Electronic Supplementary Material (ESI) for Journal of Analytical Atomic Spectrometry

Supplementary Information

Technical Note

An automatic cryotrapping and cryofocussing system for parallel ICP-MS and EI-MS detection of volatile arsenic compounds in gaseous samples

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(8 pages, 9 figures)

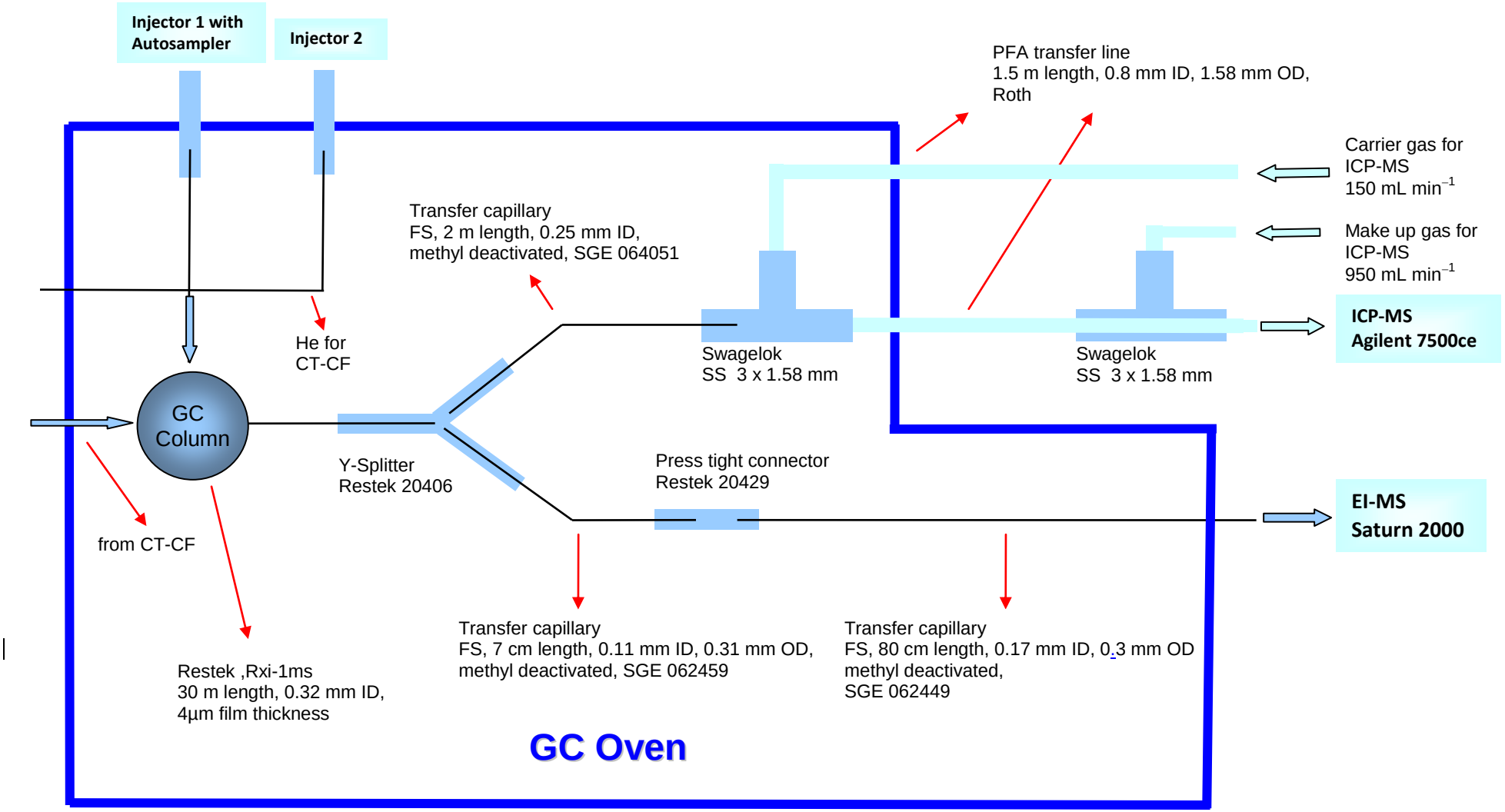

Fig. S1. Detailed schematic presentation of the connections between the GC analytical column and ICP-MS and EI-MS constructed in GC oven.

