



Pyrrolizidine Alkaloids

Analysis in food and feed offered by Eurofins

Pyrrolizidine alkaloids (PAs) are secondary metabolic products, formed to protect against herbivores by a multitude of plant species worldwide. More than 500 different pyrrolizidine alkaloids and corresponding N-oxides are known, some of them being extremely toxic.

Occurrence in plants

An estimated 6,000 plant species – 3 % of all blooming plants – may contain pyrrolizidine alkaloids. The most relevant PA-producing plants being ragwort (*Senecio jacobaea* L.) and other members of the daisy family (asteraceae), representatives of the broadleaf and borage family (boraginaceae) and the family of pulses (fabaceae or leguminosae).

Occurrence in food and feed

Pyrrolizidine alkaloids usually enter food and feed via PA-containing weeds. Lettuce, leafy vegetables, herbs, spices, tea, honey and pollen-based products as well as borage oil have long been known as potentially affected food groups.

The occurrence of PAs in pseudocereals was also reported by the Federal Institute for Risk-Assessment (BfR) in 2014.

PAs can be a serious problem in animal feed, especially in hay and silage, as the animals no longer perceive the characteristic inherent odour of the special plants.

Generally, pyrrolizidine alkaloids can be distributed very inhomogeneously in the food commodities as only single parts of the weeds may be present in a larger lot.

Toxicology

Pyrrolizidine alkaloids can damage the liver and show genotoxic and carcinogenic effects in animal studies, for which no safe threshold value can be derived. In June 2020, the BfR published an updated risk assessment on pyrrolizidine alkaloids in food in its statement 026/2020.

Maximum levels for PAs in the EU

Since July 2022 maximum levels for pyrrolizidine alkaloids are in force in the following food groups: Tea (including flavoured) and herbal infusions, food supplements, various dried herbs and borage and cumin. These are laid down in the new European Contaminants Regulation (EU) 2023/915.

The maximum levels refer to the sum of 21 pyrrolizidine alkaloids or N-oxides as well as 14 additional PAs and N-oxides, which are known to co-elute with one or more of the 21 pyrrolizidine alkaloids.

Analysis

Our experts from the Competence Centre for mycotoxins and toxic plant alkaloids have long-term experience with the LC-MS/MS analysis of pyrrolizidine alkaloids. The homogenisation of sufficiently large sample quantities is also of importance, since pyrrolizidine alkaloids can be very inhomogeneously distributed. The portfolio includes tests covering the legally regulated pyrrolizidine alkaloids as well as other tests with an extended substance spectrum (substances of the extended spectrum in *italics*):

- echimidine/heliosupine and echimidine N-oxide
- echinatine/rinderine/indicine/lycopsamine
- *erucifoline* and *erucifoline N-oxide*
- europine and europine N-oxide

- heliosupine N-oxide
- heliotrine and heliotrine N-oxide
- intermedine and intermedine N-oxide/incidine N-oxide/echinatine N-oxide
- *jacobine* and *jacobine N-oxide*
- lasiocarpine and lasiocarpine N-oxide
- lycopsamine N-oxide
- *monocrotaline* and *monocrotaline N-oxide*
- retrorsine/usaramine
- retrorsine N-oxide/usaramine N-oxide
- rinderine N-oxide
- senecionine N-oxid/integerrimine N-oxide
- senecionine/integerrimine
- seneciphylline/spartioidine
- seneciphylline N-oxide/spartioidine N-oxide
- senecivernine and senecivernine N-oxide
- senkirkine
- *trichodesmine*

Of course, Eurofins also offers the analysis of pyrrolizidine alkaloids under GMP. Please also read our flyer "Pyrrolizidine Alkaloids under GMP/cGMP".

