

MIAPE: Column Chromatography

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Abstract

MIAPE - Column Chromatography (MIAPE-CC) is one module of the Minimal Information About a Proteomics Experiment (MIAPE) documentation system. MIAPE is developed by the Proteomics Standards Initiative of the Human Proteome Organisation (HUPO-PSI). MIAPE modules aim to deliver a set of technical guidelines representing the minimal information required to report and sufficiently support assessment and interpretation of a proteomics experiment. This MIAPE-CC module is the result of work carried out through the Sample Processing Workgroup of the Proteome Standards Initiative. It has been designed to specify a minimal set of information to document a column chromatography experiment.

MIAPE: Column Chromatography

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This module identifies the minimum information required to report the use of columns in a proteomics experiment, in a manner compliant with the aims as laid out in the 'MIAPE Principles' document [1]

Introduction

Several techniques exist within the proteomics domain to facilitate the separation of protein mixtures. One such approach involves the use of columns, which can be used to separate proteins or peptides based on a range of physical or chemical properties. For example, ion exchange chromatography separates on the basis of surface charge, and affinity chromatography separates based on ligand affinity. These reporting guidelines cover the use of columns for protein or peptide separation, with a view to supporting the sharing of best practice, validation of results, discovery of results and sharing of experimental data sets.

This document is a single module, as part of the MIAPE (Minimum Information about a Proteomics Experiment) family of reporting guidelines, produced by the Proteomics Standards Initiative (www.psidev.info). MIAPE is structured around a parent document that lays out the principles of a reporting guideline [1]. In brief, a MIAPE module represents the minimum information that should be reported about a dataset to allow a reader to interpret and critically evaluate the conclusions reached, and to support their experimental corroboration. In practice a MIAPE module comprises a checklist of information that should be provided (for example about the protocols employed) when a data set is submitted to a public repository. The MIAPE modules specify neither the format that data should be transferred in, nor the structure of the repository. However, the Proteome Standards Initiative is not developing the modules in isolation; several compatible data exchange standards are now well established and supported by public databases.

These reporting guidelines cover a column chromatography experiment from the selection and configuration of a column, through the selection of a suitable mobile phase, to the collection of fractions and associated detector readings. These guidelines do not explicitly cover a sample preparation procedure but facilitate the description of the sample. They do not include protein identification procedures. Where multidimensional chromatography is used, the material below is repeated as required for each dimension, with specific fractions from one column being used as the sample for another. Items falling outside the scope of this module may be captured in complementary modules, which can be obtained from the website (<http://www.psidev.info/index.php?q=node/91>). Note that subsequent versions of this document may have altered scope, as will almost certainly be the case for all the MIAPE modules.

The following section, detailing the reporting requirements for column chromatography is subdivided as follows:

1. General features
2. Equipment
3. Mobile Phase
4. Properties of the Column Run
5. Pre and Post Run Processes
6. Column Outputs

If multiple dimensions of separation are performed, Sections 2-6 should be repeated as appropriate.

Reporting requirement for Column Chromatography

1. General features

- a) Global Descriptors
 - Date stamp (as YYYY-MM-DD)
 - Responsible person (or institutional role if more appropriate); name, affiliation and stable contact information
- b) Sample
 - Brief description of sample
 - Processing applied to the sample
 - Sample injection

2. Equipment

- a) Product Details for Column
 - Manufacturer
 - Model
 - Separation mode
- b) Physical Characteristics of Column
 - Dimensions
 - Description of stationary phase
 - Additional accessories
- c) Chromatography System Used for the Separation
 - Manufacturer
 - Model

3. Mobile Phase: for each mobile phase

- Name of mobile phase
- Description of constituents

4. Properties of the Column Run

- Time
- Gradient
- Flow rate
- Temperature

5. Pre and Post Run Processes

- Type
- Substance
- Time
- Volume

6. Column Outputs

- a) Detection
 - Equipment used for detection
 - Type
 - Equipment settings
 - Timescale over which data was collected
 - Trace

- b) Fractions
 - Fraction name
 - Fraction description

In multi-dimensional separations, stages 1(b) to 6 are repeated.

Summary

The *MIAPE: Column Chromatography* minimum reporting requirements for columns for protein separation specify that a significant degree of detail be captured, for separations according to different physical and chemical criteria. However, providing the information required by this document should enable the effective interpretation and assessment of the results of downstream analyses, for example to identify or quantify the proteins present in a sample and potentially, support experimental corroboration. Much of the information required herein may already be stored in an electronic format, or exportable from the instrument; we anticipate further automation of this process.