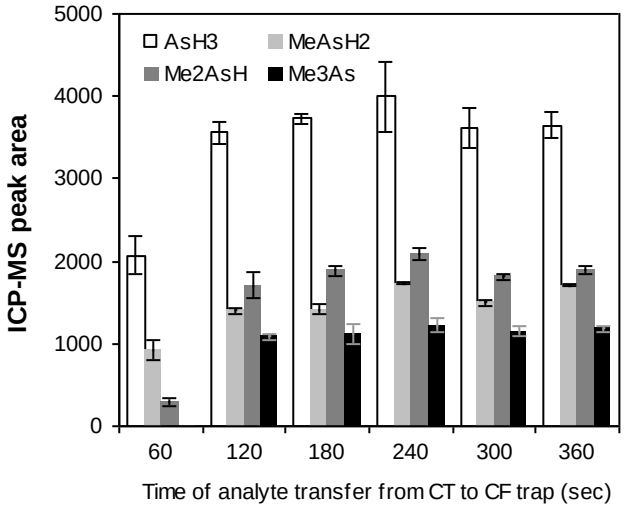

Fig. S2. ICP-MS based peak areas of of different arsine (AsH_3), monomethylarsine ($MeAsH_2$), dimethylarsine (Me_2AsH) and trimethylarsine (Me_3As) at different time length for transfer from the cryotrapping (CT) trap to the cryofocussing (CF) trap. The experimental results show more than 120 seconds is sufficient for a complete transfer of As compounds from the CT trap to the CF trap. The CT unit was consist of silcosteel tubing (65 cm length, 5.33 mm ID, 6.35 mm OD, Restek, USA) using liquid N_2 as the coolant. Heating rate was 11 watt × 360 sec. Sample trapping rate was 200 mL min^{-1}. Each arsine compounds containing 100 pg As was prepared in 1000 mL N_2. Mean values and standard deviations of triplicates are shown.

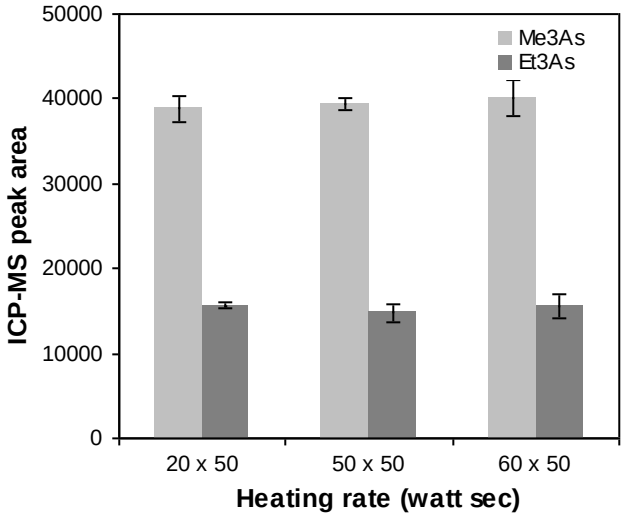

Fig. S3. ICP-MS based peak areas of trimethylarsine (Me_3As) and triethylarsine (Et_3As) at different heating rates of cryofocussing trap (CF). The results indicate that CF heating rate did not influence the recovery of As compounds significantly. The cryotrapping (CT) unit was consist of silcosteel tubing (65 cm length, 5.33 mm ID, 6.35 mm OD, Restek, USA) using liquid N_2 as the coolant. CT heating rate was 11.3 watt × 360 seconds. Sample trapping rate was 200 mL min^{-1}. 1 ng As of each arsine compounds was prepared in 1000 mL N_2. Mean values and standard deviations of triplicates are shown.

