Gas Analysis
Application Note 261

MS
Detection of Low Levels of Organic Species in Seawater

Summary

In this particular experiment, the sensitivity of a Hiden Quadrupole Mass Spectrometer (QMS) to dimethylsulphide was measured

Manufactured in England by:

HIDEN ANALYTICAL LTD
420 Europa Boulevard, Warrington, WA5 7UN, England
t: +44 (0) 1925 445225 f: +44 (0) 1925 416518
e: info@hiden.co.uk w: www.HidenAnalytical.com

Dimethylsulphide (DMS) - chemical formula CH_3SCH_3 - is a naturally produced trace substance, evolved from certain marine micro organisms, such as plankton. Detection of fluctuations in the DMS concentration in seawater therefore gives important information about the abundance of these life forms.

DMS is a simple chemical. It is volatile and dissolves easily in aqueous solution. A summary of the main peaks of the cracking pattern from the NIST database is seen in Table 1.

Mass/amu	Intensity / %	Ionic Species
62	99.9	$CH_3SCH_3^+$
47	95.4	CH_3S^+
45	40.8	CHS^+
46	36.1	CH_2S^+
61	33.3	$CH_3SCH_2^+$
35	32.2	SH_3^+
27	20.7	CH_2CH^+

Table 1: Summary of cracking pattern for DMS

Research carried out by Philippe D. Tortell of the Dept. of Botany at the University of British Columbia, Canada, has shown that very low levels of detection can be achieved using a quadrupole mass spectrometer. To conduct these experiments, a Hiden HPR-40 QMS system was used. The system is specifically designed for the detection of volatile species (such as DMS) dissolved in aqueous sample media. Other analysis application areas include soil analysis, fermentation cultures and water quality monitoring.

The HPR-40 semi-permeable membrane inlet allows dissolved species to be analysed, whilst preventing the bulk liquid to enter the QMS vacuum chamber.

The membrane inlet permeability to volatile organic species, compared to non-volatile inorganic species, enhances the systems detection capability for volatile organic species including DMS. In the University of Columbia experiment, successive dilution was used to reduce the concentration of DMS in the sample. The strongest peak at mass 62 amu was used to measure the concentration of DMS.

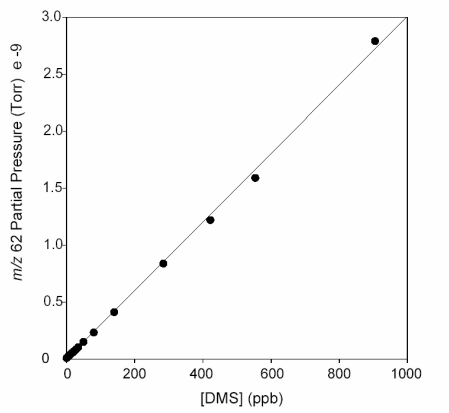

Figure 1: Plot of 62 amu Partial Pressure versus ppb concentration of DMS in seawater

As can be seen in Figure 1, the linear relationship gives a high degree of confidence regarding the detection levels. Further experiments could extend this detection level down to lower partial pressures. The detection limit of the spectrometer is 2 x 10-14 Torr.

Figure 2 the data points in the parts per billion (ppb) range, illustrate remarkable linearity.

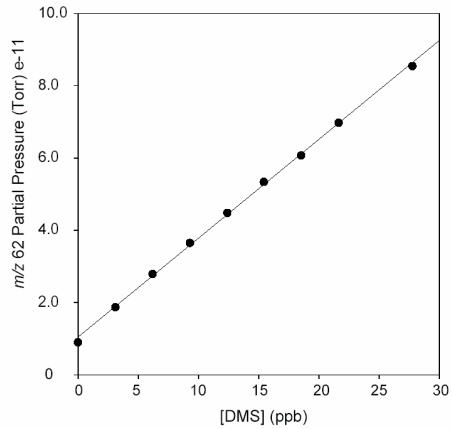

Figure 2: Plot of 62 amu Partial Pressure versus lower ppb concentration of DMS in seawater