

Study of Organic Pollutants Present in Sludge Generated in a Water Treatment Plant by Comprehensive Two-Dimensional Gas Chromatography Coupled with Time-of-Flight Mass Spectrometry

Luciana Nascimento Rocha Mangelli¹, Tiago Schena^{1,2}, Felipe Cury Mazza¹, Carin von Mühlen¹
¹Universidade do Estado do Rio de Janeiro (UERJ), Rodovia Presidente Dutra, Km 298, Resende – RJ (Brazil),
 Faculdade de Tecnologia | ²LECO Instruments, Av. das Nações Unidas, 12399, São Paulo – SP (Brazil)

INTRODUCTION

Watercourse pollution has increased worldwide, requiring improvements in the water purification process. Water treatment plants (WTP) are responsible to clean and distribute this important natural resource, but the solid residue generated from this process presents thousands of potential organic pollutants which requires a powerful separation technique to characterize it⁽¹⁾. Comprehensive two-dimensional gas chromatography (GCxGC) associated with time-of-flight mass spectrometry (TOFMS) can be employed in these complex samples⁽²⁾. The objective of this work was to develop a rapid analytical method to study organic pollutants present in WTP sludge.

EXPERIMENTAL

The residues were collected from an WTP located in Barra Mansa city (RJ-Brazil). The organic compounds were extracted using the QuEChERS methodology according to the method used by Cerqueira *et al.*⁽³⁾