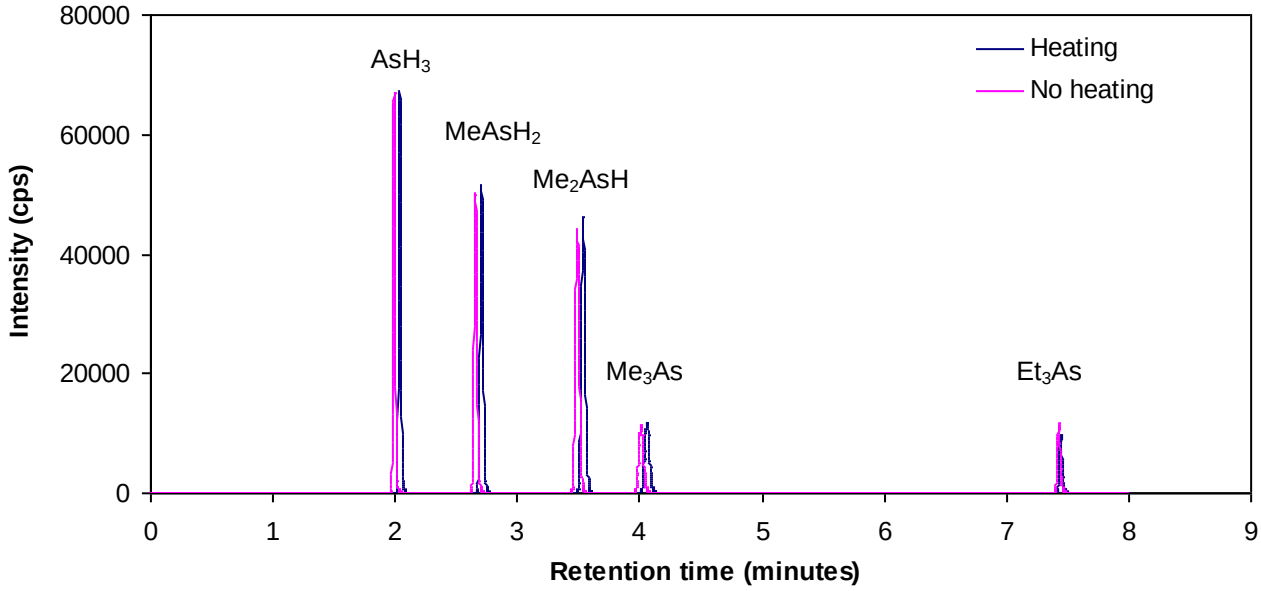

Fig. S4. ICP-MS chromatograms of arsine (AsH_3), monomethylarsine ($MeAsH_2$), dimethylarsine (Me_2AsH), trimethylarsine (Me_3As) and triethylarsine (Et_3As) with (at 100°C) and without heating transfer line show no significant effect of heating on peak width. 1 ng As of each arsine compounds was prepared in 1000 mL N_2.

