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Development of traceable and accurate dimethyl sulphide standard gas mixtures for global atmospheric monitoring

Mi Eon Kim, Ji Hwan Kang, Yong Doo Kim, and Sangil Lee
Korea Research Institute of Standards and Science, Center for Gas Analysis, Korea, Republic Of (slee@kriss.re.kr)

Dimethyl sulphide (DMS) plays important roles in atmospheric chemistry and climate change. Ambient DMS is monitored in global network and reported at nmol/mol levels. It is important to develop traceable and accurate DMS standards at ambient levels for tracking the long-term trend and understanding the roles of DMS in the atmosphere. In this study, two independent methods are developed to produce PSMs at mole fractions less than 12 nmol/mol. A dynamic dilution method, which is calibrated with methane PSMs, can generate DMS gas mixtures between ∼0.4 and ∼12 nmol/mol with relative expanded uncertainties of less than 2%. After the detailed evaluation of adsorption loss on the internal surface of gas cylinders, PSMs in a specific cylinder are developed by gravimetric method (static dilution) with relative expanded uncertainties of less than 0.4%. The long-term stability of DMS PSMs in cylinders are evaluated by using a stable internal standard and comparing with dynamically generated DMS gas mixtures. Results show that DMS PSM at 7 nmol/mol is projected to be stable for more than 60 months (using a stable internal standard) and DMS PSMs at 2-7 nmol/mol levels are stable for 10 months within a relative expanded uncertainty of less than 3%. However, DMS PSM at 0.5 nmol/mol is not stable enough after 10 months as the analytically determined mole fraction is 5.4% less than its gravimetrically determined one.