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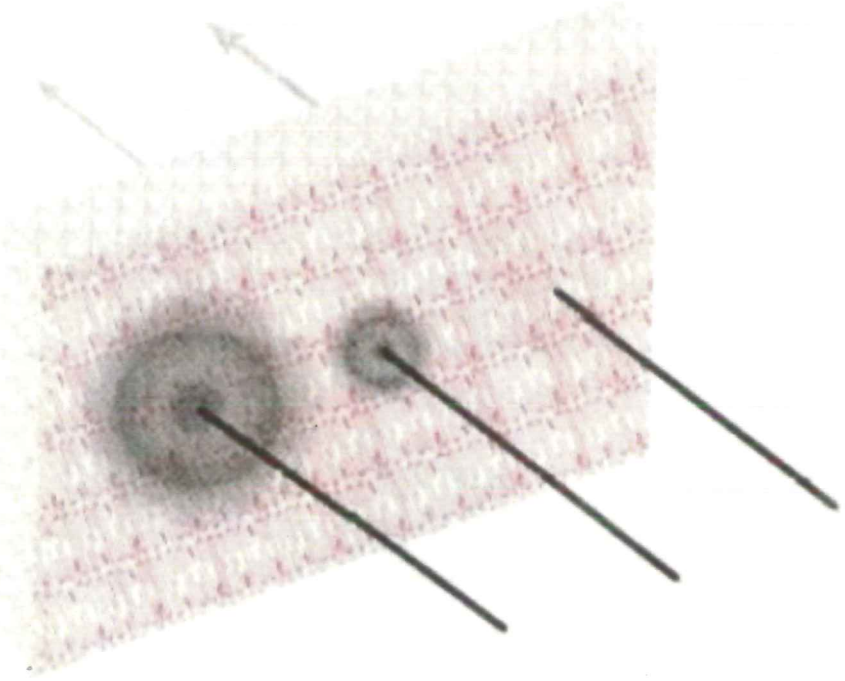

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OCCUPATIONAL SKIN EXPOSURE TO CHEMICALS: TESTING SKIN AND PROTECTIVE CLOTHING PERMEATION IN VITRO

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Although the importance of dermal exposure has been recognized for several years, it is difficult, as opposed to inhalation exposures, to estimate the significance of the dermal route. This is a concern when assessing occupational exposures, for which the percutaneous permeation may be a significant or even the main contributor to the overall dose[1]. The skin permeation rate (commonly J_{max}) is usually determined using *in vitro* studies. However, during work, most of the skin is for instance covered by regular or even protective clothing (eg. gloves, coveralls), especially when handling chemicals.

Protective clothing is systematically advocated when handling chemicals to avoid acute or chronic skin effects. Several recent studies have questioned the effectiveness of protective clothing against chemical penetration[2,3], and suggest that inadequate clothing or an inadequate use of the protective clothing may actually lead to an increase in exposure. In accordance with EN ISO 6529 norm, the effectiveness of protective clothing is determined using permeation *in vitro* tests independently of skin. Interestingly, these tests are similar to *in vitro* skin penetration tests.

The permeation of two common herbicides, isoproturon and bentazon, through skin, protective clothing and a combined skin-protective clothing layer was assessed in this study. These two chemicals are of concern especially among agricultural workers who frequently have dermal exposures during crop treatment. Skin penetration was assessed using a dynamic flow-through *in vitro* penetration system and analyses were performed with ion trap LC-MS. Two concentrations of bentazon (75 and 150 µg/mL) and isoproturon (125 and 250 µg/mL) in saline solution as well as pure commercial products were applied on excised human skin from several donors, on overalls (types 3-4 and 5-6) and on combined layers. Saline water was used as receptor fluid.

Bentazon had a lower skin permeation rate compared to isoproturon; 350, 600 ng/cm^2/h, respectively. However, bentazon and isoproturon cross the skin barrier within 2 hours even at very low concentrations. Similarly, for both products, type 3-4 tested overalls seemed very efficient unlike type 5-6, which are inadequate protective clothing 1h following the beginning of exposure. In conclusion, our *in vitro* experiments demonstrate that the two herbicides cross easily the skin barrier and only the recommended overalls for pesticide application protect efficiently agricultural workers.

Acknowledgements

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