Bundesinstitut für Risikobewertung

Provisional BfR recommendations on the analysis of pyrrolizidine alkaloids (PA) in herbal tea and tea (analyte spectrum and sampling method)

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The group of pyrrolizidine alkaloids (PA) consists of roughly 660 individual substances. Up to 35 PA are currently available as reference standards. The sum of the PA quantified with the help of these standard substances is used for the assessment of the possible health risks of PA in foods and feeds. Analysis of the same PA spectrum for calculating total PA content in herbal tea and tea is essential for the comparability of the analytical results of different laboratories. To ensure this, the Federal Institute for Risk Assessment (BfR) prepared a provisional recommendation of the minimum number of PA (21 individual substances) to be analysed in herbal tea and tea. Total PA content is calculated as the sum of the individual PA levels. This recommendation is solely based on the occurrence of PA in samples that had already been analysed. The toxicological potential was not taken into account here.

Furthermore, a representative sampling method is of special significance for the validity of the results. This is due to the inhomogeneous distribution of PA containing wild herbs in herbal teas and teas. Up to now, there are no legal provisions of sampling methods for the determination of PA in food. Therefore, the European Food Safety Authority (EFSA) as well as the BfR are recommending to provisionally using criteria of Commission Regulation (EC) No. 401/2006 laying down the methods of sampling and analysis for the official control of the levels of mycotoxins in foodstuffs.

1. Analyte spectrum recommended for the determination of the total PA content

On the basis of the current data available on the occurrence of pyrrolizidine alkaloids (PA) in herbal tea and tea, considerable relevance was found for 21 PA. The data basis used originates from 466 herbal teas and teas analysed for PA using the BfR-PA-Tee-2.0/2014 method which was successfully validated in an international ring trial.

The following PA are recommended as a **provisional** selection for the determination of the total PA content in herbal teas and teas by means of LC-MS/MS:

Echimidine	Echimidine N-oxide
Europine	Europine N-oxide
Heliotrine	Heliotrine N-oxide
Intermedine	Intermedine N-oxide
Lasiocarpine	Lasiocarpine N-oxide
Lycopsamine	Lycopsamine N-oxide
Retrorsine	Retrorsine N-oxide
Senecionine	Senecionine N-oxide
Seneciphylline	Seneciphylline N-oxide
Senecivernine	Senecivernine N-oxide
Senkirkine	

The BfR makes express reference to the fact that other PA which are not currently available as reference standards could possibly be of great significance with regard to the total PA content in samples of certain tea varieties. This was indicated by results of investigations conducted by the BfR. An adjustment of the recommended PA analyte spectrum should be targeted as soon as these PA are available as reference standards.

The data on the occurrence of PA in tea and herbal tea measured at the BfR from 2012 to 2014 were weighted according to the frequency and concentration of their occurrence, resulting in the selection of the 21 PA listed above. Deviations from the recommendation of the European Food Safety Authority (EFSA) on potential PA marker substances stated in the "Scientific Opinion on Pyrrolizidine alkaloids in food and feed"[1] (2011) do not cast any doubt on the above-listed analyte spectrum recommended for the analysis of PA in tea. The selection of PA as marker substances in the EFSA opinion is based solely on the PA profiles of certain plant species known from the literature. As the majority of the listed PA are not available as reference standards, they cannot be quantified in foods and feeds.

2. Recommendation on the sampling method for determining PA in tea and herbal tea

The BfR supports the EFSA sampling approach of using the criteria listed in Commission Regulation (EC) No. 401/2006, Annex I, E.4 regarding aflatoxin in spices for sampling to determine PA in tea and herbal tea within the scope of the project "Occurrence of pyrrolizidine alkaloids in food". Due to the analogy of the inhomogeneous distribution of plant parts containing PA in the form of so-called spot contamination, it seems reasonable to use the well-established sampling method for mycotoxins.

Further optimisation of this provisional procedure might be considered for the determination of PA in herbal tea and tea. This requires experimental data proving the optimised procedure to enable improved representativity of samples for their respective lot.

[1] EFSA, Panel on Contaminants in the Food Chain (CONTAM); Scientific Opinion on Pyrrolizidine alkaloids in food and feed. The EFSA Journal, 2011. 9(11):2406: p. 134.