IDENTIFICATION OF OZONATION TRANSFORMATION PRODUCTS OF FUROSEMIDE USING LC-HR-MS/MS

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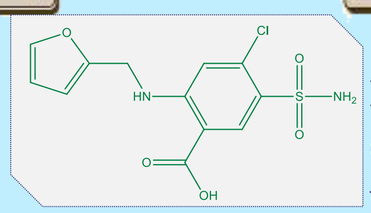
Ilias Tsilikidis **Maria-Christina Nika** **Christophoros Christophoridis** **Nikolaos S. Thomaidis**

Laboratory of Analytical Chemistry, Department of Chemistry, University of Athens, Panepistimiopolis Zografou, 157 71 Athens, Greece.
e-mail: *ntho@chem.uoa.gr*

INTRODUCTION

- Diuretic drug furosemide is detected in **wastewater & environmental samples**



- Although ozonation is applied for the elimination of micropollutants, it may lead to the formation of **unknown by-products**

AIM

Detect & identify possible produced by-products
&
Test if their formation is affected by the applied ozone dose

EXPERIMENTAL PART

Instrumentation: LC-ESI-MS/MS (**q-TOFMS**) (Bruker MaXis Impact)
Column: Acclaim C18 (Dionex-Thermo Scientific)
ESI: positive & negative mode
Gradient elution program: (A) H_2O/MeOH 90/10, (B) MeOH
positive: 5 mM amm. form. & (0.01 v/v form. acid)
negative: 5 mM amm. ac.
} *both A & B*

Acquisition mode: **1st run:** bbCID mode → **2nd run:** auto MS mode

RESULTS AND DISCUSSION

Suspect screening

1 already known by-product was detected

BP 250: 2-amino-4-chloro-5-sulfamoylbenzoic acid

Jakimska et al., 2014 (photodegradation study)

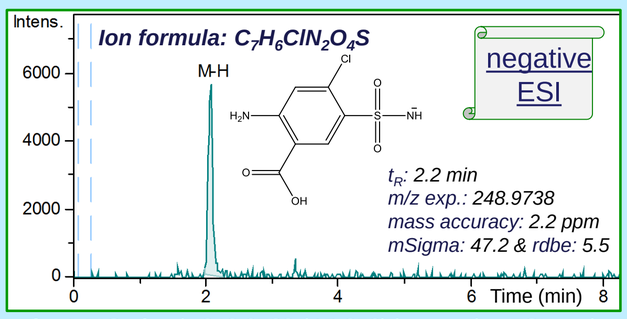


Fig. 1 EIC of m/z 248.9738 (BP 250) in negative ESI mode.

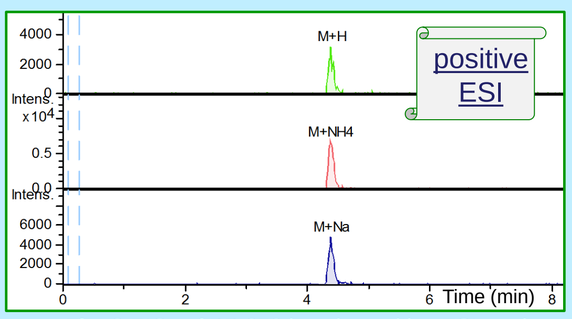


Fig. 2 EICs of BP 250 ions in positive ESI mode.

