



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



CEST 2015

Ilias Tsilikidis

Maria-Christina Nika

Christophoros Christophoridis

Nikolaos S. Thomaidis

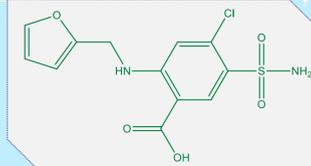
Laboratory of Analytical Chemistry, Department of Chemistry, University of Athens, Panepistimiopolis Zografou, 157 71 Athens, Greece.

e-mail: ntho@chem.uoa.gr

I₁ N₁ T₁ R₁ O₁ D₂ U₁ C₃ T₁ I₁ O₁ N₁

E₁ X₈ P₃ E₁ R₁ I₃ M₃ E₁ N₁ T₁ A₁ L₁ P₃ A₁ R₁ T₁

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**

Instrumentation: LC-ESI-MS/MS (q-TOFMS) (Bruker MaXis Impact)

Column: Acclaim C18 (Dionex-Thermo Scientific)

ESI: positive & negative mode

Gradient elution program: (A) H₂O/MeOH 90/10, (B) MeOH
positive: 5 mM amm. form. & (0.01 v/v form. acid)
negative: 5 mM amm. ac. } both A & B



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

Acquisition mode: 1st run: bbCID mode, 2nd run: auto MS mode

R₁ E₁ S₁ U₁ L₁ T₁ S₁ A₁ N₁ D₂ D₂ I₁ S₁ C₃ U₁ S₁ S₁ I₁ O₁ N₁

Suspect screening

1 already known by-product was detected

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

Jakimska et al., 2014 (photodegradation study)

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

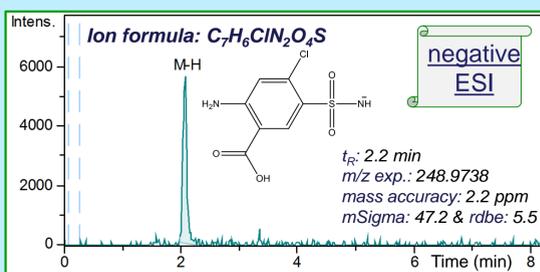


Fig. 1 EIC of m/z 248.9738 (BP 250) in negative ESI mode.

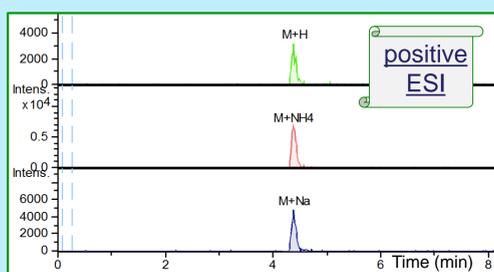


Fig. 2 EICs of BP 250 ions in positive ESI mode.

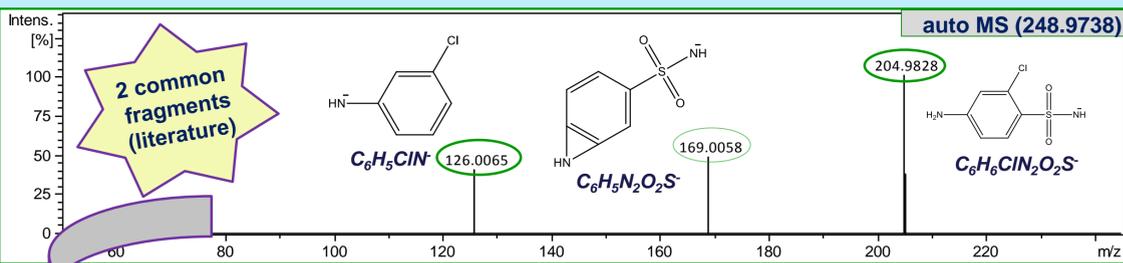


Fig. 3 Auto MS spectra of m/z 248.9738.

Confirmation with a reference standard!

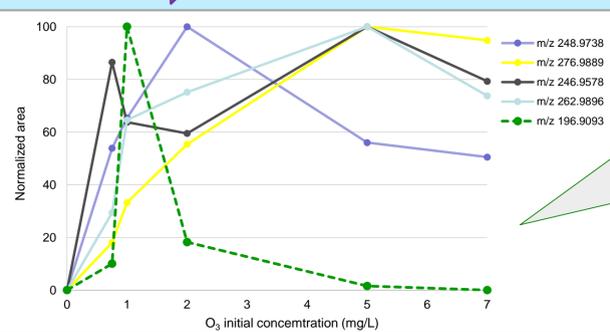


Fig. 6 Influence of the applied O₃ initial concentration on the detected by-products' formation.

