Abstract: Estimating the magnitude of ammonia (NH₃) volatilization loss under different conditions is important for proper fertilizer management. Both of the current field techniques used to trap volatilized NH₃ from soils amended with various N sources, and the techniques for the quantitative determination of NH₃ in a sample, have their limitations. This study is designed to evaluate the effectiveness of (i) two absorbents (Phosphoric or Oxalic) in trapping volatilized NH₃, (ii) two extractants (KCl or de-ionized water) in removing absorbed NH₄, and (iii) two analytical procedures (Flow Injection Analyzer vs. Ion Chromatography) in determining the concentration of NH₃ in extracts quantitatively, in most widely used passive flux methods. This evaluation was repeated under laboratory conditions, with two treatments: (i) acidified sponge treated with ammogramic fertilizer N sources (Urea, Ammonium sulfate, Ammonium chloride along with an unamended control) and manure N sources (Chicken, Cattle, and Swine manure along with an unamended control) to identify the best combination of procedures to develop a cost effective method for determining volatilized NH₃. This presentation focuses on step-by-step evaluations of results obtained from several laboratory studies, so as to develop an effective method for field and laboratory scale determination of volatilized NH₃. Per our preliminary evaluation, the best combination of procedures would be to use 3% Oxalic acid in acetone, to trap NH₃, de-ionized water, to extract the trapped NH₃ and Ion Chromatography, to determine the concentration of NH₄-N in extract. This promises to reduce chemicals, cost, and labor, without sacrificing accuracy of measurement of volatilized NH₃.

Introduction:

1. Estimating the magnitude of ammonia (NH₃) volatilization loss under different conditions is important for proper fertilizer management.
2. Current field techniques to trap volatilized NH₃ from soils amended with various N sources and techniques used for the quantitative determination of NH₃ drain substantial financial resources.
3. This justifies the need to re-evaluate current methods, prior to the development of cost effective field and laboratory methods to trap and determine the volatilized NH₃ quantitatively and accurately.
4. Therefore, the current study was designed with the following objectives:

- To evaluate the effectiveness of the most commonly used
  (i) two absorbents (Phosphoric and Oxalic) in trapping volatilized NH₃
  (ii) two extractants (KCl vs. H₂O) in removing absorbed NH₄ and
  (iii) two analytical techniques (Auto Analyzer vs. Ion Chromatography) in determining the concentration of NH₃ in extracts quantitatively in most widely used passive flux methods.

Materials and Methods Used:

- Soils:
  1) Candler fine sand (pH = 6.8) – Lake Alfred, FL. [CFS]
  2) Ogeechee loamy sand (pH = 5.2) – Savannah, GA. [OLS]

- A. Treatment set up with inorganic fertilizer N sources and rates (0, 200 kg ha⁻¹):
  - N sources
    - Treatment ID: Amt of N (mg) per 100 g of soil
    - Control [T1]: 0.0
    - Urea [T2]: 57.0
    - Ammonium sulfate [T3]: 42.0
    - Ammonium nitrate [T4]: 25.4
    - Ammonium chloride [T5]: 34.0

- B. Treatment set up with organic manure N sources and rates (0, 11.2 Mg ha⁻¹):
  - Control [T1]: Chicken manure [T2]: Cattle manure [T3]: and Swine manure [T4].

Incubation study was initiated by placing 100 g of Candler fine sand (pH = 6.8) from Lake Alfred, Florida, and Ogeechee loamy sand from Savannah, Georgia (pH = 5.2), in 5 cm diameter (1.2 cm) smooth jars. Soil samples in jar were amended as per base rates for 0, 200 kg ha⁻¹ in experiment 1. Experiment 2 was conducted with animal manures (chicken, cattle, and swine) at the application rate of 11.2 Mg ha⁻¹.

Results and Discussion: Cumulative NH₃ emission loss from fertilizer N sources

- Cumulative emission loss from CFS vs. Water Extract
- Cumulative emission loss from OLS

Relationship between Conc. of NH₄-N by IC & FIA

Y = -0.0019 + 0.97x

Comparison of cumulative NH₃ emission losses from fertilizer and manure N sources

- Evaluation of Ion Chromatograph and Flow Injection Analyzer for the determination of NH₄-N
- Commercial Labs
- Concentrations of NH₄-N in de-ionized water extract measured by FIA technique and IC technique revealed that concentrates of NH₄-N are highly reproducible irrespective of absorbent types used in this study.

Conclusion: Ammonia emission trend was in the following order: CA (NH₂CO) > (NH₄)₂ SO₄ > NH₄NO₃ > NH₄Cl > Control.

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