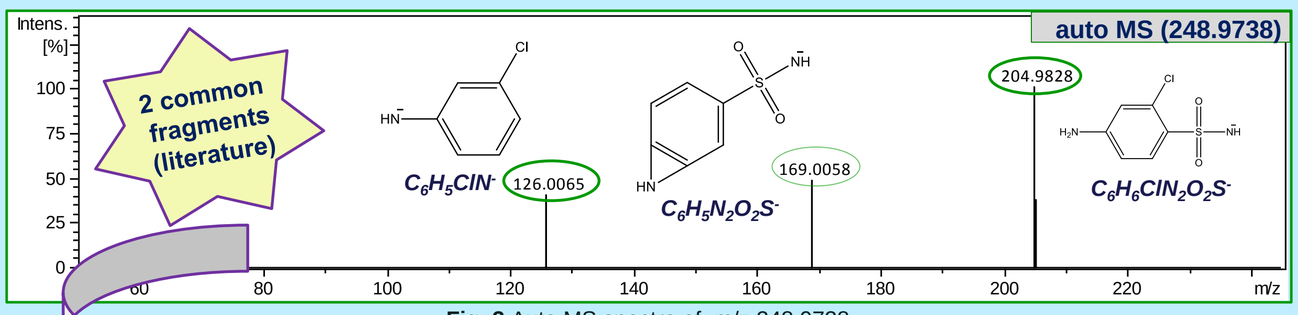
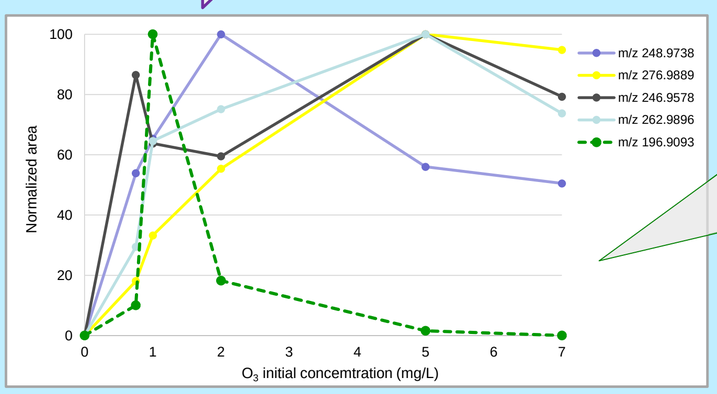


Fig. 3 Auto MS spectra of m/z 248.9738.

Confirmation with a **reference standard**!



-BP 198 is an intermediate by-product.

-BPs 250, 278, 248 & 264 are stable as the ozone dose increases.

-BP 360 is formed only when 1 mg/L of O_3 is applied.

Fig. 6 Influence of the applied O_3 initial concentration on the detected by-products' formation.

Non-target screening

Background noise subtraction is necessary

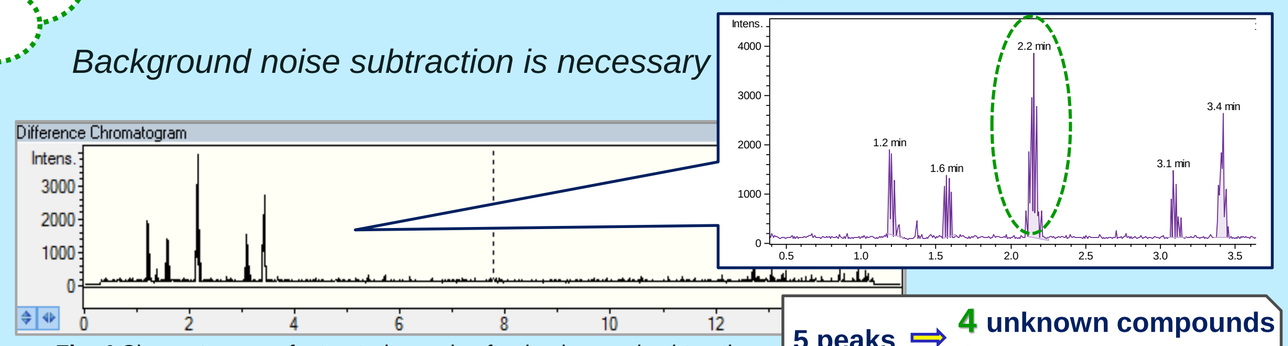
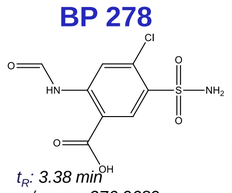


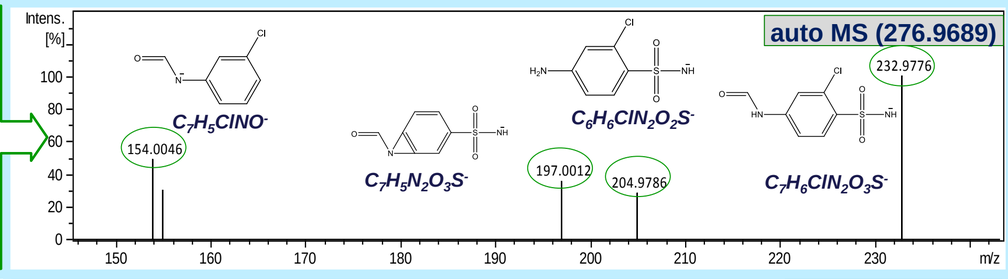
Fig. 4 Chromatogram of a treated sample after background subtraction.