References

1. Taylor C.F., Paton N.W., Lilley K.S., Binz P.-A., Julian R.K. Jr, Jones A.R., Zhu W., Apweiler R., Aebersold R., Deutsch E.W., Dunn M.J., Heck A.J.R., Leitner A., Macht M., Mann M., Martens L., Neubert T.A., Patterson S.D., Ping P., Seymour S.L., Souda P., Tsugita A., Vandekerckhove J., Vondriska T.W., Whitelegge J.P., Wilkins M.R., Xenarios I., Yates III J.R., Hermjakob H., The minimum information about a proteomics experiment (MIAPE), *Nature Biotech*, August;25(8), 887 - 893, 2007. <http://www.nature.com/nbt/journal/v25/n8/abs/nbt1329.html>.

Appendix One. The MIAPE: Column Chromatography glossary of required items

Classification	Definition
1. General Features	
1. General Features – (a) Global Descriptors	
Date Stamp	The date on which the work described was initiated; given in the standard 'YYYY-MM-DD' format (with hyphens).
Responsible person or role (or institutional role if more appropriate); provide name, affiliation and stable contact information	The (stable) primary contact person for this data set; this could be the experimenter, lab head, line manager, etc. Where responsibility rests with an institutional role (e.g. one of a number of duty officers) rather than a person, give the official name of the role rather than any one person. In all cases give affiliation and stable contact information.
1. General Features – (b) Sample	
Brief description of sample	A description of the source, such as means of collection, volume, concentration or previous step of processing. Include information about tags, molecular mass, pH and anything else relevant to experiment. In a multi-dimensional separation, this should contain the name of the fraction from the previous dimension.
Processing applied to the sample	A brief description of processing applied to the sample, including the buffer, the volume, any pre-treatments (such as the addition of an acid to facilitate binding) and any tag applied.
Sample injection	A description of sample injection procedure, such as details of the temperature and flow rate.
2. Equipment.	
2. Equipment. – (a) Product Details for Column	
Manufacturer	The name of the manufacturer.
Model	The model number provided by the manufacturer.
Separation mode	A description of the type of column being used. (e.g., Separation mechanism: Affinity, Anion Exchange, Cation Exchange, Reverse Phase, Hydrodynamic Volume).
2. Equipment. – (b) Physical Characteristics of Column	
Dimensions	The dimensions of the column in terms of length and inner diameter or the total volume of the column where this value is appropriate, for example to describe gel filtration experiments.
Description of stationary phase.	A description of the constituents of the stationary phase, including the name of the packing material and the particle size, or describe packing materials including their manufacturer if stationary phase obtained separately from column.
Additional accessories	Details of any guards or traps used in conjunction with the column.
2. Equipment. – (c) Chromatography system used for the separation, where applicable.	
Manufacturer	The name of the manufacturer.
Model	The model name provided by the manufacturer.
3. Mobile Phase: for each mobile phase	
Name of mobile phase	Name used to refer to mobile phase in <i>Properties of Column Run</i> .

Description of Constituents	For each constituent, a description and the concentration.
<i>4. Properties of the Column Run (parameters that may change over time)</i>	
Time	The total time of the Column Run with appropriate units.
Gradient	The proportion of each of the mobile phases at a point in time, or the function describing the gradient, including the overall duration of the gradient. There may be several steps that together make up the gradient.
Flow rate	The rate at which the mobile phase is applied to the column, including the time period for which this holds if it varies during the experiment.
Temperature	The temperature at which the column is run, including the time period for which this holds if it varies during the experiment.
<i>5. Pre and Post Run Processes.</i>	
Type	A description of the purpose of the process, such as equilibration, calibration or washing.
Substance	A description of the reagent used in the process.
Time	The duration of the process.
Flow rate	The rate at which the mobile phase is applied to the column.
<i>6. Column outputs</i>	
<i>6. Column outputs – (a) Detection (if appropriate – this section would not normally be used for post-processing such mass spectrometry, for which additional MIAPE modules exist. In addition, this section may not be required if the trace has not been used for an analytical purpose.)</i>	
Equipment used for detection	Manufacturer and model, or description.
Type	A description of the kind of detector (e.g. UV).
Equipment settings	A description of control properties of the detector, such as the wavelength that is being detected.
Timescale over which data was collected	The time range covered by the trace produced by the detector.
Trace	The location and format of the trace if appropriate.
<i>6. Column outputs – (b) Fractions (if separation purpose is preparative)</i>	
Fraction name	An optional name, unique within a run, by which a fraction can be referenced.
Fraction description	Either a description of the procedure by which the fractions were collected i.e. start/end time, size (time or volume), mode (fixed or peak directed), or a description of the individual fractions (e.g. time of collection, volume).