Portable liquid chromatography – an attractive tool for fast on-site analyses

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Portable chromatographic system (miniLC)

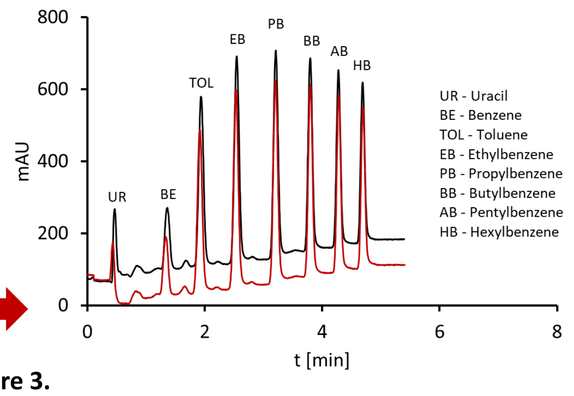
Currently, there is a growing interest in on-site sample analysis in the fields as environment, defense, agriculture, food and nutrition, as well as polymer chemistry or pharmaceutical science. This has initiated the development of small and portable analytical instruments. The portable chromatographic system (miniLC) has been assembled in the laboratory. It consists of a high pressure syringe pump and pair of low-pressure syringe pumps ensuring rapid and reproducible analyses; a high pressure injector for accurate sample injection; a capillary column ensuring rapid and efficient gradient separation; and optical detector. The examples of how this system can be used are presented.

miniLC – Overview

Mobile phase flow:	1–25 µL/min
Maximum pressure:	100 MPa
Sample volume:	0.5–5 µL
Capillary columns:	0.2 × 100 mm, 0.3 × 50 mm
RSD of retention time:	< 0.5 %
RSD of peak area:	< 5 %
Column oven:	up to 60 °C (±0.2 °C)
Li-ion battery:	> 8 hour of operation
Size:	430 × 380 × 154 mm
Weight:	9 kg

Figure 1. The miniLC system

Alkylbenzenes



Repeatability of analysis

RSD of retention time: < 0.5 %
RSD of peak area: < 5 %

Figure 3.
Column: Kinetex®2.6u XB-C18 100Å, 0.3 × 50 mm; Mobile phase: solvent A - water, solvent B - methanol; Gradient: 50-96% v/v B in 90 µl, flow rate 15 µl/min; UV detection 210 nm.

Polycyclic aromatic hydrocarbons

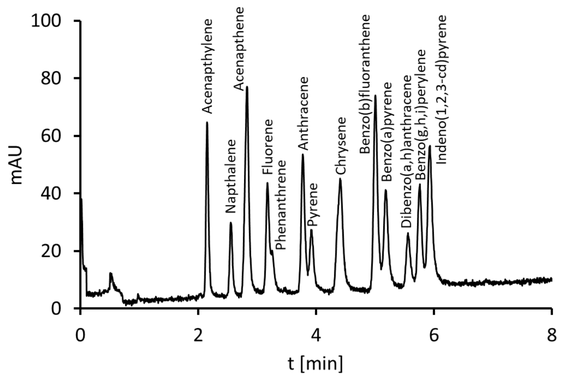
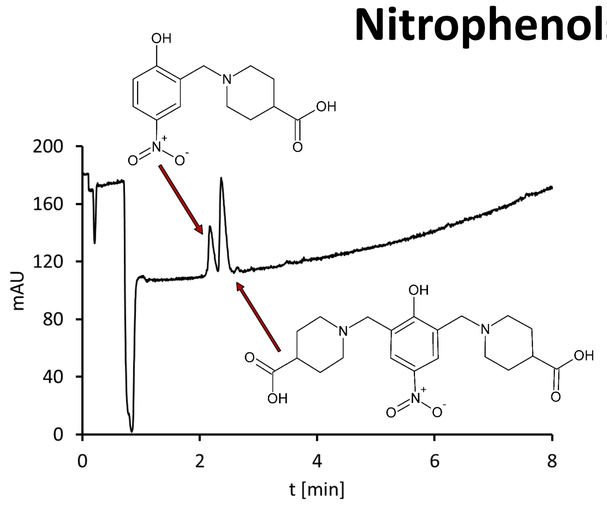


Figure 4.
Column: Kinetex®2.6u F5 100Å, 0.3 × 50 mm; Mobile phase: solvent A - water, solvent B - acetonitrile; Gradient: 40-85% v/v B in 90 µl, flow rate 10 µl/min; UV detection 210 nm.