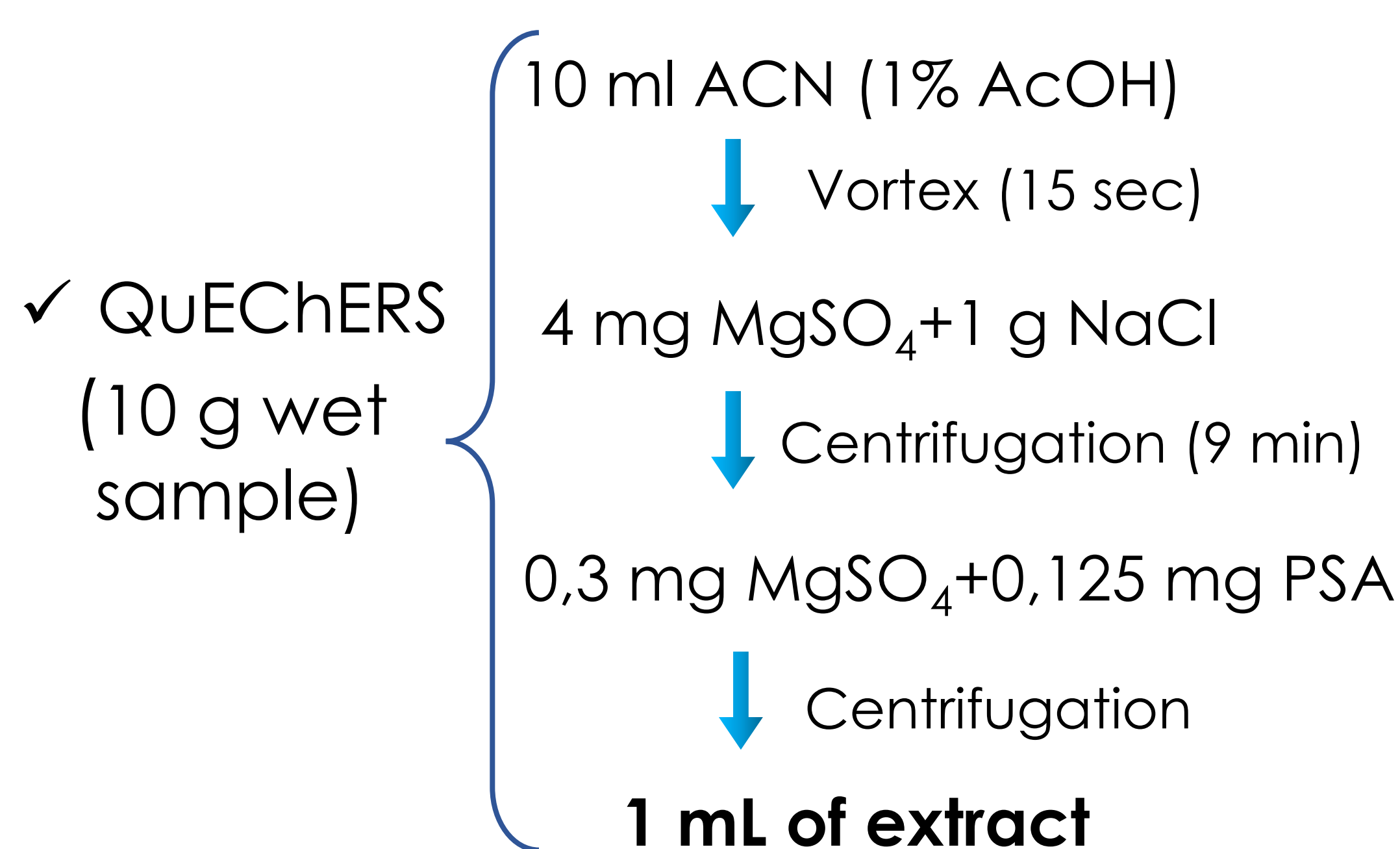


Table 1. Fast-GCxGC-TOFMS conditions

Fast-GCxGC-TOFMS
GCxGC System: LECO Pegasus® 4D, equipped with a 7890A GC system (Agilent Technologies) and liquid cryogen-free thermal modulator
¹ D: RTX-5 (10 m x 0.18 mm x 0.20 μm)
² D: RXI-17Sil (0.74 m x 0.10 mm x 0.10 μm)
Sample volume of 1 μL in splitless mode
Oven: 40 °C (0.5 min) – 15 °C/min – 300 °C (2 min)
ΔT: 15 °C; P _M : 3 s with 0.60 s of hot pulse with chiller set at -80 °C.
Acquisition Rate: 200 Hz
Injector, Transfer Line, and Ion Source Temperature: 280 °C, 300 °C, 250 °C, respectively.
Flow rate 1.0 ml.min ⁻¹