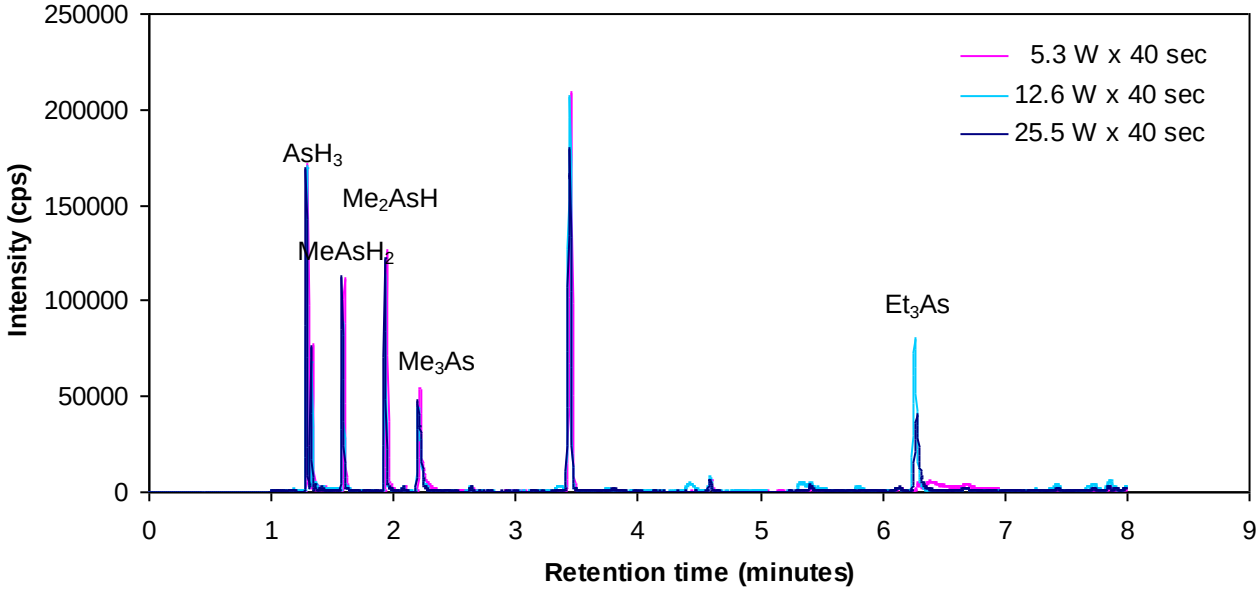

Fig. S5. EI-MS chromatograms of arsine (AsH_3), monomethylarsine ($MeAsH_2$), dimethylarsine (Me_2AsH), trimethylarsine (Me_3As) and triethylarsine (Et_3As) show the influence of CT heating rates on Et_3As analysis. The chromatographic peak of Et_3As became smaller at the higher heating rates (25.5 W × 40 seconds) and deformed at the lower CT heating rate (5.3 W × 40 seconds). 10 ng As of AsH_3, $MeAsH_2$, Me_2AsH and Me_3As and 11.3 ng of Et_3As was prepared in 1000 mL N_2.

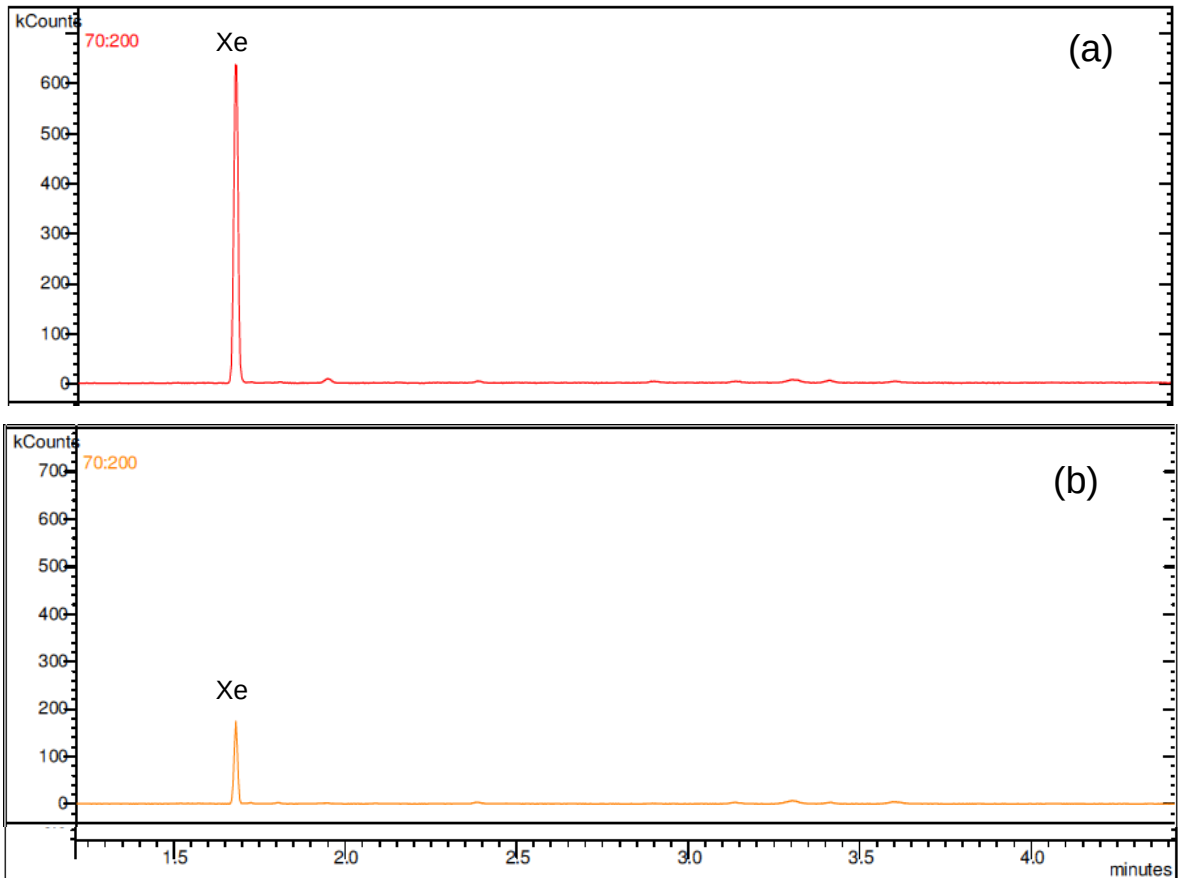

Fig. S6. EI-MS chromatograms show the presence of Xe in (a) N_2 used throughout this study and (b) in the air.

