

MALDI micro MX Resolution

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This is an Application Brief and does not contain a detailed Experimental section.

Abstract

The resolving power of the Waters Micromass MALDI micro MX is demonstrated in reflectron and linear mode, in positive ion and negative ion modes.

Benefits

In this test the MALDI micro MX always surpassed the instrument specifications

Introduction

Mass resolution is the ability to separate two adjacent masses. It defines the performance of an analyzer and is a measure of the extent to which adjacent ions can be distinguished from each other with less than a defined amount of overlap. For a single peak this can be calculated from the width of a peak at a defined height and is usually referred to as Full Width Half Maximum (FWHM). FWHM is the resolution measured with a 50% valley overlap between peaks of adjacent m/z .

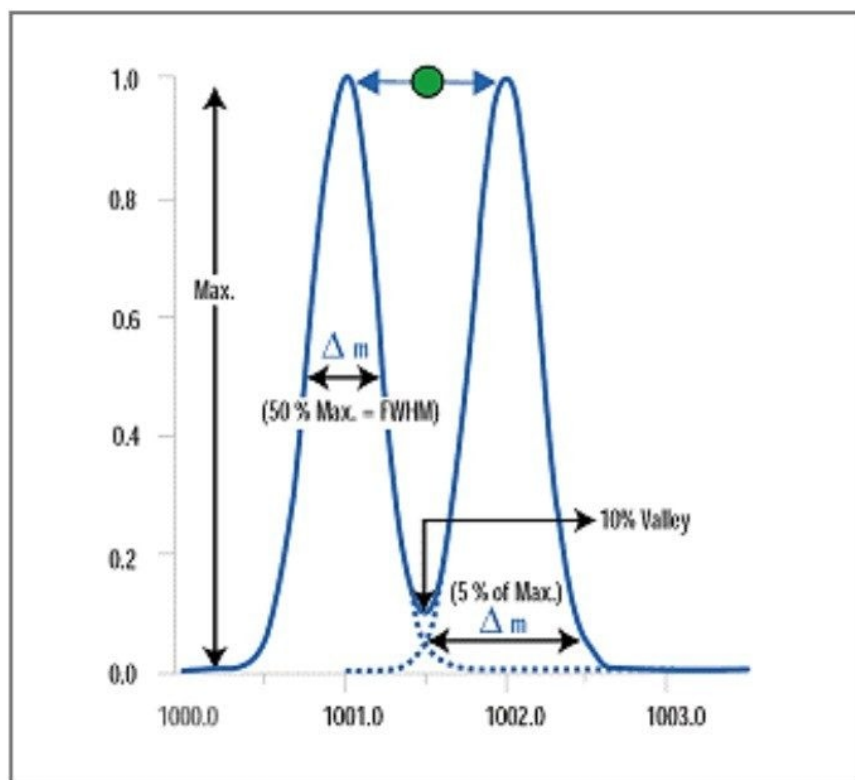


Figure 1. Definition of FWHM for a mass spectral peak.

Resolution can be calculated using the following equation:

$$Resolution = \frac{m}{\Delta m}$$

where m is the observed m/z and Δm is the measured width at half peak height. Two key advantages of increasing resolution are:

- Increased ability to separate peaks which are close in m/z
- Improved detection limits through the generation of narrower, taller peaks.

It is often assumed that high resolution is always required for good mass accuracy, this has however been shown

not to be the case.¹

Experimental

The resolving power of the Waters Micromass MALDI micro MX is demonstrated in reflectron and linear mode, in positive ion and negative ion modes.

Resolution Reflectron Mode

Sample: Adrenocorticotrophic hormone clip 18–39 (ACTH) at a concentration of 2 pmol/μL in 0.1% trifluoroacetic acid (TFA).

Matrix: Purified α-cyano-4-hydroxy cinnamic acid matrix was obtained from Waters (186002331). Matrix was prepared at 2 mg/mL in 1:1 acetonitrile:aqueous 0.1% TFA.

Samples were mixed 1:1 with matrix and 1 μL was spotted directly onto the target plate and allowed to air dry prior to analysis.