Nitrophenols

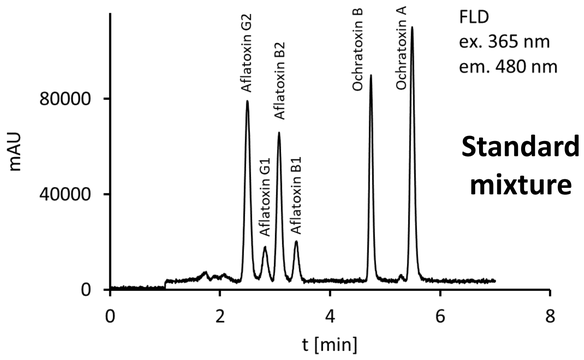


Purity of reaction's products

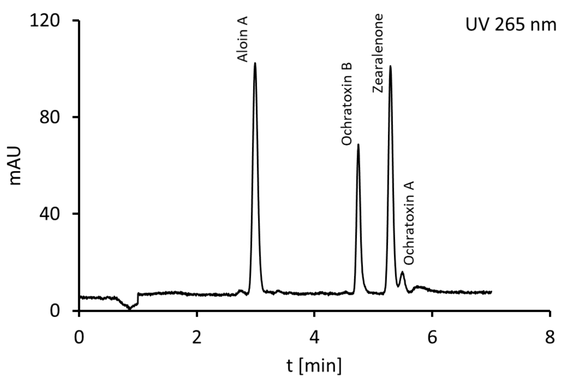
Figure 5.
Column: Kinetex®2.6u F5 100Å, 0.3 × 50 mm; Mobile phase: solvent A - water + 0.1% formic acid, solvent B - methanol + 0.1% formic acid; Gradient: 5-100% v/v B in 90 µl, flow rate 10 µl/min; UV detection 210 nm.

Mycotoxins

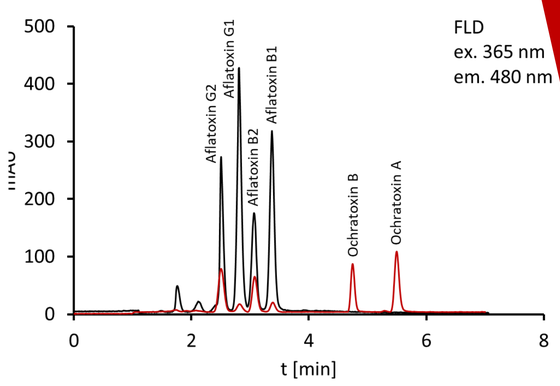
The miniLC-DAD-FLD analysis

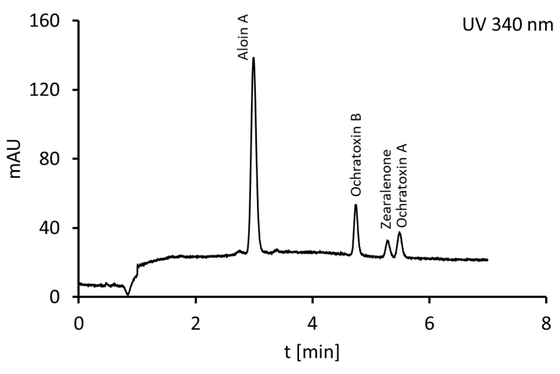


Standard mixture



Real sample





Wheat grain was inoculated by fungus *Aspergillus parasiticus var. globosus* culture (CCM F-550) and cultivated for 7 days. Sample was extracted by 80% ACN, filtrated, diluted and concetrated using SPE Strata C18-U. After dilution it was analyzed using miniLC.

Figure 2.
Column: Fortis H_2O 3µm 100Å , 0.2 × 100 mm; Mobile phase: A - 1% v/v H_3PO_4 in water, B - methanol:acetonitrile 3:2; Gradient: 5 - 65 % v/v B in 90 µl, flow rate 10 µl/min; Standard mix.: aflatoxins G2, G1, B2, B1, ochratoxin B, zearalenone, ochratoxin A, aloin A; UV detection at 265 nm and 340 nm; FLD detection at 480 nm (excitation at 365 nm).

Limit of detection (LOD) using miniLC: AF-G2 (0.4 µg/L), AF-G1 (6 µg/L), AF-B2 (0.5 µg/L), AF-B1 (6 µg/L), OchrA (60 µg/L), OchrB (380 µg/L), Zearaleon (60 µg/L).

Microcystins and nodularin

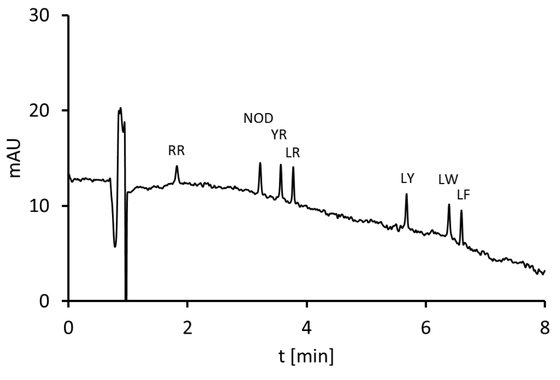


Figure 6.
Column: Kinetex®2.6u XB-C18 100Å, 0.3 × 50 mm; Mobile phase: solvent A - water + 1% H_3PO_4, solvent B - methanol + 1% H_3PO_4; Gradient: 30-80% v/v B in 90 µl, flow rate 10 µl/min; UV detection 235 nm.

Conclusions

The miniLC can be used for fast on-site analyses and needs only less than 500 µl of mobile phase per analysis and regeneration of the column. The gradient separations are achieved in time less than 8 minutes. The miniLC eliminates the need for transport the sample to the laboratory.

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