RESULTS AND DISCUSSION

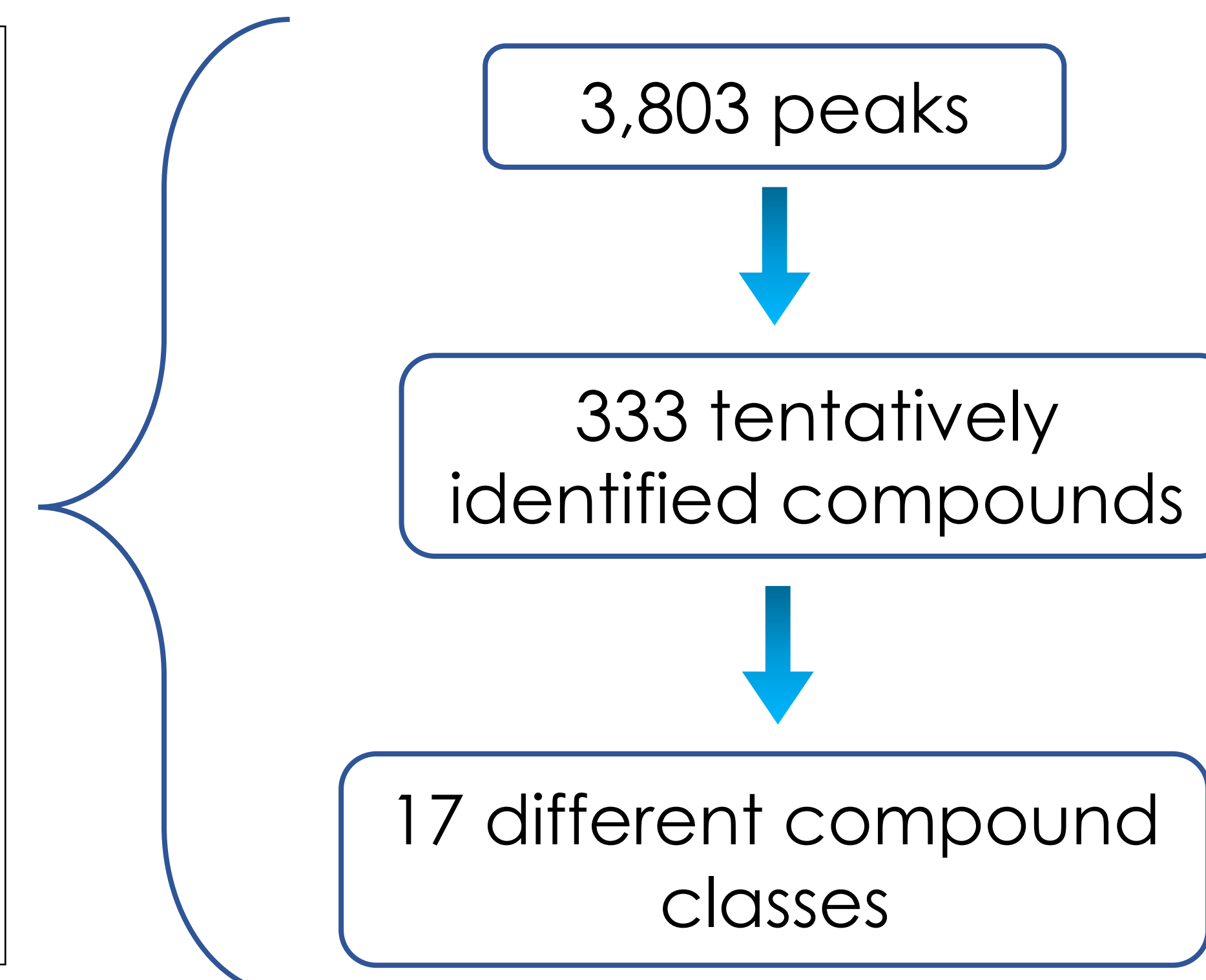
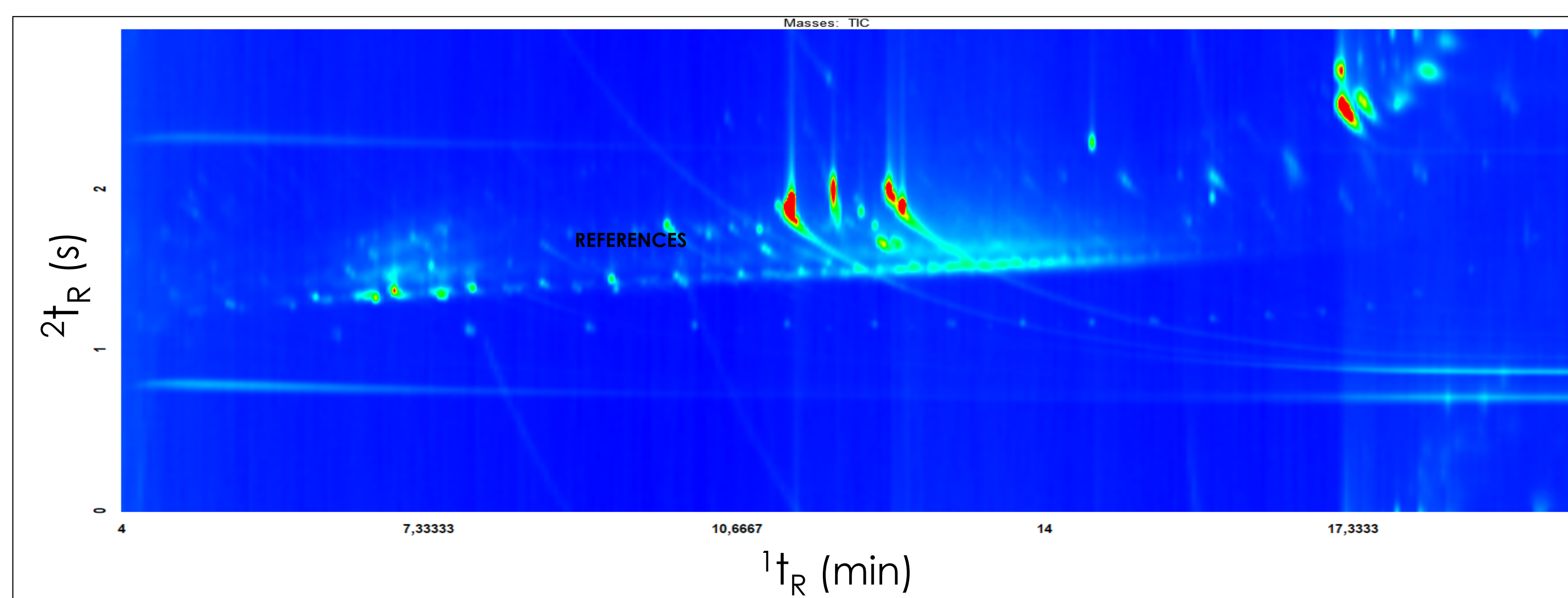


Figure 1: Color plot of the WTP residue extract analyzed by fast-GCxGC-TOFMS.

