BUNSEKI KAGAKU

Print ISSN : 0525-1931

Gas chromatography mass spectrometry system with nitrogen as a carrier gas

Takeshi MURATA

Author information

Keywords: nitrogen as a carrier gas of GC/MS, coupling of fused silica capillary gas chromatographic column to mass spectrometer, electron impact ionization mass spectrometry

JOURNAL FREE ACCESS

1986 Volume 35 Issue 4 Pages 339-343

DOI https://doi.org/10.2116/bunsekikagaku.35.4_339

Details

Abstract

The principle of the jet separators used in gas chromatography mass spectrometry (GC/MS) combined system requires that helium should be used as a carrier gas because it has a small mass number. With helium as a carrier gas, a GC/MS system ensures its highest performance, but helium has the drawbacks that it is costly and hardly available in some countries. A series of investigations has been carried out to see if nitrogen can be used as a substitute for helium. Though the higher molecular weight(large molecular radius) of nitrogen than that of helium caused some problems, practically satisfactory results could be obtained if suitable operational parameters were selected. The GC was directly connected to the MS by using a fused silica capillary column. The system was equipped with an EI/CI dual ion source of a differential evacuation type. The electron impact energy was a set to 200 eV so that detecting sensitivity might not lower even if nitrogen was used as the carrier gas. The sample was a methyl caprate solution, which was introduced via the SPL-G9 splitless sample injector. The column inlet pressure, measured with the pressure gauge of the SPL-G9, was raised from 0.5 kg/cm^2 to 2.3 kg/cm^2 in step, and the pressure of ion source and the total ion intensities in these steps were investigated. When helium was used, pressure of ion source was found to change from 0.5×10^{-5} Torr to 2.5×10^{-5} Torr, while in the case of nitrogen, it changed from 6×10^{-5} Torr to 14×10^{-5} Torr. This low vacuum resulting in a low sensitivity could be enhanced, however, by 34 times by raising electron impact energy from 70 eV to 200 eV. In short, the sensitivity for nitrogen carrier gas could be raised to

1/34/4 times than ensured for helium carrier gas, by a suitable selection of MS parameters. When nitrogen was used as the carrier gas, a high flow rate could not be allowed ; otherwise it would result in longer retention time, low resolution, and/or asymmetry of peaks. Putting these data together, the GC/MS with nitrogen carrier gas provided a sensitivity 1/71/10 lower than ensured for helium carrier gas.This sensitivity is satisfactory enough except when minor components are to be determined.

References (9)

1) R. Teranishi, R. G. Buttery, W. H. Mcfadden, T. R. Mon, J. Wasserman : Anal. Chem., 36, 1509 (1964).

2) N. Sellier, G. Guiochon : J. Chromatogr. Sci., 8,147 (1970).

3) W. Henderson, G. Steel : Anal. Chem., 44, 2302 (1972).

4) J. F. K. Huber, E. Matisova, E. Kenndler : Anal. Chem., 54, 1297 (1982).

5) W. G. Koller, G. Tressol : HRC CC, J. High Resolut. Chromatogr. Chromatogr. Commun., 3,359 (1980).

6) T. E. Jensen, R. Raminsky, B. D. McVeety, T. J. Wozniak, R. A. Hites : Anal. Chem., 54, 2388 (1982).

7) M. S. B. Munson, F. H. Field : J. Am. Chem.

8) B. Munson : Anal. Chem., 43, 13 (1971).

9) B. L. Jelus, B. Munson, C. Fenselau : Biomed. Mass Spectrom., 1, 96 (1974).

Cited by (2)

Shizuka Saito-Shida, Mari Nagata, Satoru Nemoto, et al. Multi-residue determination of pesticides in green tea by gas chromatography-tandem mass spectrometry with atmospheric pressure chemical ionisation using nitrogen as the carrier gas. Food Additives & Contaminants Part A. 2021, Vol.38, No.1, p.125.

Ai Shiono, Atsushi Watanabe, Chuichi Watanabe, et al. Evolved gas analysis-mass spectrometry in an oxidative atmosphere using a temperature-programmable furnace-type pyrolyzer. Journal of Analytical and Applied Pyrolysis. 2021, Vol.156, p.105122.

Edited and published by The Japan Society for Analytical Chemistry
Production services Sobun Printing Co., Ltd.