Recent trends in drug analysis using liquid-phase microextraction

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The last two decades, several different approaches to liquid-phase microextraction (LPME) have been developed. In all of these, analytes of interest are extracted from an aqueous sample and into a microliter volume (< 100 µL) of acceptor liquid. The acceptor liquid can be an aqueous solution, which can be analyzed directly by liquid chromatography (LC), mass spectrometry (MS), or capillary electrophoresis (CE). Alternatively, the acceptor liquid can be an organic solvent, which can be analyzed directly by gas chromatography (GC). Justification for the LPME research has been to (1) reduce the consumption of hazardous solvents (green chemistry), (2) increase pre-concentration, (3) eliminate the need for solvent evaporation and reconstitution, and (4) to enhance compatibility with micro-scale chromatography systems. Major LPME approaches include single-drop microextraction (SDME) [1], hollow-fiber liquid-phase microextraction (HF-LPME) [2], dispersive liquid-liquid microextraction (DLLME) [3], electromembrane extraction (EME) [4], and parallel artificial liquid membrane extraction (PALME) [5]. This keynote lecture focus on PALME and EME, which are highly efficient techniques for extraction of drugs and peptides from biological fluids (such as blood plasma and urine).

The lecture will give an overview of recent PALME and EME research. The lecture will show how the extraction chemistry can be tailored to basic drugs, acidic drugs, non-polar drugs, polar drugs, and peptides, based on (1) pH, (2) SLM composition, and (3) electrical field (EME). Examples of PALME and EME in 96-well and micro-chip systems will be given. Finally, the perspectives of both techniques will be discussed; PALME and EME are new approaches for sample preparation, they are easily combined with LC-MS, and may be interesting alternatives to traditional techniques such as protein precipitation, solid-phase extraction, and liquid-liquid extraction. In addition, as highlighted at the end of the lecture, EME may be developed into a highly specific extraction system, and therefore it may be combined successfully with very simple smartphone detection systems. Especially in the latter area, substantial research is expected in the future.

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[1] Jeannot M.A., Cantwell F.C., *Anal. Chem.* **1996**, *68*, 2236-2240.
[2] Pedersen-Bjergaard S., Rasmussen K.E., *Anal. Chem.* **1999**, *71*, 2650-2656.
[3] Rezaee M. *et al.*, *J. Chromatogr. A* **2006**, *1116*, 1-9.
[4] Pedersen-Bjergaard S., Rasmussen K.E., *J. Chromatogr. A* **2006**, *1109*, 183-190.
[5] Gjelstad A., Rasmussen K.E., Parmer M.P., Pedersen-Bjergaard S., *Bioanalysis* **2013**, *5*, 1377-1385.