Alkaloids in feed and food: an emerging risk?

Alkaloids are naturally occurring compounds containing basic nitrogen atoms. They are produced by a large variety of organisms, including plants and fungi. Many alkaloids are toxic to humans and animals. Examples of alkaloids that are of concern to human and animal health are the pyrrolizidine and tropane alkaloids (plant toxins) and the ergot alkaloids (mycotoxins). Over the last years, the scientific and regulatory interest for alkaloids has increased, in particular for alkaloids in animal feeds. This is witnessed by three recent scientific opinions of the European Food Safety Authority on pyrrolizidine, tropane and ergot alkaloids as undesirable substances in animal feed. Currently there are no analytical methods for these alkaloids that have been formally validated in interlaboratory studies, reliable reference materials (calibrants and matrices) are scarce, and regulations hardly exist.

In particular the pyrrolizidine alkaloids (PA) have recently attracted much attention. Examples of European food and feed safety issues caused by PA, include animal hay contaminated with ragwort (2006) and Rucola salad contaminated with common groundsel (2009). A dramatic episode in Afghanistan (2008) caused by wheat contaminated with charmac (a local weed), led to the death of a few dozens of people in rural communities, and hundreds got ill. Whereas human exposure to PA was primarily due to contaminated bread, it was also found that significant carry-over into goat's milk and subsequently into a local dairy product (qurut) had occurred.

In the Netherlands a pilot carry-over experiment with dairy cows was conducted in 2009. Three animals were given feed with ragwort and
narrow-leaved ragwort, with known amounts of various PA, during a five-week period. Milk samples of these animals were investigated for PA. LC-MS/MS methodology was applied to analyse the samples of animal feed and milk. Senkirkine, jacoline, otosenine, jaconine, florosenine and jacobine were found in the milk (only tertiary bases, no N-oxides). Jacoline was the most abundant of the PA in milk (81%), whereas this toxin was only a minor constituent in the PA profile of the cow's feed (1%). The transfer rate of this compound was estimated to be 6-8%.

The need for reliable and rapid analytical methodology to determine alkaloids in food and feed was recognized by the European Commission in the first call for proposals for a research project in the 7th Framework Programme in the field of Food, Agriculture and Fisheries, and Biotechnology. This has resulted in the 4-year Large Collaborative Project CONffIDENCE, coordinated by RIKILT - Institute of Food Safety. The project, which runs from 2008-2012, focuses on the development of simple, fast and multi-analyte detection of various contaminants in food and feed. It includes a work package on alkaloids, where attention is given to pyrrolizidine, tropane and ergot alkaloids.

Alkaloids in food and feed have caused problems in the past and the present. They are now recognized as posing (potential) risks to man and animals, and the current interest is justified from a scientific, food safety and regulatory point of view.