NH3-Source

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Introduction:

The NH_3 source is an instrument to continuously produce pure NH_3 mixtures in humidified air with a flow rate of 0.5 - 2 l/min. NH_3 formation is based on the reaction of ammonium (NH_4^+) with NaOH in diluted aqueous solution in a temperature controlled stripping coil similar to a HONO source developed by *Kleffmann et al.* showing fast time response of a few minutes (see Fig. 1). The NH_3 concentration is controlled by the known Henry's law constant and the instrument's parameter (NH_4^+ and NaOH concentrations, gas and liquid flow rates, pH of the mixed solutions, temperature of the stripping coil).

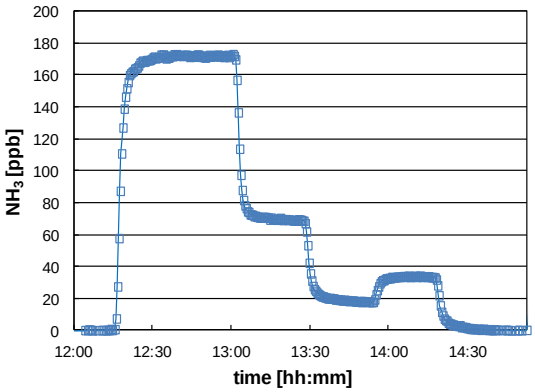

Fig.1: Example of varying the NH_3 concentration by changing the NH_4^+ concentration. Each data point reflects a 30 s period.

The time response of the NH_3-LOPAP instrument used here to measure NH_3 was 5 min.

The source produces pure NH_3/air mixtures humidified at the temperature of the stripping coil (dewpoint), which can be varied in the range 5-20°C. The NH_3 gas phase concentration (2-600 ppbv) is linearly correlated to the NH_4^+ liquid phase concentration used and thus, the NH_3 concentrations can be easily adjusted (see Fig. 2). The precision of the source is typically ca. ±1 % (see Figure 3).

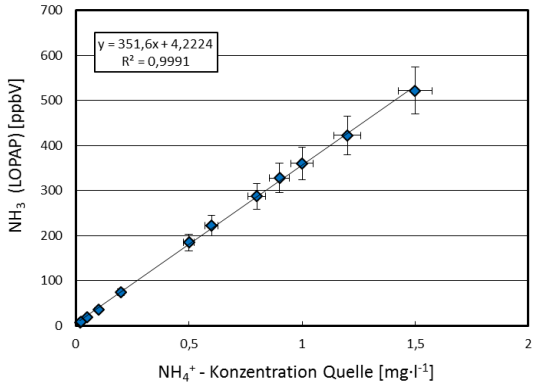

Fig. 2: NH_3 concentration of the NH_3 source as a function of the NH_4^+ concentration used.

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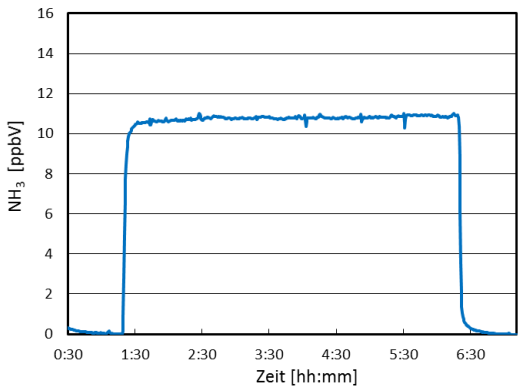

Fig. 3: Precision of the NH_3 source. Noise may also be caused by the noise of the NH_3-LOPAP instrument used to measure NH_3 (1 % precision). Thus, the given precision of 1 % of the NH_3 source should be considered as an upper limit.

While the source produces stable and pure NH_3, the output of the source is depending on several variables (NH_4^+ and NaOH concentrations, gas and liquid flow rates, pH of the mixed solutions, temperature of the stripping coil). The instrument is provided by a calculation sheet by which the output of the source can be absolutely calculated when these variables are measured. The estimated accuracy of this calculation is ca. 10 %, which is mainly limited by the uncertainties in the temperature dependent Henry's law constant of NH_3 in alkaline solutions. Thus, the source can be also used for approximate calibration of NH_3 instruments where simple calibration methods are not available.

References:

Kleffmann, J., T. Benter, P. Wiesen: Heterogeneous Reaction of Nitric Acid with Nitric Oxide on Glass Surfaces under Simulated Atmospheric Conditions, *J. Phys. Chem. A*, 2004, **108**, 5793-5799.

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