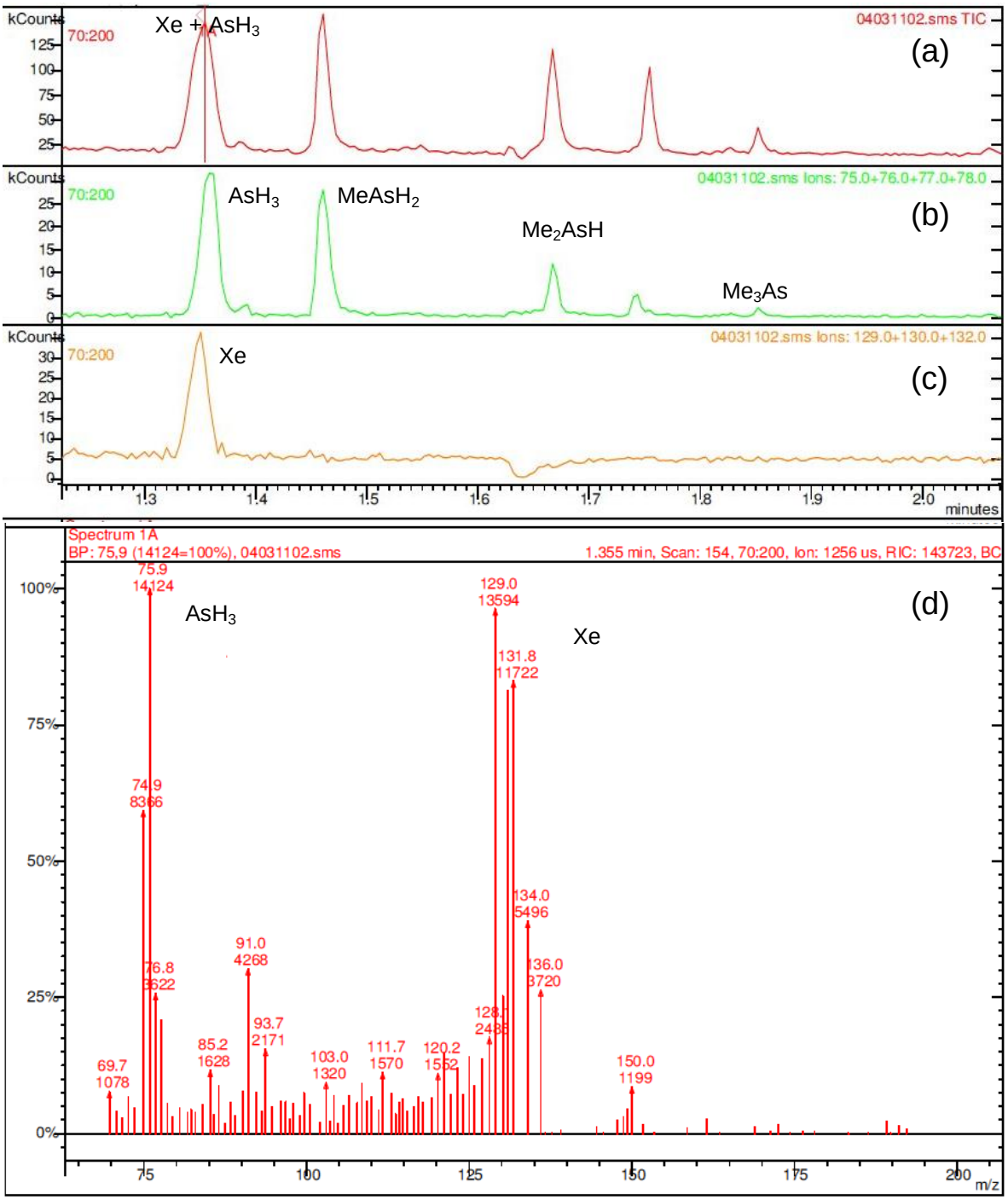

Fig. S7. EI-MS chromatogram of Xe, arsine (AsH_3), monomethylarsine ($MeAsH_2$), dimethylarsine (Me_2AsH) and trimethylarsine (Me_3As) with (a) total ion current, (b) arsenic, (c) Xe (d) mass spectrum using an analytical column with 0.25 µm film thick. The mass spectrum shows that the peak eluting at 1.35 minutes contains both AsH_3 and Xe.

