Development of a microfluidic circuit “microreactor” to Atmospheric Analyses

A. A. Gomes¹, J. O. W. V. Bustillos², A. S. Vianna JR², E. Landulfo¹, W. de Rossi¹

¹Center of Lasers and Applications (CLA), Institute of Energetic and Nuclear Research (IPEN), Avda. Lineu Prestes 2242, 05508-000, Cidade Universitária – São Paulo (Brazil)
²Center of Chemistry and Environment (CQMA), Institute of Energetic and Nuclear Research (IPEN), Avda. Lineu Prestes 2242, 05508-000, Cidade Universitária – São Paulo (Brazil)

Introduction

The growing production of goods and services, as well as, the large volume of vehicles in urban areas have generated an impact on the atmosphere. These contaminations bring several problems to human health, regarding inflammations of the respiratory tract and the increase of the cases of diseases related to these types of problems (Braga et al., 2011). One factor that influences the air quality is the formation of photochemical smog in the tropospheric layer. The Glyoxal (GLY) and Methylglyoxal (MGLY) have recently attracted attention to several types of studies, as they are a major contributor to the formation of Secondary Organic Aerosol and a major precursor to the formation of tropospheric ozone at a global level, due to photolysis and photo-oxidation processes that (Zarzana et al., 2017). This research aims to study and develop a microfluidic circuit (micro-reactor) for detection and quantification of GLY and MGLY in laboratory scale.

Instrumentation and Methodology

First results

New Femtosecond laser workstation applied in the process of microreactor fabrication

Conclusion

The proposed methodology, until this moment, has generated satisfactory results, which propitiate our evolution in this research field, and consequently in the future the realization of the following points:
- Performing the derivatization reaction;
- Performing the comparison between the proposed microreactor and commercial one;
- Validation of parameters and measurement of GLY and MGLY in situ;

Acknowledgements

This study was financed in part by the Coordenação de Aperfeiçoamento de Pessoal de Nível Superior - Brasil (CAPES) - Finance Code: 001/2014-USP TECNOCROMO Nuclear.

References

Figures

Design of P-ASAR microreactor and its characteristics

GLY and MGLY proposal flowchart and result sample

Joule effect 380°C

Heat 61°C–200°C

Ethyl ether dry ice

Cold trap -80°C

Water collector

Pump vacuum ~ 5.33 kPa

Sampled

GLY and MGLY detection

Mass Spectrum

Temperature control (Cold -5°C)

Temperature control (Heat 50 – 90°C)

New Femtosecond laser workstation applied in the process of microreactor fabrication

Flow Control System

Microreactor