

PROTEIN IDENTIFICATION IN BIOLOGICAL AND BIOMARKER RESEARCH

BENJAMIN LAU YII CHUNG; NURASSIKIN MUSTAM; HASLIZA HASSAN;
ABRIZAH OTHMAN and UMI SALAMAH RAMLI

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Proteomics is the systematic identification and characterisation of proteins, their structures and functions. The Proteomics and Metabolomics (PROMET) at the Advanced Biotechnology and Breeding Centre (ABBC) of the Malaysian Palm Oil Board (MPOB) has extensive experience in the analyses of protein using mass spectrometry. The facility provides support, equipment and expertise for analysing complex protein mixtures. The proteomics set up was developed based on one-dimensional (1D) or two-dimensional (2D) gel electrophoresis (GE) coupled to Matrix-assisted Laser Desorption Ionization-Time-of-Flight/Time-of-Flight mass spectrometer (MALDI-TOF/TOF MS) for numerous research efforts in MPOB, within areas such as oil palm disease, yield traits and modulation of oil palm fruit ripening (Hassan *et al.*, 2013; Lau *et al.*, 2015; 2016a, b; 2017). Proteomics analysis helps to identify proteins towards understanding biological roles, clarification of biological mechanisms and identification of biomarkers.

THE TECHNOLOGY

Figure 1 outlines the steps in large-scale and comprehensive protein analysis which involve the following components:

- Protein separation;
- Protein digestion;
- Peptide mass analysis using mass spectrometry; and
- Mass spectra interpretation.

Crude protein separation can be performed through one-dimensional (1D) or two-dimensional (2D) gel electrophoresis (GE), based on their molecular weights (1DGE only) and isoelectric points. Gel bands (1D) or spots (2D) containing separated proteins are excised and enzymatically cut into fragments of the proteins or peptides using protease(s). Amino acid sequence of the peptide can be identified using MALDI-TOF/TOF MS followed by identification with theoretical peptide mass for the protein. Several protein-sequence databases are readily available in the public domain, such as SWISSPROT and NCBI.

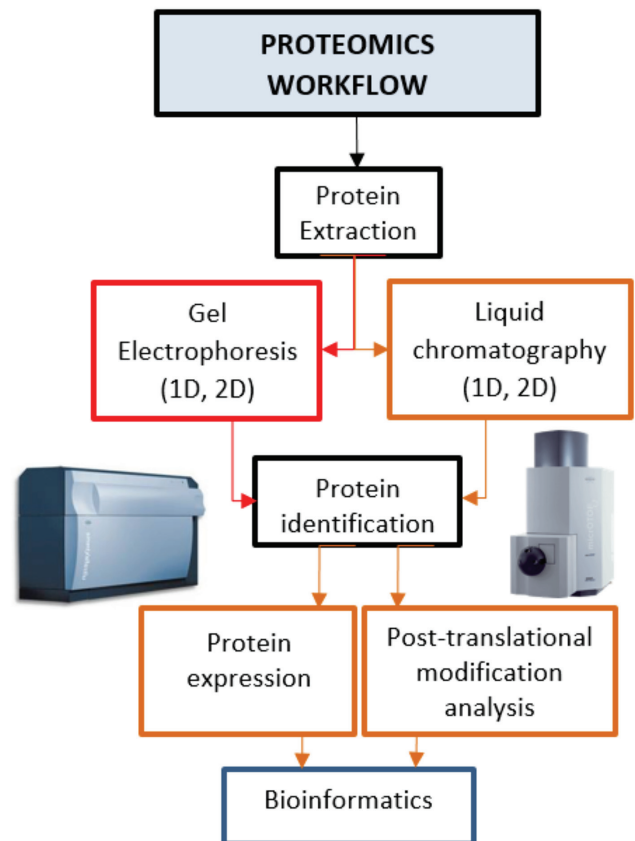


Figure 1. General workflow for proteomics-based research.

SERVICE OFFERED

The availability of a MALDI-TOF/TOF MS instrumentation enables MPOB to offer a variety of proteomics services to protein scientists. The service offered will facilitate proteomics research in Malaysia by providing essential proteomics tools and the required advanced instrumentation to carry out protein identification towards solving various biological problems, not only related to the oil palm industry but to other agricultural and non-agricultural industries as well. This service would also promote national collaborations between MPOB with other research institutions and provide training/consultation platforms. Services offered are as following:

- Protein separation using one-dimensional sodium dodecyl sulphate polyacrylamide gel electrophoresis (SDS-PAGE);

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Head of Corporate Implementation and Consultancy Unit, Malaysian Palm Oil Board. 6, Persiaran Institusi, Bandar Baru Bangi, 43000 Kajang, Selangor, Malaysia.
Tel: 03-8769 4574 Fax: 03-8926 1337 E-mail: tot@mpob.gov.my Website: www.mpob.gov.my



- Tryptic digestion of proteins obtained from SDS-PAGE 1D, enzymatic digestion (in-gel or in-solution) and peptide clean-up;
- Analysis of the digests mass spectrometrically to provide basic identification or validation; and
- Customised services such as experimental design, consultation and training.

NOVELTY

1. Gel-based proteomics is the most versatile and mature method used in many plant proteomics studies.
2. A complete and flexible proteomics pipeline has been developed at MPOB and we are offering the services from experimental design/sample preparation to protein mass spectrometry analysis. MPOB will also be the second national research institution that offers MALDI-TOF/TOF MS analysis at the moment.

IMPACT

Protein identification service would make high-level technology, equipment and expertise for studying proteins in cells and tissues available to the biological and biomarker-related researchers in Malaysia. The service will aid in understanding how proteins work, for example, the infection mechanism of *Ganoderma* disease in the oil palm industry, or how proteins work together in cells and tissues. Close collaborations could help in developing proteomics application projects and share the expertise required to answer critical biological questions and in search of protein biomarkers.

ECONOMIC ANALYSIS

Service types	Service details	Price (RM)	
		Academic	Commercial
1D gel up to 10 wells - Coomassie stained	Sample preparation, run gel, staining with Coomassie, image capture with a scanner	150/gel	200/gel
In-gel Digestion	To include reduction and alkylation; peptide clean-up	200/sample	250/sample
In-solution Digestion	To include reduction and alkylation; peptide clean-up	150/sample	200/sample
Basic protein identification	MS and MS/MS data acquisition, database search and report	200/sample	250/sample
Customised services		Enquiry	

CONCLUSION

The PROMET laboratory at MPOB embarks on specialised proteomics research that utilises MALDI-TOF/TOF MS technology, not only to study the oil palm, but also other proteomics-based applications.

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For more information, kindly contact:
 Head of Corporate Implementation and Consultancy Unit,
 MPOB, 6, Persiaran Institusi, Bandar Baru Bangi,
 43000 Kajang, Selangor, Malaysia
 Tel: 03-8769 4574 Fax: 03-8926 1337
 E-mail: tot@mpob.gov.my www.mpob.gov.my