Catching Counterfeit GLP-1s in Minutes:

Confirming Semaglutide and Liraglutide Identity with a Compact Ion Trap MS

MASSTECH

Overview

- Counterfeit and adulterated GLP-1 receptor agonists are a fast-growing public-health and forensic concern. Semaglutide and liraglutide products purchased outside the legitimate supply chain frequently contain the incorrect active ingredient or under-dosed peptides.
- This application note demonstrates how the MT Explorer 30 (MTE30) a compact, benchtop ion trap mass spectrometer confirms GLP-1 peptide identity in minutes through direct-infusion electrospray, with MS^n fragmentation providing unambiguous structural confirmation in a single run.
- The workflow is designed for forensic labs, regulatory screening, compounding-pharmacy QC, and harm-reduction settings anywhere confident peptide identification is required.

Key Words

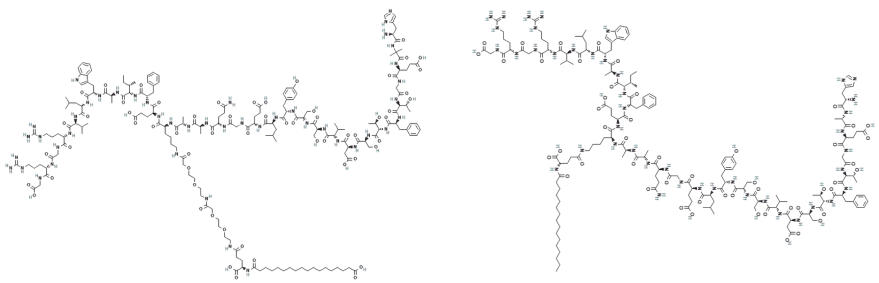
GLP-1 therapeutics, semaglutide, liraglutide, pharmaceutical mass spectrometry, counterfeit drug detection

Introduction

The increasing global demand for GLP-1 receptor agonists such as semaglutide and liraglutide has created a growing need for rapid and accessible analytical methods for pharmaceutical verification and quality assessment. This demand for GLP-1 receptor agonists has outstripped legitimate supply, and the gap is being filled by counterfeit pens, illicit online vendors, and unregulated compounded preparations. Counterfeit and improperly formulated GLP-1 therapeutics present significant safety concerns, highlighting the importance of analytical tools capable of confirming drug identity and purity. Mass spectrometry provides a powerful approach for sensitive and selective characterization of peptide-based therapeutics. The MTE-30 ion trap performs a full MS scan followed by isolation and MS^n fragmentation of any observed precursor in the same run, with no prior knowledge of the sample required.

Methods

- Semaglutide (MW 4114 Da) and liraglutide (MW 3751 Da) reference standards were diluted to working concentrations (50-100ug/mL) and directly injected into the MT Explorer 30 equipped with e-ESI.
- MS and MS/MS modes were employed for detecting intact charge states and generating diagnostic product ions.



Semaglutide and Liraglutide, via PubChem

Ion source	e-ESI (electrospray) with nanoemitter tip
Polarity	Positive ion mode
Scan modes	Full MS, then targeted MS/MS (MS^n available)
Scan range	m/z 600 – 2000 (full scan); product-ion scans set per precursor
Precursors monitored	Semaglutide $[M+3H]^{3+}$ m/z 1372; $[M+4H]^{4+}$ m/z 1028.6 | Liraglutide $[M+3H]^{3+}$ m/z 1251.4; $[M+4H]^{4+}$ m/z 938.5
Product Ions	Semaglutide: m/z 1303.0, 1359.5 (1372.0 precursor). Liraglutide: m/z 1064.3 (1251.6 precursor).

