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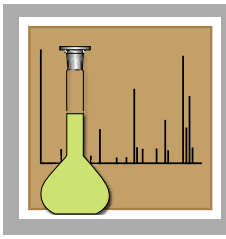

Highlights of Analytical Chemistry in Switzerland

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Transcriptomics: A New Strategy to Screen for Hazardous Contaminants in Food

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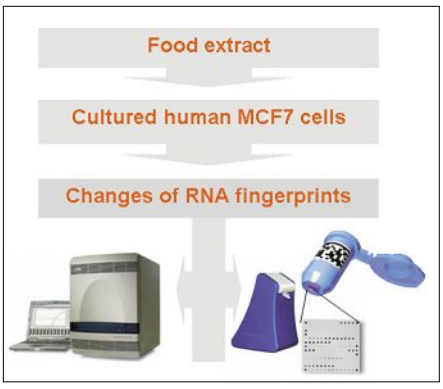
Type A trichothecenes (primarily T-2 and HT-2) are naturally occurring food contaminants originating from fungal infection of crop plants or mould infestation after harvest. These *Fusarium* mycotoxins display potent cytotoxic as well as immunosuppressive effects and are considered potential warfare agents. Based on animal studies, a temporary tolerable daily intake (t-TDI) of 0.06 µg/kg body weight/day for the sum of T-2 and HT-2 has been issued in the European Union. However, exposure assessments suggest that the combined intake of these mycotoxins exceeds in many countries the adopted t-TDI threshold. Therefore, to guarantee consumer protection, sensitive methods are necessary to detect T-2 and HT-2 toxins at parts per billion levels.

Towards that goal, we have recently established a new screening assay where cultured human cells are used as 'cytosensors' of hazardous contaminants in food. This assay is based on the observation that even traces of T-2 or HT-2 are able to induce massive and fast changes of gene expression in breast cancer cells. Two different platforms have been used to monitor these genomic effects at the transcriptional level: i) quantitative real time polymerase chain reaction (qPCR) with the fluorescent TaqMan® technology, and ii) miniaturised DNA microarrays (microchips) with colorimetric detection of biotin-labelled targets. In brief, the assay is carried out by exposing cultured human cells for 8–24 h to food extracts processed through MycoSep® clean-up columns. Next, selected RNA transcripts are converted to complementary DNA by reverse transcription and quantified either by qPCR or hybridisation on microchips. After normalization of expression changes against endogenous housekeeping controls, the resulting data are finally translated to T-2 toxin equivalents.

This novel bioassay strategy offers many important benefits for risk assessment and risk management, including its high sensitivity and its ability to detect multiple endpoints in a toxicologically relevant target system. In the future, this transcriptomic strategy will be extended to other food contaminants and it will also be used for mechanistic studies to analyse additive or antagonistic interactions between the individual components of complex contaminant mixtures.



Simplified scheme of transcriptomic-based methods for the detection of type A trichothecenes by qPCR (Applied Biosystems) and DNA microchips (Clondiag Chip Technologies).

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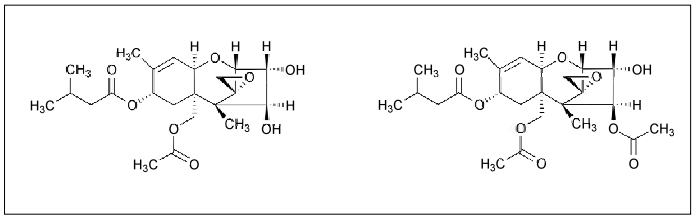
References

P. Bowens, K. Lancova, R. Dip, V. Povilaityte, J. Stroka, H. Naegeli, *Analyst* **2009**, *134*, 939.

K. Lancova, P. Bowens, J. Stroka, H. Gmünder, T. Ellinger, H. Naegeli, *World Mycotoxin J.* **2009**, *2*, 247.



Chemical structures of two major representatives of type A trichothecenes, HT-2 (left) and T-2 toxins (right).

Barley ear and grain infected with *Fusarium* fungi that are the major producers of trichothecene mycotoxins.

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