TechnicalNOTE

Waters

LCT PREMIER: EXTENDED DYNAMIC RANGE

Waters Corporation, MS Technologies Centre, Manchester, UK

Introduction

The Waters® LCT Premier™ Mass Spectrometer is the highest performance bench-top orthogonal acceleration time-of-flight (oa-TOF) LC/MS system available today. Prior to LCT Premier, oa-TOF mass spectrometry had limited dynamic range due to instrument detector saturation at high ion intensities. This resulted in limited quantitative capability, and thus was not a suitable instrument for certain applications. In addition, exact mass measurement was compromised at high ion intensities.

Technology

With the LCT Premier Mass Spectrometer's innovative design, the detection system of the instrument has been improved and now incorporates new technology: Dynamic Range Enhancement (DRE™). With DRE, the detection system of the LCT Premier has been extended by an order of magnitude, now providing four orders of dynamic range for both quantitation and exact mass measurement. This provides the user with an oa-TOF LC/MS system that can acquire sensitive, full spectral data for applications requiring either qualitative or quantitative answers over a wide range of ion intensities.

With the additional benefit of exact mass measurement, the LCT Premier Mass Spectrometer is the ideal choice for applications such as Open Access exact mass measurement, pharmaceutical compound screening, impurity and metabolite identification, biomarker analysis and protein identification. The LCT Premier also has the potential to be used for environmental/toxicology applications requiring quantitative information on very complex mixture/multiple component samples without any loss in sensitivity.

Figure 1 shows the quantitative LC/MS analysis of sulfadimethoxine, a small molecule with a molecular weight of 310 Da, analysed by positive ion electrospray LC/MS with and without DRE. The range of analysis covers 0.5 to 5000 ng/mL and a linear fit has been made to all points. Without DRE, you can see that the points measured produce a curve at the higher sample concentrations due to detector saturation. With DRE on the LCT Premier, the

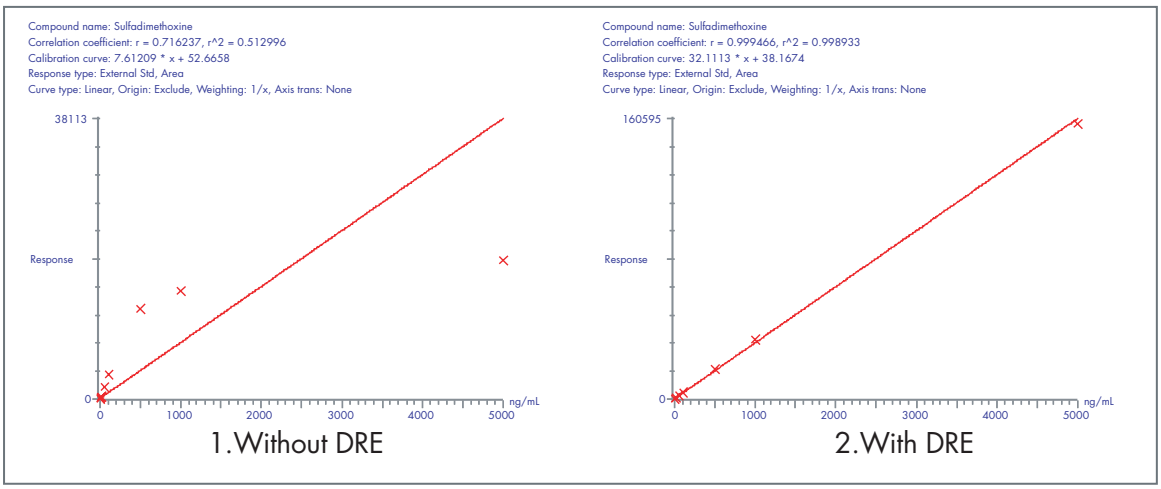

Figure 1. Quantitative analysis of Sulfadimethoxine with and without Dynamic Range Enhancement (DRE).

