Application of Tandem Mass Spectrometry in a Miniature Ion Trap MS: Measuring BTEX

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ABSTRACT

A miniaturized, lightweight, low-power consumption mass spectrometer capable of MS/MS has been developed for detecting volatile organic compounds in headspace.

Two inlet systems have been engineered for headspace analysis with the miniature instrument.

The instrument was able to detect the components of BTEX over a wide dynamic range (100 ppm - 500 ppb over membrane and 700 ppb - 25 ppb via the pre-concentrator inlet) with the enhanced selectivity of MS/MS.

INTRODUCTION

BTEX (benzene, toluene, ethylbenzene, and xylene) are volatile organic compounds (VOCs) that are abundant in ambient air. Two sample inlets are used for this application, a semi-permeable heated membrane inlet, and a novel pre-concentrator. The combination of inlets provides a larger dynamic range for chemical detection. The membrane inlet is used to detect concentrations over a wide dynamic range, while the pre-concentrator is used to detect concentrations in the lower parts of the range.

METHODS

All mass spectrometric analyses were performed on the MMS-1000 mass spectrometer: ionization was performed using electron ionization (EI) in the mass analyzer; and, in the ion trap, tandem mass spectrometry was performed with electron impact (EI) ionization. Data analyses were performed with the Conductor (1st Detect, Houston, TX) software package. Standard samples of each compound were prepared as described in EPA method 8015B in section 7.1.1. Five calibration standards were used: 0, 5, 10, 50, and 150 parts per billion (ppb). Sampling times were varied from 10 seconds to 2 minutes. The method detection limit (MDL) was 1 ppb for BTEX components.

RESULTS

The instrument was able to detect the components of BTEX over a wide dynamic range (100 ppm - 500 ppb over membrane and 700 ppb - 25 ppb via the pre-concentrator inlet) with the enhanced selectivity of MS/MS.

All samples were analyzed by both the membrane inlet and the pre-concentrator. The combination of inlets provides a larger dynamic range for chemical detection. The membrane inlet is used to detect concentrations over a wide dynamic range, while the pre-concentrator is used to detect concentrations in the lower parts of the range.

The MDL for BTEX components was 1 ppb for both inlets. The method detection limit (MDL) was 1 ppb for BTEX components.

The instrument was able to detect the components of BTEX over a wide dynamic range (100 ppm - 500 ppb over membrane and 700 ppb - 25 ppb via the pre-concentrator inlet) with the enhanced selectivity of MS/MS.

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REFERENCES