5 peaks ⇒ **4 unknown compounds**, **1 already known**

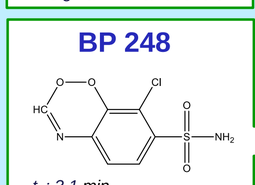
BP 278



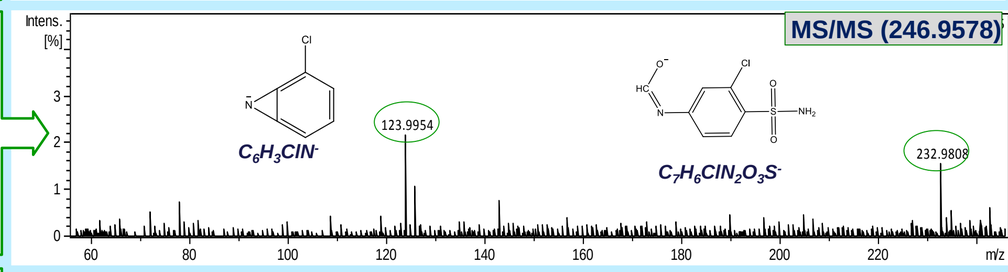
tR: 3.38 min
m/z exp.: 276.9689
mass accuracy: 0.9 ppm
mSigma: 14.2 & rdbe: 6.5



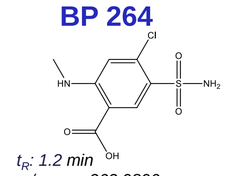
BP 248



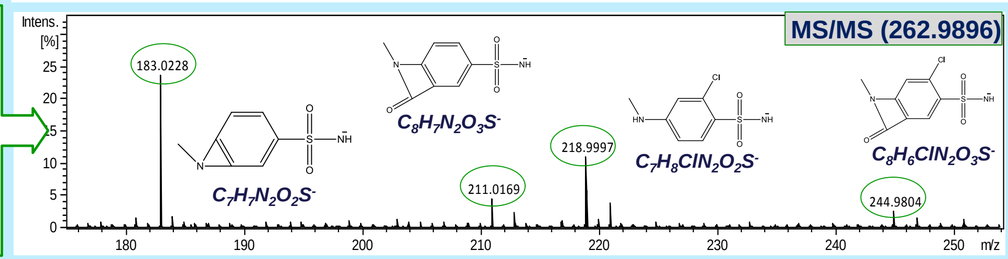
tR: 3.1 min
m/z exp.: 246.9578
mass accuracy: 3.1 ppm
mSigma: 55.6 & rdbe: 6.5



BP 264



tR: 1.2 min
m/z exp.: 262.9896
mass accuracy: 0.9 ppm
mSigma: 44.2 & rdbe: 5.5



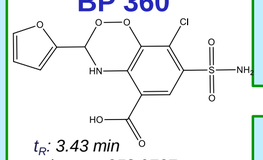
BP 198

The proposed formulas don't match to a by-product possible to be formed!

unknown

tR: 1.6 min
m/z exp.: 196.9093

BP 360



tR: 3.43 min
m/z exp.: 358.9737
mass accuracy: -2.5 ppm
mSigma: 50.4 & rdbe: 9.5

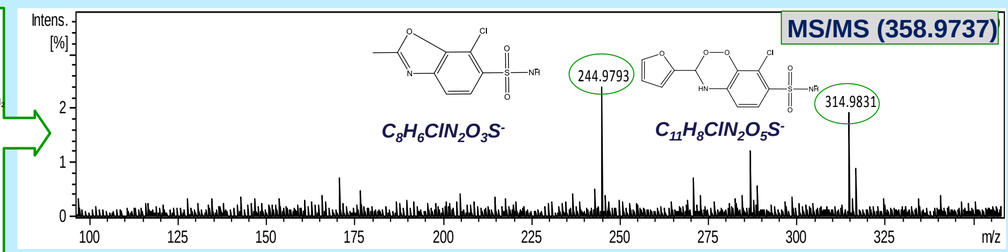


Fig. 5 Proposed structures, identification data & MS/MS spectra of the detected by-products.

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TrAMS
Trace Analysis and Mass Spectrometry Group

CONCLUSIONS

- BP 250 was detected through suspect screening & its structure was confirmed with a reference standard.
- Four by-products were detected through non-target screening and were tentatively identified.
- The formation of most of the detected by-products is irrelevant to the initial ozone concentration.