Data acquisition: Six separate acquisitions in positive and negative mode.

Resolution Linear Mode

Sample: Cytochrome C (equine) at a concentration of 2 pmol/μL in 0.1% TFA.

Matrix: The matrix was prepared and used in 2 stages,

- 10 mg/mL sinapinic acid in acetone (Matrix 1)
- 10 mg/mL sinapinic acid in 60:40 aqueous 0.1% TFA:acetonitrile (Matrix 2)

1 μL of Matrix 1 was applied to the target plate and allowed to air dry then Matrix 2 was mixed 1:1 with the sample and 1 μL was spotted on top of the Matrix 1 thin film.

Data acquisition: Six separate acquisitions in positive and negative mode.

Results and Discussion

The results obtained are summarised in Table 1. Examples for each mode are shown in Figures 2–5. The MALDI micro MX exceeded the specified resolution in every mode.

| Mode | Polarity | Average resolution (six acquisitions) | Instrument specification |
|------------|----------|--|--------------------------|
| Reflectron | positive | 14,158 | 10,000 |
| Reflectron | negative | 11,354 | 10,000 |
| Linear | positive | 1,082 | 1,000 |
| Linear | negative | 1,124 | 1,000 |

Table 1. Average resolution over six acquisitions.

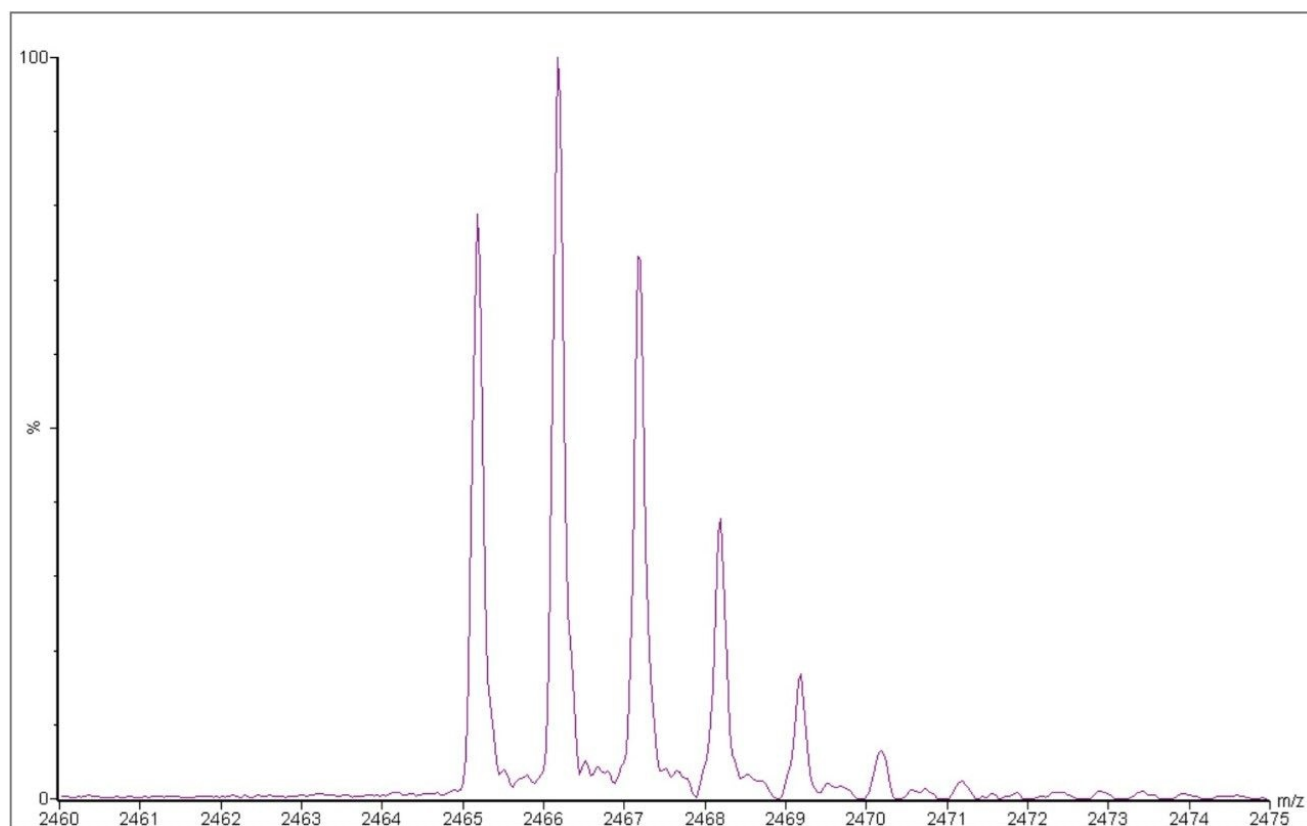


Figure 2. Example of resolution in reflectron mode (positive). Observed resolution $\approx 16,000$.

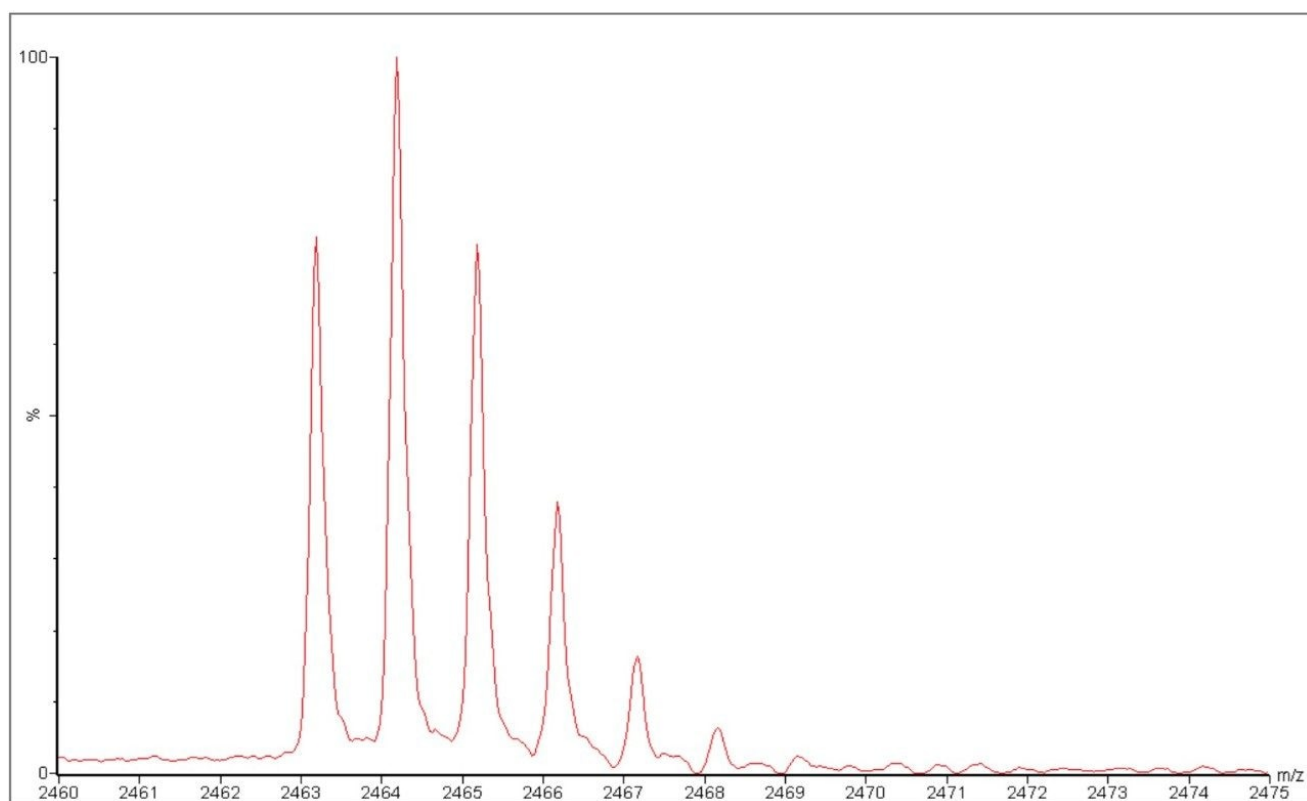


Figure 2. Example of resolution in reflectron mode (negative). Observed resolution $\approx 13,000$.

