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LC-MS-MS Can Distinguish Between Toxic and Non-Toxic Pyrrolizidine Alkaloids in Plants

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Several plants including medicinal plants and weeds that contaminate food crops contain pyrrolizidine alkaloids (PA). In the case of medicinal plants not used regularly, a low level of PA can be accommodated, but because food is consumed over a long time the allowable levels must be much lower [1]. Maize and soybean farmers in South Africa suffer economic losses due to the presence of *Crotalaria sphaerocarpa* seed pods in crops by the implementation of current regulations [1]. Because many *Crotalaria* species contain toxic PAs, there is a limit on the quantity of seeds that are allowed in the grain. *C. sphaerocarpa* undoubtedly contains pyrrolizidine alkaloids but toxicity to animals could not be established in several unpublished trials.

PAs are not toxic *per se,* but can be converted to toxic metabolites in the liver. To be converted to the toxic metabolite the pyrrolizidine alkaloids must contain a 1,2-unsaturated necine base [2]. It would be extremely useful if a method could be developed to discriminate between PAs with and without these moieties. The collision activated dissociation spectra of these necine bases yields characteristic product ions, which were used to develop a LC-MS/MS screening method to quantify the presence of toxic pyrrolizidine alkaloids in natural products.

Based on our results the level of toxicity in *C. sphaerocarpa* was so low that the number of seed allowed per Kg of maize or soybeans may be increased to such a level that *C. sphaerocarpa* contamination would not cause any problems to maize or soybean farmers.

The method was also used to determine the level of toxic pyrrolizidine alkaloids in the rumen content of poisoned cattle confirming that a *Senecio spp* was responsible.

[1] Eloff JN, Jansen van Rijssen FW, Naudé TW, Joubert JPJ. What levels of potentially toxic seed should be allowed in grains in South Africa? I. Background and pyrrolizidine alkaloid containing plants. South African J Sci. 2003; 99: 337–344.

[2] Mattocks AR. Chemistry and Toxicology of Pyrrolizidine Alkaloids. Academic Press, London. UK, 1986.