Implementing Information Dependent Acquisition to an Hybrid RF/DC Quadrupole-Linear Ion Trap Mass Spectrometer

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OVERVIEW

Information Dependent Acquisition Applications on QTRAP® – a hybrid RF/DC quadruple linear ion trap

- Detection of Phase I and II metabolites
- Protein identification from a single injection
- Identification of Post-Translational Modification

INTRODUCTION

The increasing importance of LCMS in areas of drug discovery and proteomics has created a higher demand on the analytical capabilities of instrument in terms of sensitivity, throughput and automation. The advent of tools like Information Dependent Analysis (IDA) enables user to improve their throughput by delivering MS and MS/MS data in a single analysis. In order to ensure that the information generated is of high quality the analyst has to invest in the selection of the appropriate scanning criteria. The QTRAP® hybrid quadrupole-linear ion trap system brings together the power of instrument specificity and sensitivity, with the automation of IDA to maximise the value of MS data in a plethora of applications – the range of analytical performance spanned from discovery and toxicology to proteomic applications. This paper presents the implementation and application possibilities of IDA on a Q TRAP® system to maximise data collection from single MS to MS3.

MATERIALS AND METHODS

All the experiments were conducted on an hybrid RF/DC quadrupole linear ion trap mass spectrometer, QTRAP® (Applied Biosystems/MDS Sciex, Concord, ON, Canada). The scan types available on QTRAP® were listed in Table 1. IDA looped multiple Level 2 experiments for the entire duration of the LC analysis (Figure 1). All in all, the ability to combine the information from 2 survey scans in the decision making process. Enhanced resolution is carried out prior to formal ion selection by using the Neutral Loss scan to dynamically exclude MS/MS spectral data and to reduce the mass assignment, thus allowing the user to focus on the relevant multiply charged precursor ions. Though IDA can be used with inclusion lists to focus on expected metabolite transformations, unexpected transformations will remain unexplored. Therefore, using preacquisition on mass lists for phase I and II, respectively, can help to maximise the amount of useful information. Information is defined as a set of characteristics that alert the user to the presence of a known or unknown compound. IDA (information dependent acquisition) can ensure that unexpected metabolites can be more effectively detected and confirmed in a single injection.

IDA Description

In the Analyst® software, IDA was implemented to offer flexibility when taking advantage of the scan specificity and sensitivity of MS systems such as QTRAP® (Applied Biosystems/MDS Sciex, Concord, ON, Canada). The scan types available on QTRAP® were listed in Table 1. IDA looped multiple Level 2 experiments for the entire duration of the LC analysis (Figure 1). In order to take advantage of the scan specificity of scans such as precursor or real-time neutral loss, while minimizing data collection, IDA tests the ability to combine the information from 2 survey scans in the decision making process. Enhanced resolution is carried out prior to formal ion selection by using the Neutral Loss scan to dynamically exclude MS/MS spectral data and to reduce the mass assignment, thus allowing the user to focus on the relevant multiply charged precursor ions. Though IDA can be used with inclusion lists to focus on expected metabolite transformations, unexpected transformations will remain unexplored. Therefore, using preacquisition on mass lists for phase I and II, respectively, can help to maximise the amount of useful information. Information is defined as a set of characteristics that alert the user to the presence of a known or unknown compound. IDA (information dependent acquisition) can ensure that unexpected metabolites can be more effectively detected and confirmed in a single injection.

IDA for the Identification of Phase I and II Metabolites

The identification of metabolites in vivo or in vitro is frequently challenged by the presence of chemical noise or eluting endogenous species, especially under rapid chromatographic conditions. Though IDA can be used with inclusion lists to focus on expected metabolite transformations, unexpected transformations will remain unexplored. Therefore, using preacquisition on mass lists for phase I and II, respectively, can help to maximise the amount of useful information. Information is defined as a set of characteristics that alert the user to the presence of a known or unknown compound. IDA (information dependent acquisition) can ensure that unexpected metabolites can be more effectively detected and confirmed in a single injection.

Results

IDA for the Identification of Proteins

The identification of peptides at impact the overall sensitivity and specificity of the entire search process. Though IDA can be used with inclusion lists to focus on expected protein transformations, the detection of unexpected modifications is not possible. Therefore, using preacquisition on mass lists for phase I and II, respectively, can help to maximise the amount of useful information. Table 1. List of possible survey and dependent scans available on Q TRAP®

Methods

The QTRAP® functionalities allow users to devise experiments for their specific applications, with a high degree of accuracy and increased resolution. The result is an increased confidence in the results obtained, the ability to further refine experiments for more thorough investigation together with a decrease in resource utilization.

REFERENCES

2. N. Pace, T. Gamble, J. C. Y. LeBlanc, The power of Information Dependent Acquisition: a hybrid RF/DC quadrupole-linear ion trap system brings together the power of instrument specificity and sensitivity, with the automation of IDA to maximise the value of MS data in a plethora of applications – the range of analytical performance spanned from discovery and toxicology to proteomic applications. This paper presents the implementation and application possibilities of IDA on a Q TRAP® system to maximise data collection from single MS to MS3.
3. The QTRAP® instrument offers both the specificity of triple quadrupole scan (neutral loss and precursor ion) and the usual QTRAP® full scan MSMS sensitivity on the same platform. This flexible nature in combination with IDA allows the user to minimize the number of experiments required to obtain the right answer. The specificity of the survey scan has the added benefit of collecting only the useful information in the minimum amount of experiment, thus simplifying the data review process. Specificity for precursor applications can also be obtained with the Multidimensional Charge Scan (MDCS) of the QTRAP®. The QTRAP® functionalities allow users to devise experiments for their specific applications, with a high degree of accuracy and increased resolution. The result is an increased confidence in the results obtained.

TRADEMARKS/LICENSING

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