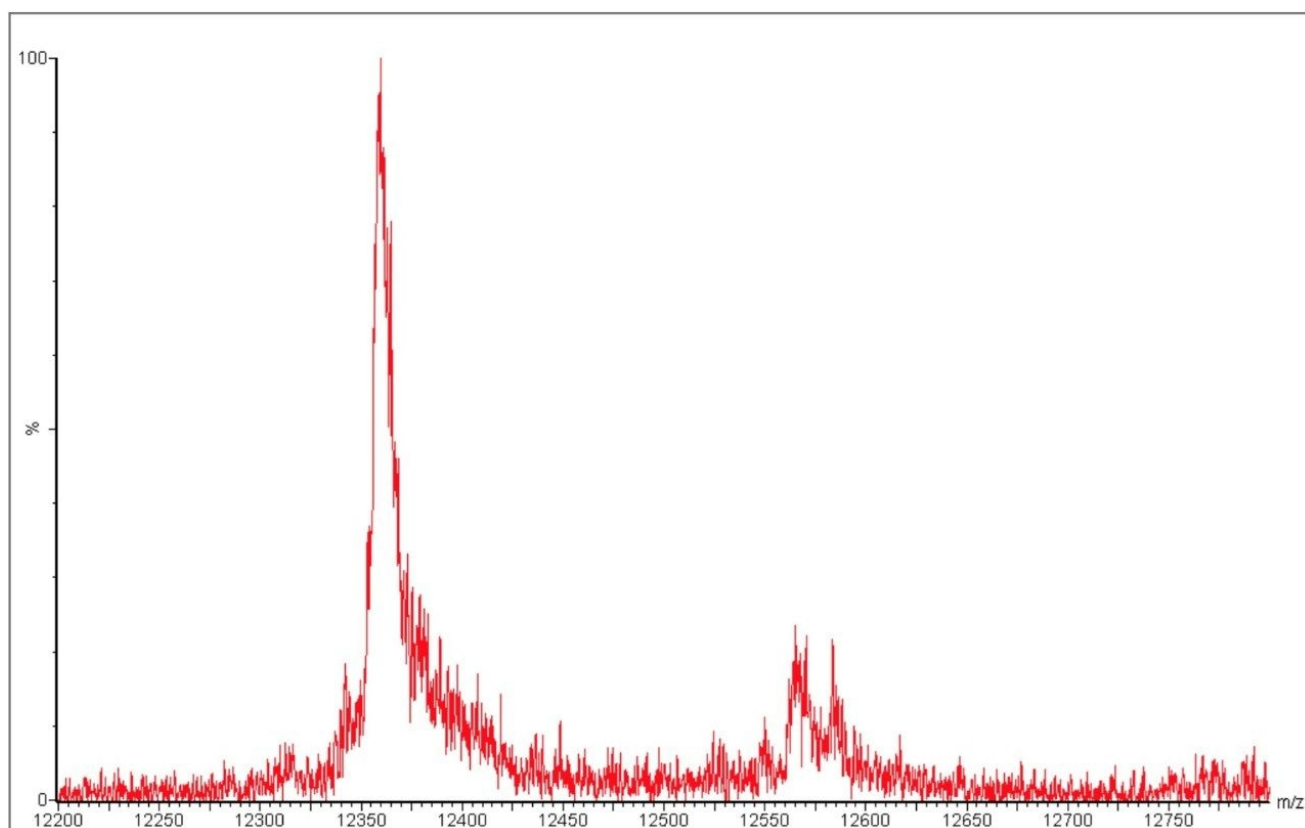


Figure 4. Example of resolution in linear mode (positive). Observed resolution ≈ 1350 .

