Micro- and nano-bioaffinity mass spectrometry of emerging food contaminants.

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Introduction

Functional binding assays with molecular receptors or transport proteins and whole-cell bioassays are important tools in the future detection of known and unknown chemical contaminants in food.

However, mass spectrometric identification of both known and unknown bio-active compounds in positive (non-compliant) samples will remain crucial and bio-affinity based isolation will be developed in this four year project [1,2]. Since bio-materials are costly micro- and nanoscale isolations will be combined with nano-LC-ToF-MS (figure 1).

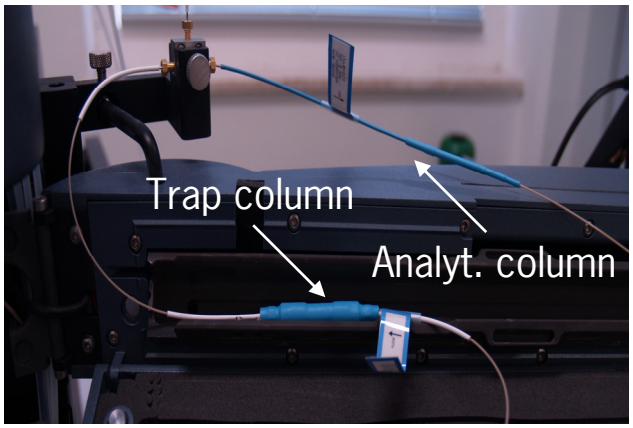

Figure 1. Typical nano-LC trap (20 mm x 0.18 mm, 5 µm) and analytical column (150 mm x 0.1 mm, 1.7 µm).

Current approach

As an example within RIKILT, receptor-based bioassays are more frequently used as inexpensive tools for screening of contaminants in food and feed. Following this prescreening, concentrated sample extracts are fractionised by LC towards two parallel 96-wells fraction collectors. Fractions of one plate are re-screened with the bioassay and active positions are used to locate the wells in the second plate for chemical analysis by LC-ToF-MS.

This is a labour intensive as well as costly procedure and the fractions of interest may contain other inactive compounds which hamper the identification of active compounds.

Alternative approach

Alternatively, bioactivity-based sample pre-treatment methods will be developed using for example receptors or transport proteins. Due to the high costs of these biomaterials, these isolation procedures will be miniaturised by using functionalised super paramagnetic micro- and nanospheres (figure 2).

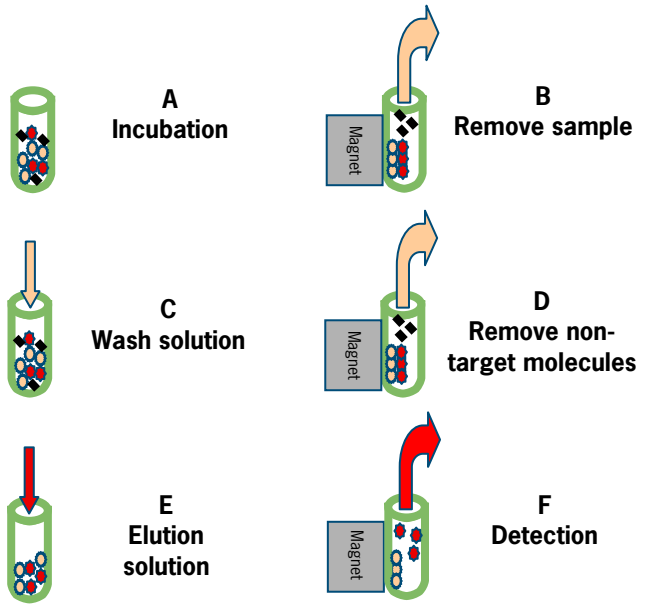

Figure 2. Bioactivity-based isolation using biomolecules bound to magnetic nano- or microparticles. = para-magnetic particles, = target molecules, = non-target molecules

At this stage, the performance of super paramagnetic micro- and nanoparticles are compared with help of antibodies against the mycotoxin ochratoxin-A as the first model. Due to the smaller size of nanoparticles, more surface area can be expected in a smaller volume compared to microparticles.

Main purpose

Using this combination of bioactivity-based sample clean-up with nano-LC-ToF-MS, new tools will become available for targeted/untargeted screening and confirmation in foods.

References

1. Marchesini, G.R. et al. 2008. Nanoscale affinity chip interface for coupling inhibition SPR immunosensor screening with nano-LC TOF MS. Anal. Chem., 80, 1159-1168.

2. Bovee, T.F.H. et al. 2009. Validation and application of a yest bioassay for screening androgenic activity in calf urine and feed. Anal. Chim. Acta, 637, 225-234.

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