SUGARCANE CROP AS EMISSION SOURCE OF REACTIVE NITROGEN COMPOUNDS AND ITS ROLE IN THE ENVIRONMENT

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INTRODUCTION

- Brazil is the major producer of sugar and ethanol biofuel in the world
- Sugarcane is one of the most important crops for brazilian economy
- High productivities requires high amounts of **FERTILIZER**

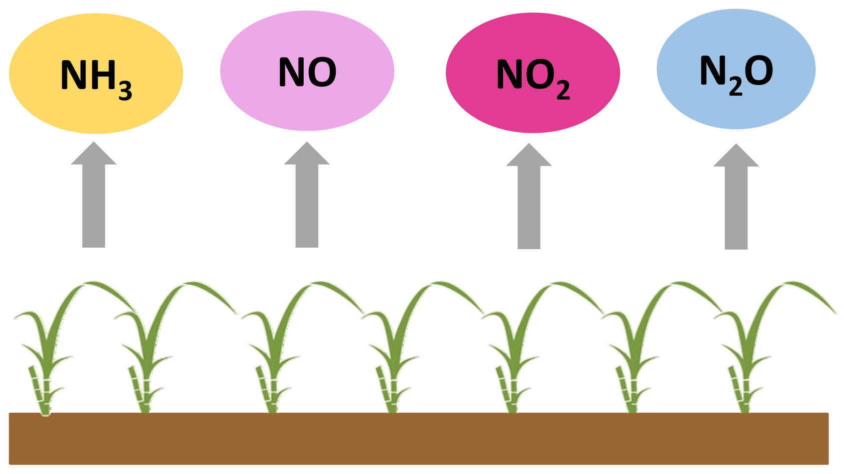
NITROGEN FERTILIZER

The plant is not capable to take all the nitrogen applied

Part of the fertilizer is available to the soil, water and air (by volatilization)

CONSEQUENTLY:

- Occurs a massive increase of reactive nitrogen emitted to the environment
- The excess of reactive nitrogen cause several environmental problems
- N_2O is a greehouse gas and has being studied in sugarcane crops
- Currently, few information regarding other nitrogen compounds emission such as NO, NO_2 and NH_3 is available



In this way

The development of simple and portable methodologies wich enable to perform samplings in field and the determination of concentrations of NO, NO_2 and NH_3 emitted from fertilized soils are required

The monitoring of such emissions will improve the knowledge about the impacts of sugarcane crops to the environment

OBJECTIVE

Development of analytical methodologies for determination of concentration of reactive nitrogen compounds NH_3, NO and NO_2 by samplings in sugarcane crops and perform the monitoring of such species during the cultivation stages.

EXPERIMENTAL

Passive samplers

- Advantages: low cost, simple, portable, do not require power source
- Useful for determination of an avarage concentration in a certain period of time
- Suitable for installation and samplings in field

Construction of passive samplers
Commercial monitors polyestyrene
Inside the monitors: celulose filters coated with absorbent solution specific to each analite (oxalic acid 5% (w/w) for NH_3 and triethanolamine 11% (v/v) for NO_2) + Teflon membranes

Sampling period
Installation of the passive samplers in a chosen location

Analysis
1) Extraction of the analites present in the filters (water for NH_3 and methanol for NO_2)
2) Add reagents specific for colorimetric reaction (Berthelot and Griess-Saltzman)
3) UV-Vis Measurements

Determination of concentration
Calculations of the amount of analite present in the filters by the intensity of color obtained in the reaction
Determination of analite concentration by relation with Fick's Law of diffusion

Optimization studies

RESULTS AND DISCUSSION

1) Analytical Curve

Analite	Linear fit equation	R^2	Limit of quantification
NH_3	Abs = -0,0002531 + 0,01289 [NH_3]	0,9991	1,0 µmol L^{-1}
NO_2	Abs = 0,00619 + 0,02868 [NO_2]	0,9997	0,3 µmol L^{-1}

It was obtained a linear behavior between the analite concentration and the absorbance of the solutions. The analytical curve was constructed in triplicate, with the relative standard deviation of all points below 10%, which demonstrate the good precision of the method.

2) Repeatability

15 samplers was prepared and installed outdoor where they sampling for 24 hours. After the analysis and determinations of concentrations it was obtained good precision and concentrations consistents with the expected for the day of sampling.

Analite	Mean concentration	Relative standard deviation
NH_3	25,1±0,749	10,8%
NO_2	2,23±0,241	3,0%

3) Stability of storage

The passive sampler for NO_2 was tested regarding its stability of response obtained after different time of storage after sampling. It was obtained stability of the measured signal after 60 days of sampling, with relative standard deviation of only 7,3% in the concentraton in the period. The passive sampler for NH_3 is still under evaluation in this criterion.

CONCLUSION

The passive samplers for NH_3 and NO_2 presented satisfactory performance in the repeatability study with relative standard deviation of 10,8% and 3,0%, respectively, by the measurements of 15 replicates and variations of only 7,3% of concentration measured over 60 days of storage for NO_2. The passive sampler for NH_3 is still being evaluated in this criterion. Based on the results, the developed passive samplers were suitable for determination of NH_3 and NO_2 concentrations in the environment and present the necessary simplicity to enable their installation in sugarcane crops.

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