

# Analytical Chemistry Research Report

## Executive Summary

This report presents the results of a comprehensive analytical study utilizing liquid chromatography-tandem mass spectrometry (LC-MS/MS) for the detection and quantification of target analytes.

## Key Findings:

- Method detection limit: 0.5 ng/mL
- Linear range: 1-1000 ng/mL ( $R^2 > 0.999$ )
- Intra-day precision: <5% CV
- Recovery: 95-105%

## Methodology

The analytical method was developed following FDA and EMA guidelines for bioanalytical method validation. Sample preparation involved protein precipitation followed by solid-phase extraction.

### *Sample Preparation Protocol*

- Add 100  $\mu$ L internal standard solution to 100  $\mu$ L plasma sample
- Add 300  $\mu$ L acetonitrile for protein precipitation
- Vortex for 30 seconds, centrifuge at 14,000 rpm for 10 minutes
- Transfer supernatant to SPE cartridge (pre-conditioned)
- Wash with 1 mL 5% methanol in water
- Elute with 1 mL methanol, evaporate to dryness
- Reconstitute in 100  $\mu$ L mobile phase A

## Results

*Calibration curve parameters for all target analytes:*

Analyte	LLOQ (ng/mL)	ULOQ (ng/mL)	Slope	R <sup>2</sup>
Compound A	1.0	1000	0.0234	0.9998
Compound B	0.5	500	0.0456	0.9995
Compound C	2.0	2000	0.0178	0.9997
Internal Std	-	-	-	-

*Table 1: Calibration curve regression parameters for target analytes*

### *Chromatographic Separation*

Representative chromatogram showing baseline separation of all analytes:

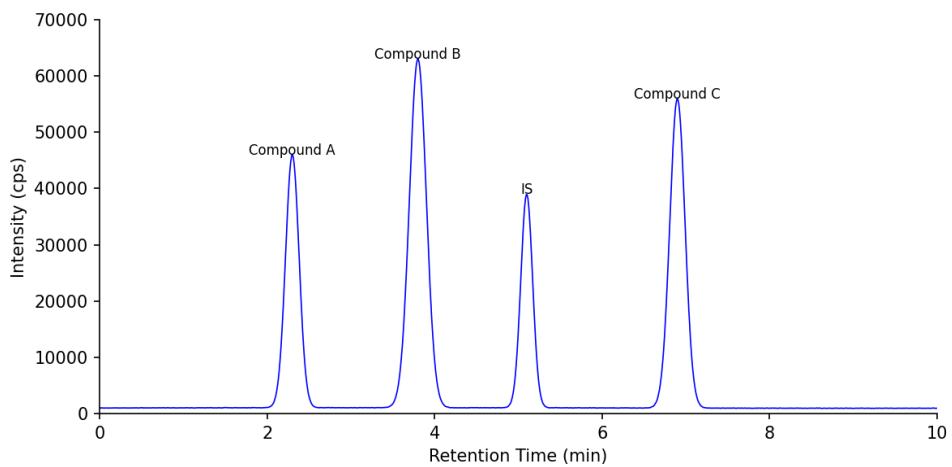


Figure 1: Representative LC-MS/MS chromatogram (MRM mode)

## Quality Control Results

QC Level	Nominal (ng/mL)	Mean Found	Accuracy (%)	Precision (%CV)
LLOQ	1.0	1.02	102.0	8.5
Low	3.0	2.95	98.3	4.2
Medium	100	101.5	101.5	3.1
High	800	792	99.0	2.8

Table 2: Quality control sample accuracy and precision (n=6 replicates)

## Stability evaluation results:

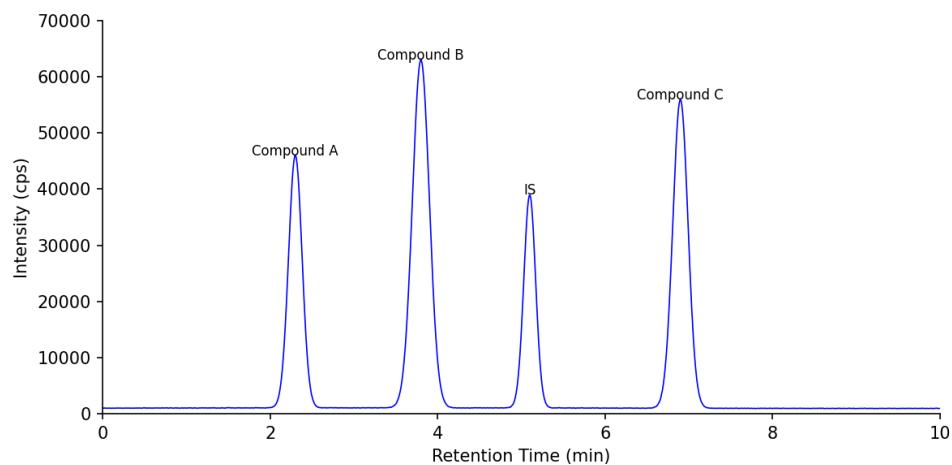


Figure 2: Analyte stability under various storage conditions

## Additional visualization:

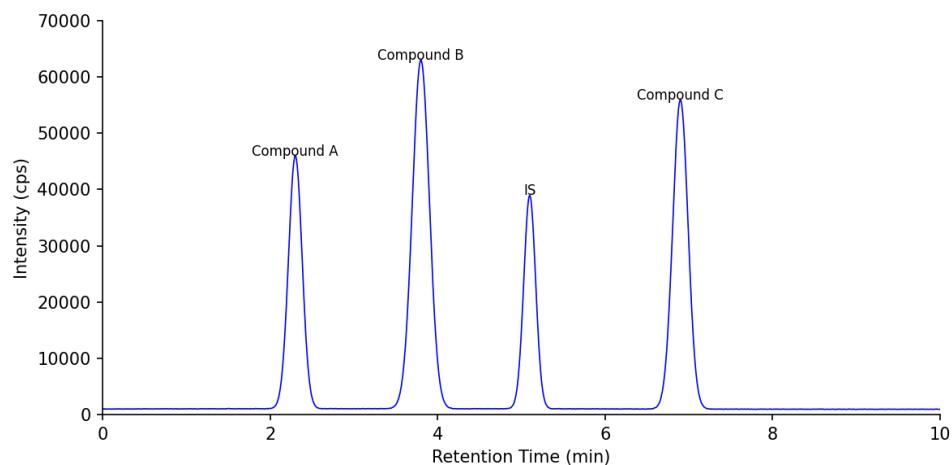


Figure 3: Supplementary chromatogram data

## **Conclusions**

The validated LC-MS/MS method demonstrates excellent performance characteristics suitable for routine bioanalytical applications. All validation parameters meet regulatory acceptance criteria.

*This method is recommended for implementation in the clinical laboratory.*