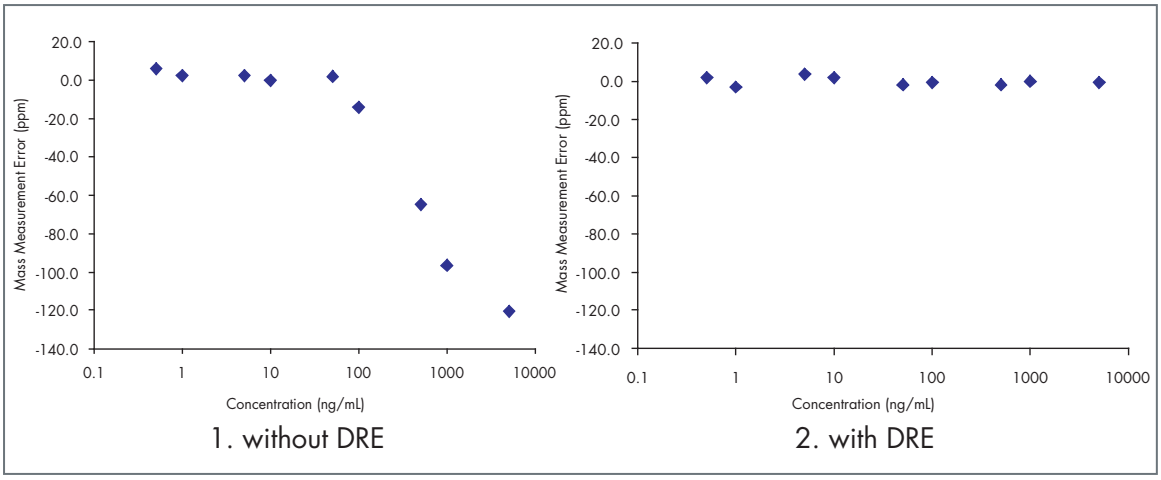

Figure 2. Exact mass measurement of Sulfadimethoxine.

same samples analyzed over the same four orders of magnitude produce a linear graph through the points—ideal for routine quantitation.

Figure 2 shows the exact mass measurement error of sulfadimethoxine for each of the peaks analysed. Without DRE, as the concentration of the sample increases, the exact mass measurement error deviates in a negative direction from the expected mass, which is due to detector saturation at high ion currents. With DRE, the exact mass measurement is maintained to within 3 ppm of expected over the four orders of magnitude.

Sulphadimethoxine has also been analysed by LC/MS with APcI (atmospheric pressure chemical ionisation) over the concentration range 1 to 10,000 pg/µL. Figure 3 shows the quantitation report, displaying that excellent linearity is obtained with APcI and DRE on the LCT Premier. The correlation coefficient over the analysed concentration range is better than 0.999.

Use of the LCT Premier Mass Spectrometer with DRE also offers an application for the analysis of peptides with nano-scale chromatography. Glu-fibrinopeptide (GFP) has been analysed by nanoLC and detected by the LCT Premier using NanoLockSpray™. GFP produces a doubly charged ion at m/z 785.8, with

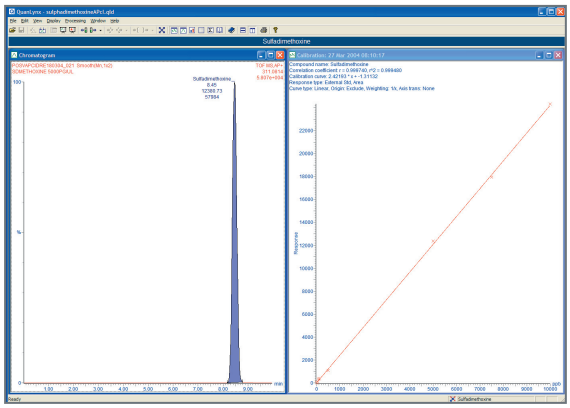

Figure 3. Analysis of Sulphadimethoxine with APcI and DRE.

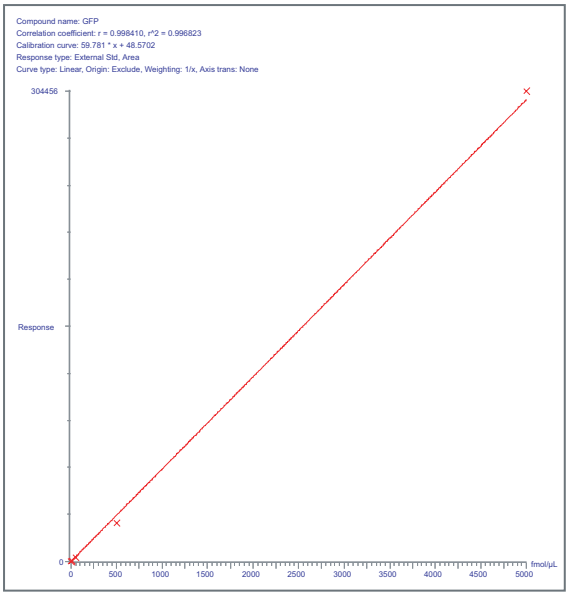

Figure 4. Quantitation graph for Glu-fibrinopeptide.

an exact mass in positive nano-electrospray of m/z 785.8426. The amount of GFP injected on column was from 0.5 femtomole to 5000 femtomoles. Figure 4 shows the quantitation curve with a linear fit from the 0.5 to 5000 femtomole sample with DRE. No internal standard was used.