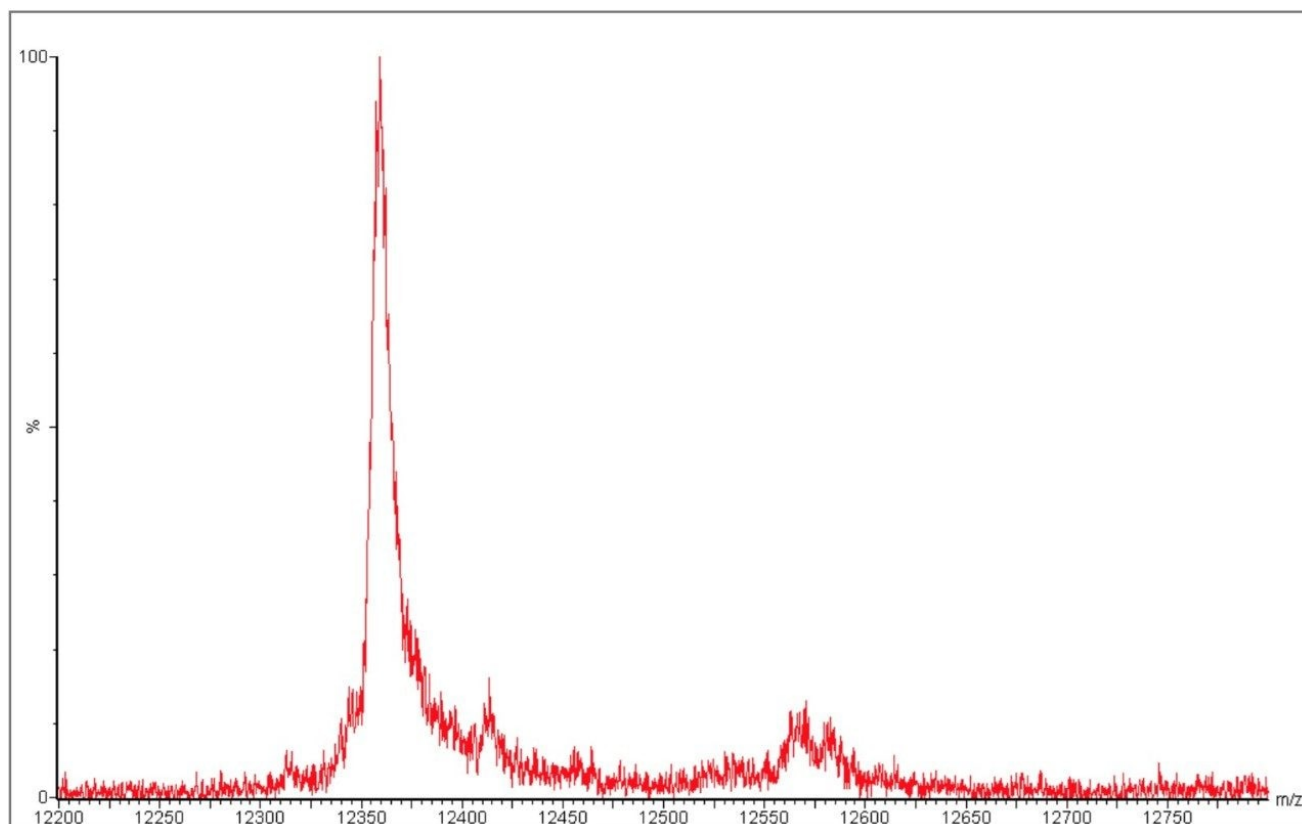


Figure 5. Example of resolution in linear mode (negative). Observed resolution ≈ 1150 .

Conclusion

- In this test the MALDI micro MX always surpassed the instrument specifications
- In reflectron, positive ion mode a resolution of *ca* 16,000 was measured, 60% better than the specified value of 10,000

References

1. Tyler, A. N.; Clayton, E.; Green, B. N. *Anal. Chem.* 1996, 68, 3561–3569.

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