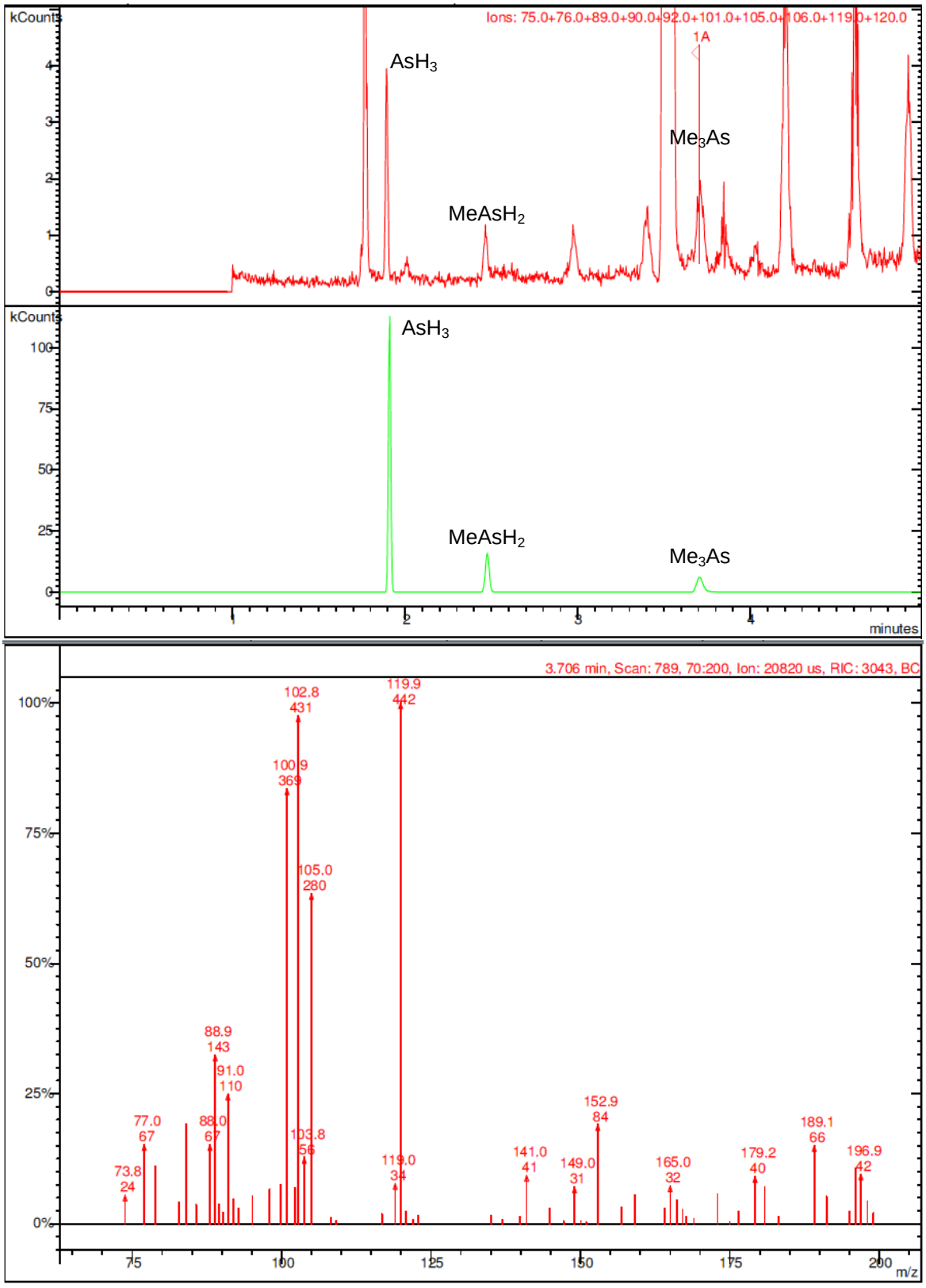

Fig. S8. (a) EI-MS and (b) ICP-MS chromatograms of arsine (AsH_3), monomethylarsine ($MeAsH_2$), dimethylarsine (Me_2AsH) and trimethylarsine (Me_3As) in headspace of wetland soil incubation at 15°C for 9 days without additional spiking of As(III) (250 µg As) (see Table 3). The incubation was achieved with 60 g of Histosol (sampled in Fichtelgebirge, NE-Bavaria, Germany) with water content of 93% w/w overflooded with 100 mL artifical rainwater. (c) The corresponding mass spectrum of Me_3As.

