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Negative electrospray ionization ion mobility spectrometry combined with paper-based molecular imprinted polymer disks: A novel approach for rapid target screening of trace organic compounds in water samples

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Abstract

A novel approach for the rapid target screening of water contaminants in trace concentrations was applied for the determination of the artificial sweetener Acesulfame-K, an accepted municipal wastewater indicator. This new method combines the selective enrichment of target analytes on paper-based molecular imprinted polymer disks and the subsequent analysis using a modified ion mobility spectrometer allowing negative electrospray ionization (ESI-IMS). Our developed ion mobility spectrometer permits the sensitive detection of Acesulfame with a limit of detection of 93 $\mu\text{g L}^{-1}$ within few seconds without sample separation. The use of modified paper filters for fast extraction and enrichment of the target substance from water samples results in a lower limit of detection of 0.19 $\mu\text{g L}^{-1}$. This procedure is directly applicable in the field, the transport and the proper storage of bulky sample bottles is avoided. The capability of the procedure developed was demonstrated by measuring real samples from a river at locations upstream and downstream of the effluent of the central municipal waste water treatment plant. The quantitative data of ion mobility measurements show a very good agreement with those obtained with the commonly used standard procedure (high performance liquid chromatography-tandem mass spectrometry).

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