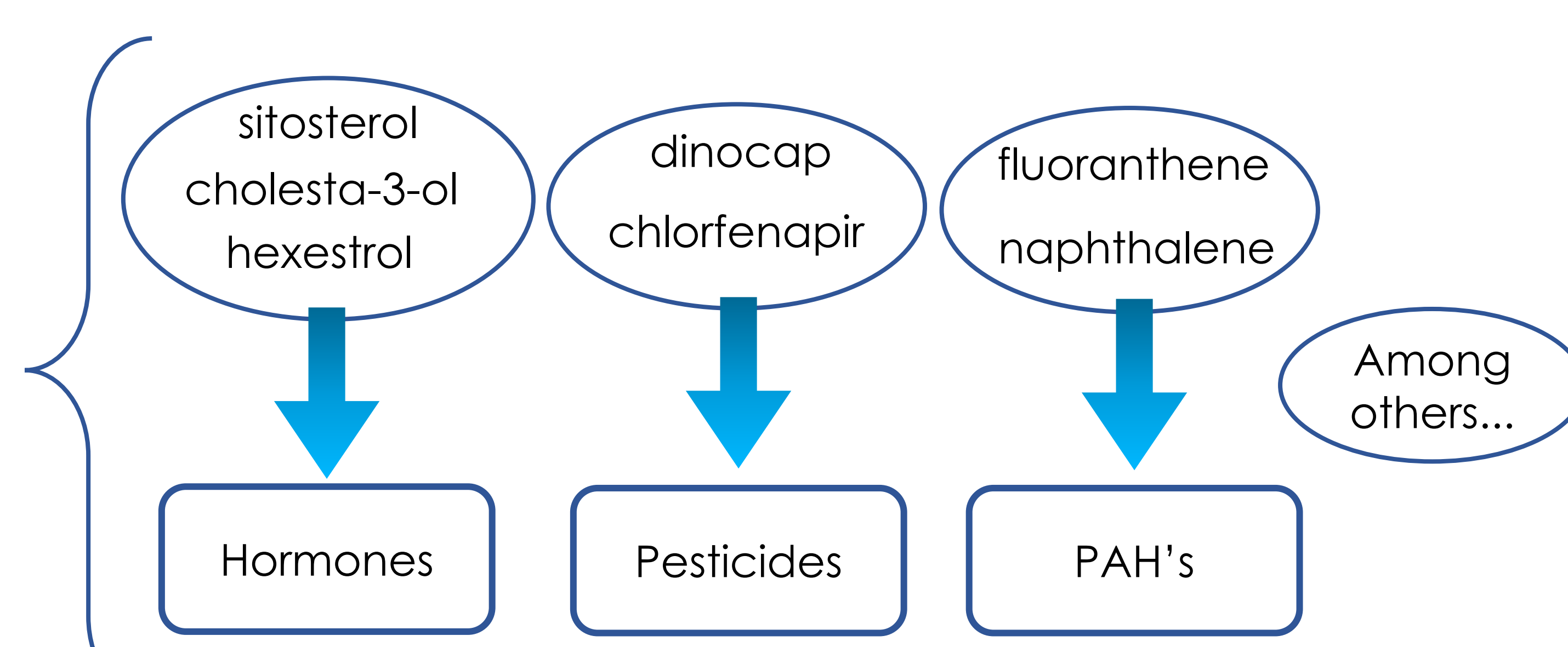
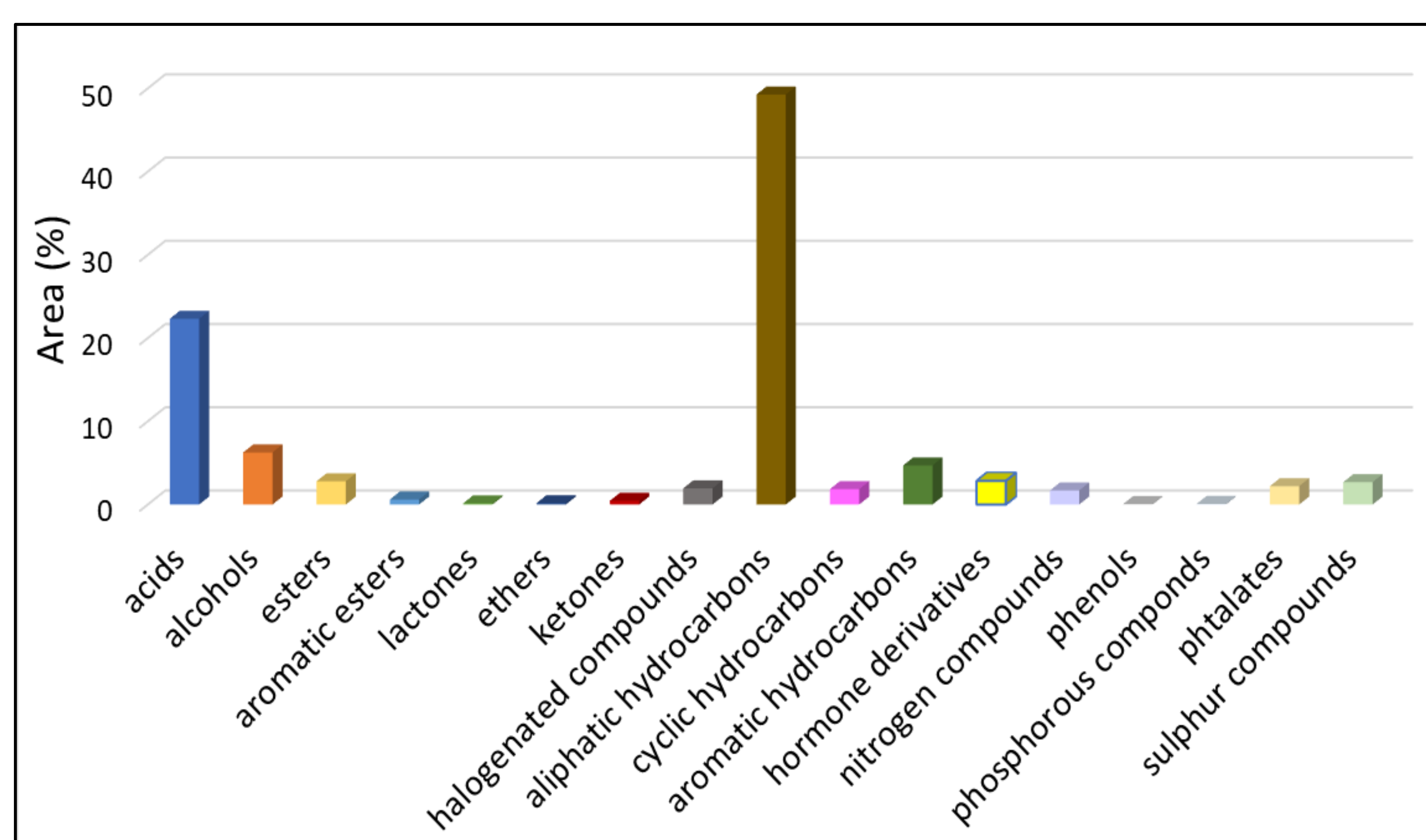


Figure 2: Compound classes distribution present in WTP residue extract (in terms of area percentage).

CONCLUSIONS

- ✓ **Fast-GCxGC-TOFMS**
 - promising analytical tool → complex matrices
 - time saving
 - ↑ chromatographic quality
- ✓ **WTP residues**
 - fast-GCxGC/TOFMS → sample characterization
 - highly polluting compounds
 - correct disposal → industrial waste landfills

REFERENCES

1. Agência Nacional de Águas (Brasil). Conjuntura dos recursos hídricos no Brasil: relatório pleno / Agência Nacional de Águas. Brasília: ANA, 2019.
2. Schena, T; Farrapeira, R; Bjerk, T. R; Krause, L. C.; von Mühlen, C; Caramão, E. B. Sep. Sci. Plus. 2, 89, 2019.
3. Cerqueira, M. B. R; Guilherme, J. R; Caldas, S. S; Martins, M. L; Zanella, R; Primel, E. G. Chemosphere 107, 74, 2014.

ACKNOWLEDGMENTS

