Characterization of biogenic volatile emission of rice in a Portuguese paddy field by comprehensive two dimensional gas chromatography

[a]Mateus E P, [a]Couto N, [b]Silva M G, [a]Ribeiro A B, [a]Guedes P, [c]Marriott P

Rice can be considered the most important staple food for a large part of the world's human population. It is estimated that twice as much food will be needed in the years 2000-2025 comparing with the 1960s, becoming urgent to study ways to develop the cereal production as well as environmental consequences that can appear.

The grains emit volatile organic compounds (VOCs) that play a role in its susceptibility and defence against pathogens or herbivores. Nevertheless, it is known that under normal circumstances only trace amounts of VOCs are found in rice, whilst stressed specimens can release higher amounts of target compounds.

VOCs emission by *Oriza sativa* L. Ariete were measured in irrigated rice fields at Salvaterra de Magos (Lisboa e Vale do Tejo region, Portugal) under different conditions: a) *open field*, loamy sand and silty clay soils; b) *open chambers*, silty clay soil, increasing temperature w/ and w/o enhanced CO_2 concentrations.

To perform monitorization, both dynamic (Tenax TA sorbent tubes) and static (headspace solid microextraction) sampling methods were used. Using one dimensional gas chromatography (1D-GC), either with flame ionization or mass spectrometer detectors, detection and amounts of biogenic volatile emissions of *O. sativa* were relatively scarce. In dynamic sampling, for example, the environmental background and the vestigial amounts of VOCs released determined the limited results.

With comprehensive two dimensional gas chromatography (GC×GC) information about *O. sativa* emissions increased when compared to 1D systems. The presence of two columns with different stationary phases improved the separation of the complex environmental sample, therefore increasing sensitivity and resolution, namely for trace amounts.

By means of GC×GC coupled with a FID and a quadropole mass spectrometer (qMS) it was possible to extract qualitative and semi quantitative information considering the composition of the rice volatile fraction (steam distillation extracts).

The separation, detection and identification of volatile compounds emited by plants at trace amounts (i.e. terpenes, terpenoids, and green leaf volatiles) provided valuable knowledge about the influence of different cultural and stress factors in the crop.

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[a] *CENSE-Departamento de Ciências e Engenharia do Ambiente, Faculdade de Ciências e Tecnologia, Universidade Nova de Lisboa, 2829-516 Caparica, Portugal (epm@fct.unl.pt)*
[b] *REQUIMTE-Departamento de Química, Faculdade de Ciências e Tecnologia, Universidade Nova de Lisboa, 2829-516 Caparica, Portugal*
[c] *Centre for Green Chemistry, School of Chemistry, Monash University, VIC, Australia*