-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 O₃ is applied.

BP 198
The proposed formulas don't match to a by-product possible to be formed!
unknown
t_R: 1.6 min
m/z exp.: 196.9093

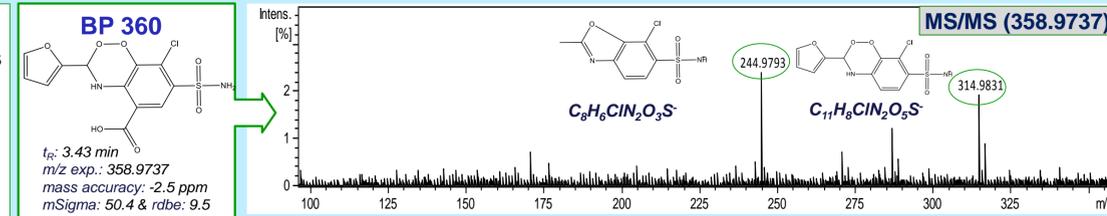
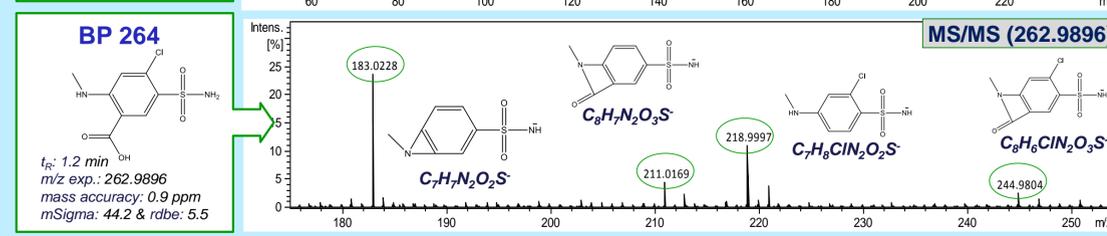
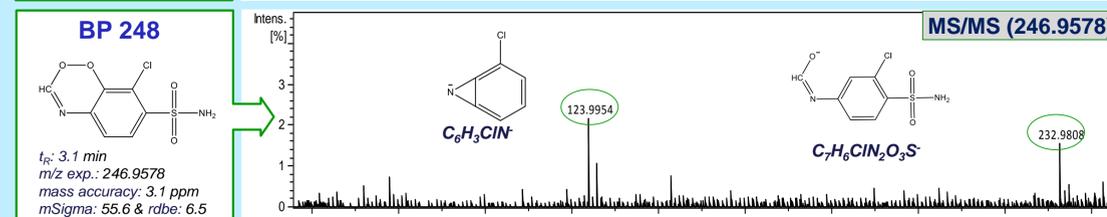
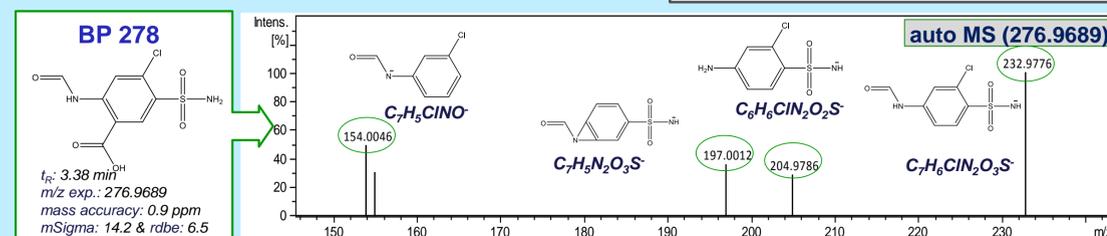


Fig. 5 Proposed structures, identification data & MS/MS spectra of the detected by-products.

A₁ C₃ K₅ N₁ O₁ W₄ L₁ E₁ D₂ G₂ E₁ M₃ E₁ N₁ T₁ S₁

This research has been co-financed by the European Union and Greek national funds through the Operational Program "Education and Lifelong Learning" of the National Strategic Reference Framework (NSRF) – ARISTEIA 624 (TREMOPOL project).



- 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.

C₃ O₁ N₁ C₃ L₁ U₁ S₁ I₁ O₁ N₁ S₁