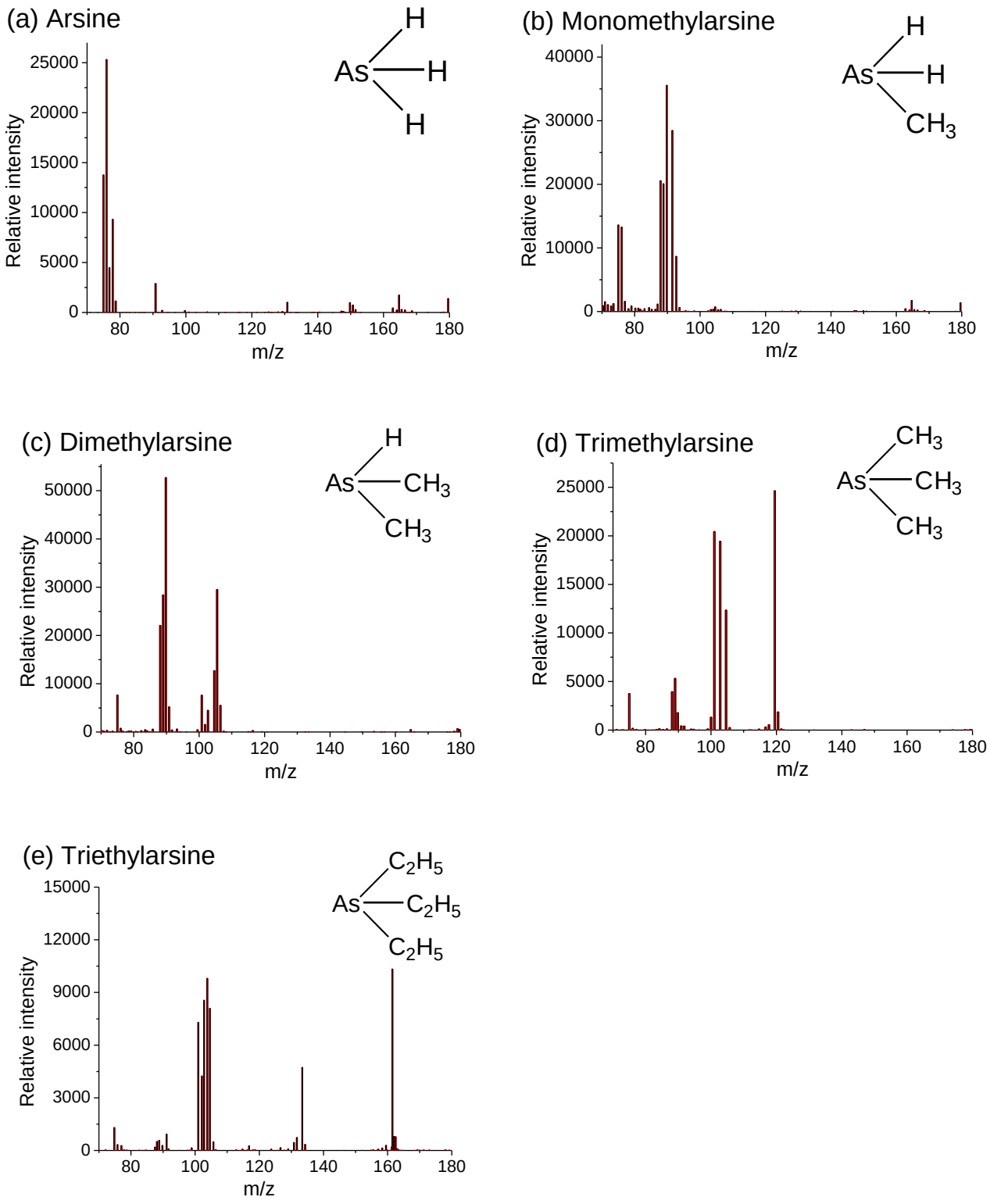

Fig. S9. EI-MS spectra of (a) arsine, (b), monomethylarsine, (c) dimethylarsine (d), trimethylarsine (from Fig. 4) and (e) triethylarsine (from EI-MS chromatogram of the measurement in ESI, Fig. S5†).