Figure 5 shows the mass spectrum of the lowest level GFP standard (0.5 femtomole) with an exact mass measurement error of -1.4 ppm from expected. Figure 6 plots the exact mass measurement error for each of the standards over the 0.5 to 5000 femtomole quantitation range. As can be seen with DRE, exact mass measurement is maintained to within 3 ppm of expected even for the high intensity samples.

The LCT Premier: wide dynamic range oa-TOF mass spectrometry for both exact mass measurement and quantitation.

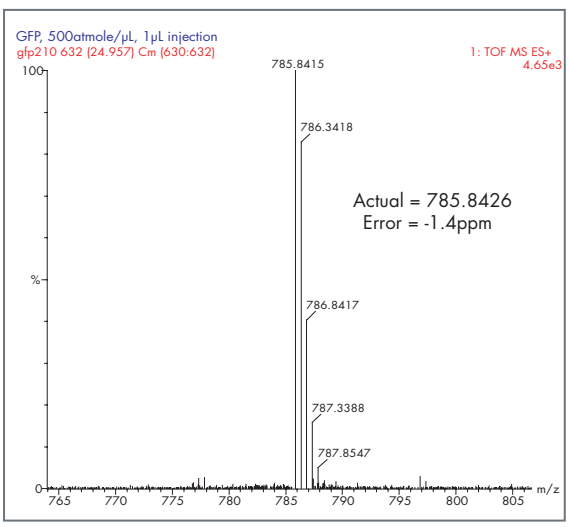

Figure 5. Exact mass measurement of GFP (500 atmole sample).

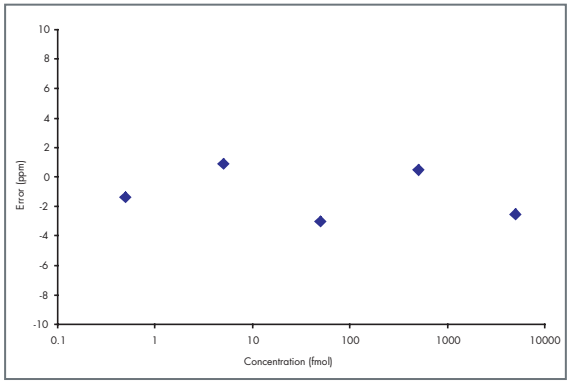

Figure 6. Exact mass measurement of GFP over 0.5 to 5000 fmol concentration range.

TechnicalNOTE

Waters

Sales Offices:

AUSTRIA 43 1 877 18 07
AUSTRALIA 61 2 9933 1777
BELGIUM AND LUXEMBOURG 32 2 726 1000
BRAZIL 55 11 5543 7788
CANADA 800 252 4752 X2205
CZECH REPUBLIC 420 2 617 11384
DENMARK 45 46 59 8080
FINLAND 358 9 506 4140
FRANCE 33 1 3048 7200
GERMANY 49 6196 400600
HONG KONG 852 29 64 1800
HUNGARY 36 1 350 5086
INDIA 91 80 2837 1900
IRELAND 353 1 448 1500
ITALY 39 02 27 4211
JAPAN 81 3 3471 7191
KOREA 82 2 820 2700
MEXICO 52 55 5524 7636
THE NETHERLANDS 31 76 508 7200
NORWAY 47 6 384 6050
PEOPLE'S REPUBLIC OF CHINA 86 10 8451 8918
POLAND 48 22 833 4400
PUERTO RICO 787 747 8445
RUSSIA/CIS 7 095 931 9193
SINGAPORE 65 6278 7997
SPAIN 34 93 600 9300
SWEDEN 46 8 555 11 500
SWITZERLAND 41 62 889 2030
TAIWAN 886 2 2543 1898
UK 44 208 238 6100
US 800 252 4752

Waters

WATERS CORPORATION
34 Maple St.
Milford, MA 01757 U.S.A.
T: 508 478 2000
F: 508 872 1990
www.waters.com

For Complete Confidence

LLOYD'S REGISTER QUALITY ASSURANCE · ISO9001

UKAS QUALITY MANAGEMENT 001

IQNet VIT