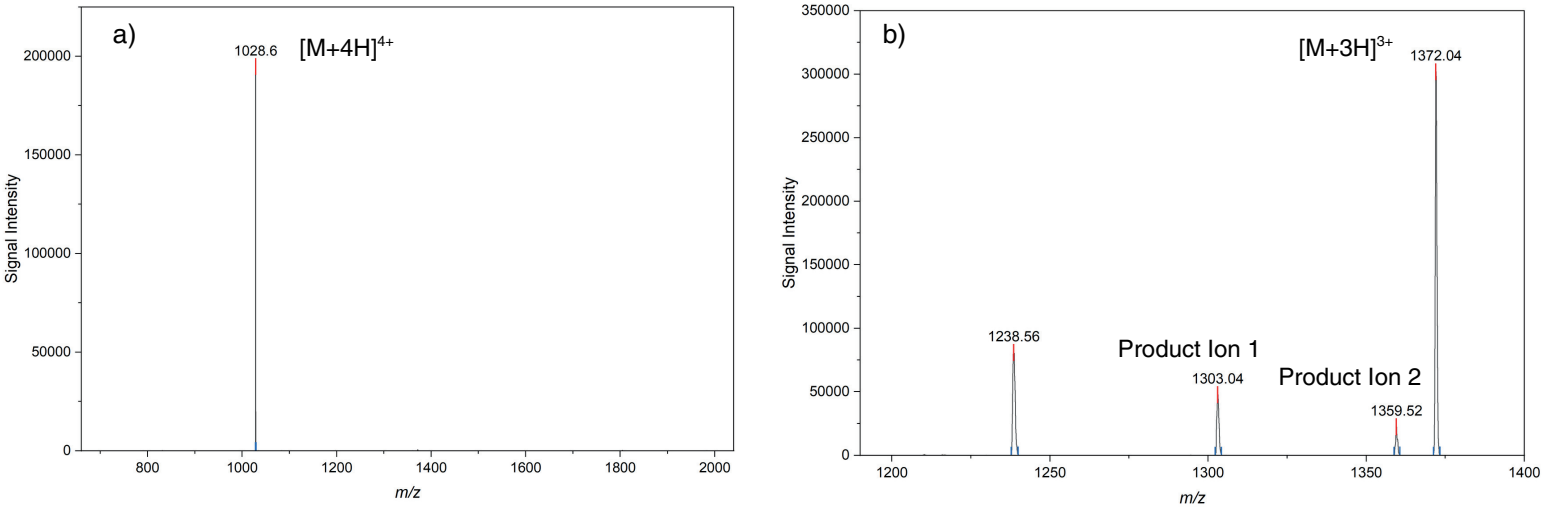


Figure a) Semaglutide $[M+4H]^{4+}$ MS peak *m/z* 1028.6 b) Semaglutide MS/MS spectrum with precursor $[M+3H]^{3+}$ ion at *m/z* 1372.0 and product ions *m/z* 1303.0 and 1359.5.

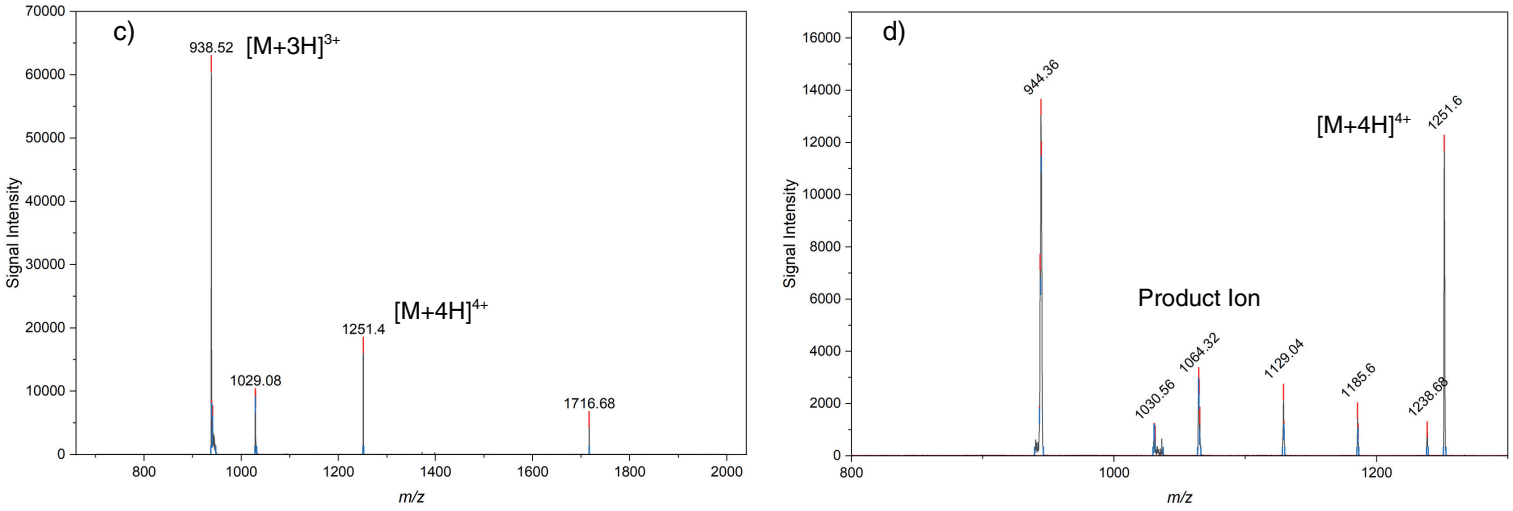


Figure c) Liraglutide $[M+3H]^{3+}$ MS peak at *m/z* 1251.4 and $[M+4H]^{4+}$ MS peak m/z 938.5 d) Liraglutide MS/MS spectrum with precursor $[M+4H]^{4+}$ ion at m/z 1251.6 and product ion m/z 1064.3

Results

- Semaglutide $[M+4H]^{4+}$ multiply charged peak was detected in MS full scan mode and $[M+3H]^{3+}$ peak and two fragments recorded in GLP-1 MS literature were produced.
- Liraglutide $[M+3H]^{3+}$ and $[M+4H]^{4+}$ multiply charged peaks were detected in MS full scan mode and a fragment recorded in GLP-1 MS literature was produced.
- Additional peaks observed in both spectra are candidates for further MS^n characterization
- The combined MS + MS/MS confirmation **runs in under two minutes per sample**, with the spectra and fragment assignments serving as the record for identity confirmation.

6992 Columbia Gateway Dr #160
Columbia, MD 21046
T: (443) 539-1758
E: sales@apmaldi.com