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Determination of atmospheric iodine species using a diffusion denuder and GC-MS technique

Ru-Jin Huang, Sen-Chao Lai, Marc-Christopher Reinnig,
Jörg Warnke and Thorsten Hoffmann

Institute of Inorganic and Analytical Chemistry, University of Mainz, Duesbergweg 10-14,
D-55128 Mainz, Germany, t.hoffmann@uni-mainz.de

Over the past two decades the atmospheric impact of iodine chemistry has been receiving increasing scientific attention and still is a growing research field of interest due to the potential atmospheric significance of iodine photochemistry. More recently, interest in marine atmospheric iodine chemistry has been greatly stimulated by the observation of new particle formation events in the marine boundary layer (MBL) and the suggestion that molecular iodine is likely the most important precursor for new particle formation and the dominant source of reactive iodine in the coastal MBL (1,2). Although some progress has been made, a number of uncertainties in the sources, sinks, kinetics parameters and recycling of iodine remained and the identification and quantitative analysis of some key reactive iodine species still is a challenging analytical problem.

In this study a diffusion denuder system capable to preconcentrate and quantitative analyse gaseous molecular iodine (I_2) and iodine monochloride (ICl), which are two key species in the iodine atmospheric chemistry, was developed. 1,3,5-trimethoxybenzene and α-cyclodextrins/I^- proved suitable for the collection of gaseous ICl and I_2, respectively. The respective experimental collection efficiency was 98.2% and 99.4% for I_2 and ICl at the gas flow rate 300 mL min^{-1}. The experimental efficiencies agreed well with the theoretical values for both I_2 and ICl for gas flow rates from 300 to 1800 mL min^{-1}. The operation of both I_2- and ICl-denuder was independent of relative humidity and storage periods (at least 2 weeks prior to and after sampling, respectively). Thus, it provides a practical, reliable and convenient protocol for the quantitative information on the sources strength in both open sea and coastal areas and the understanding of the biological and chemical mechanism of their release.

References

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