems in Colombia and other developing countries as their current risk assessment framework is based on models from industrialized countries. This work is part of the project “Life Cycle Human Exposure and Risk Assessment of Pesticide Application on Agricultural Products in Colombia” financed by the Swiss National Foundation.

Keywords: Dermal exposure, inhalation exposure, pesticides, risk assessment, developing countries