Atmospheric Mercury Species near the Gulf of Trieste, N Adriatic

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Abstract: First measurement results of the atmospheric mercury species total gaseous elemental mercury, total particulate mercury and reactive gaseous mercury near the Gulf of Trieste, N. Adriatic are presented.

Key words: atmospheric mercury, TGM, TPM, RGM, the Gulf of Trieste

INTRODUCTION

Mercury is an atmospheric pollutant with a complex biogeochemical cycle including different processes such as oxidation/reduction, deposition and re-emission from natural and anthropogenic sources (SCHROEDER AND MUNTHE, 1998; WÄNGBERG ET AL., 2003). Atmospheric mercury exists in three different forms: gaseous elemental mercury (Hg^0), divalent reactive gaseous mercury (RGM) and that associated with particulate matter (TPM). RGM and TPM are more readily deposited on local to regional scales through wet and dry deposition mechanisms. This presentation is concerned with the results from two weeks measuring campaigns made in the Gulf of Trieste, N Adriatic in November 2003 and January 2004. The research was performed within the on-going EU-project MERCYMS (An integrated approach to assess the mercury cycling in the Mediterranean Basin) where part of the project is related to the investigation of atmospheric mercury species in different marine background locations near the Mediterranean Sea. The Gulf of Trieste is the most mercury contaminated area in the Mediterranean Sea due to high mercury inputs from the River Isonzo whose tributary the River Idrijca has been draining the mercury mining area of Idrija for nearly 500 years. These are the first measurements of atmospheric mercury species in this area (Figure 1).

The results of this study should help to understand the complete process of mercury cycling in this environment, including the complex chemistry of mercury in the atmosphere.

EXPERIMENTAL

Total gaseous mercury (TGM) refers to Hg^0 and small contributions from other gaseous Hg species that may also be trapped by the sampler and detected as Hg^0. The concentration of TGM was determined using the manual method based on gold trap amalgamation and detection by CV AFS (BLOOM AND FITZGERALD, 1988). The airflow was normally > 0.5 L min^{-1}. With a 24 h sampling time the detection limit was typically 0.01 ng m^{-3}. Manual annular denuder methodology was applied to provide ambient RGM measure-

Figure 1. Sampling location in the Gulf of Trieste, N Adriatic.

ments (LANDIS ET AL., 2002). RGM was collected onto KCl-coated quartz annular denuders and then thermally decomposed (500 °C) and quantified as Hg^0 using the standard CV AFS procedure. TPM was determined with a new method based on the AES Minitrap developed by LU ET AL. (1998) which was later patented under the name AESminiSamplR™ (LU ET AL., 2003). The sampling device serves as both particulate trap and pyrolyzer for airborne particulate mercury species. The air sampling flow rate was ~10 L min^{-1} and the detection limit for a 24 h sample was < 2 pg m^{-3} for both RGM and TPM. The precision of measurements was estimated to be ± 10 % calculated as 1 S.D.

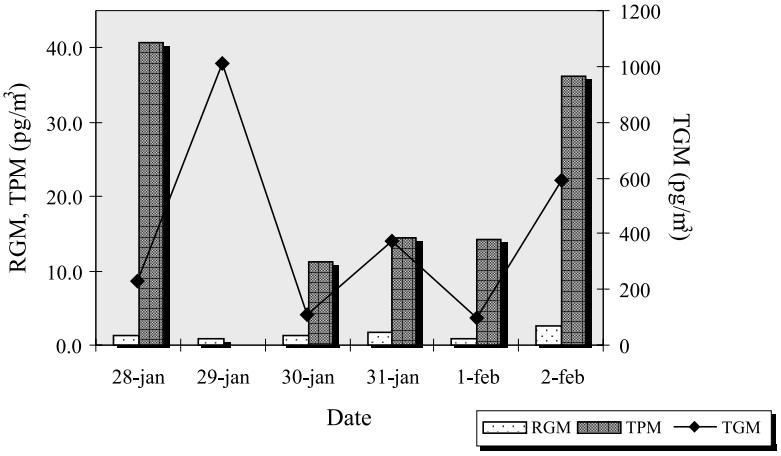

Figure 2. TGM, TPM and RGM concentrations during the sampling period in January, 2004.

RESULTS AND DISCUSSION

The concentrations of RGM were low, ranging between 3.0 and 5.0 pg m^{-3} in November 2003. Even lower RGM values were observed in January 2004 with an average value of 1.3 ± 0.6 pg m^{-3}. The concentrations of TGM, TPM and RGM during the sampling period performed in January 2004 are shown graphically in Figure 2.

TGM concentrations were between 0.11 and 1.05 ng m^{-3}, reflecting background conditions. TPM concentrations were in the range 11.7-42.7 pg m^{-3} representing up to 17 % of the TGM. Fairly low RGM concentrations corresponding to about 1 % of the TGM in the atmosphere were found. These data are comparable with the concentrations determined in other coastal sea locations near the Mediterranean and fall in the concentration range typical of ambient air in Europe (PIRRONE ET AL., 2001). However, on the basis of these first measurements no conclusions can be obtained and further investigation is needed to understand the observed concentration variations in atmospheric mercury species.

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