Australian Government

Department of Education, Employment and Workplace Relations

MSL975009A Apply routine chromatographic techniques

Revision Number: 1

MSL975009A Apply routine chromatographic techniques

Modification History

Not applicable.

Unit Descriptor

Unit descriptor	This unit of competency covers the ability to analyse samples using routine chromatographic techniques. The unit also includes establishing client needs for routine and non-routine samples, optimising enterprise procedures and instruments for specific samples, obtaining valid and reliable data and reporting test results. Personnel are required to recognise atypical test data/results and troubleshoot common analytical procedure and equipment problems.

Application of the Unit

Application of the unit	This unit of competency is applicable to laboratory technical officers working in all industry sectors. All operations and analytical methods must comply with relevant standards, appropriate procedures and/or enterprise requirements. Although a supervisor may not always be present, the technician will follow standard operating procedures (SOPs) that clearly describe the scope of permitted practice including varying enterprise/test procedures and communicating results to people outside the laboratory. Industry representatives have provided case studies to illustrate the practical application of this unit of competency and to show its relevance in a workplace setting, at the end of this unit of competency under the section 'This competency in practice'.

Licensing/Regulatory Information

Not applicable.

Pre-Requisites

Prerequisite units		
	MSL974003A	*Perform chemical tests and procedures*
		OR
	MSL974004A	*Perform food tests*
		OR
	MSL974006A	*Perform biological procedures*
	MSL973007A	*Perform microscopic examination*
	MSL973004A	*Perform aseptic techniques*
		AND
	MSL973002A	*Prepare working solutions*
		OR
	MSL974001A	*Prepare, standardise and use solutions*

Employability Skills Information

Employability skills	This unit contains employability skills.

Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.

Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Establish client needs and schedule analysis	1.1. Liaise with client or sample provider to determine client needs and sample history 1.2. Record sample description, compare with specification and record and report discrepancies 1.3. Identify non-routine samples and the possible need to vary enterprise procedures 1.4. Seek advice from supervisor about any proposed variations and document all approved changes 1.5. Schedule analysis using enterprise procedures
2. Prepare samples and standards	2.1. Obtain a representative analytical portion of the laboratory sample 2.2. Prepare sample in accordance with testing requirements 2.3. Prepare validation checks for analytical portion
3. Set up and optimise instrument	3.1. Perform pre-use and safety checks in accordance with enterprise procedures 3.2. Start up and condition the instrument using enterprise procedures 3.3. Optimise instrumental parameters to suit sample and test requirements 3.4. Check calibration status of instrument and perform calibration using specified standards and procedures, if applicable
4. Perform analysis	4.1. Measure analyte response for standards, validation checks and samples 4.2. Conduct sufficient measurements to obtain reliable data 4.3. Return instruments to standby or shutdown condition, as required
5. Process and analyse data	5.1. Confirm data is the result of valid measurements 5.2. Perform required calculations and ensure results are consistent with standards or estimations and expectations 5.3. Record results with the appropriate accuracy, precision and units 5.4. Analyse trends in data and/or results and report out of specification or atypical results promptly to appropriate personnel 5.5. Troubleshoot analytical procedure or equipment

ELEMENT	PERFORMANCE CRITERIA
	problems which have led to atypical data or results
6. Maintain a safe work environment	6.1. Identify risks, hazards, safety equipment and control measures associated with sample handling, preparation and analytical method 6.2. Use personal protective equipment and safety procedures specified for test method and materials to be tested 6.3. Minimise the generation of wastes and environmental impacts 6.4. Ensure the safe disposal of laboratory wastes 6.5. Clean, care for and store equipment and consumables in accordance with enterprise procedures
7. Maintain laboratory records	7.1. Enter approved data and results into laboratory information management system (LIMS) 7.2. Maintain equipment logs in accordance with enterprise procedures 7.3. Maintain security and confidentiality of laboratory data and enterprise information 7.4. Communicate results to appropriate personnel

Required Skills and Knowledge

REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

Required skills

Required skills include:

- interpreting client requests, test methods and procedures
- setting up and shutting down equipment using enterprise procedures
- checking the calibration/qualification status of equipment
- preparing standards and samples
- installing and maintaining a variety of chromatographic columns
- choosing and optimising procedures and equipment settings to suit sample/test requirements
- operating equipment to obtain valid and reliable data
- making approved adjustments to procedures for non-routine samples
- recognising atypical data/results
- identifying and calculating potential sources of uncertainty
- troubleshooting common procedure and equipment problems
- applying theoretical knowledge to interpret data and makes relevant conclusions
- recording and reporting data/results in accordance with enterprise procedures
- maintaining security, integrity and traceability of samples and documentation
- followingoccupational health and safety (OHS) procedures and principles of good laboratory practice (GLP)

Required knowledge

Required knowledge includes:

- chromatographic principles and concepts related to instrumentation operation, material preparation and testing
- handling of unstable or hazardous chemicals and samples and/or the fragile/labile nature of biological material
- sample preparation procedures
- use of chromatographic techniques for qualitative and quantitative analysis
- function of key components of the instrument
- use of different chromatographic methods for analysis and preparation of specific samples
- effects on outputs and results of modifying instrumental variables (e.g. injection temperature, gas flow rate, column pressures, column type and detector type)
- procedure for optimising separation through changing operation parameters (e.g. injection technique, solvent type, sample size and sample preparation)
- basic procedure and equipment troubleshooting techniques

REQUIRED SKILLS AND KNOWLEDGE

- preparation and use of calibration charts and/or standards
- calculation steps to give results in appropriate precision and units
- enterprise and/or legal traceability requirements
- basic equipment maintenance procedures
- relevant health, safety and environment requirements

Specific industry

Additional knowledge requirements may apply for different industry sectors. For example:

Biomedical and environmental services:

- techniques that capitalise on biological properties to assist in chromatographic separations

Evidence Guide

EVIDENCE GUIDE	
The Evidence Guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.	
Overview of assessment	
Critical aspects for assessment and evidence required to demonstrate competency in this unit	Assessors should ensure that candidates can: • interpret client requests, test methods and procedures accurately • safely set up and shut down equipment using enterprise procedures • check calibration/qualification status of equipment • prepare standards and samples appropriately • install and maintain a variety of chromatographic columns • choose and optimise procedures and equipment settings to suit sample/test requirements • operate equipment to obtain valid and reliable data • make approved adjustments to procedures for non-routine samples • recognise atypical data/results • troubleshoot common procedure and equipment problems • apply theoretical knowledge to interpret data and makes relevant conclusions • record and report data/results in accordance with enterprise procedures • maintain security, integrity and traceability of samples and documentation • follow OHS procedures and principles of GLP.
Context of and specific resources for assessment	This unit of competency is to be assessed in the workplace or simulated workplace environment. This unit of competency may be assessed with: • *MSL925001A Analyse data and report results*. Resources may include: • standard laboratory equipped with routine chromatographic equipment, laboratory reagents and equipment • SOPs and test methods.

EVIDENCE GUIDE	
Method of assessment	The following assessment methods are suggested: • review of test data/results obtained by the candidate over time to ensure accuracy, consistency and timeliness of results • inspection of test records and workplace documentation completed by the candidate • feedback from peers and supervisors • observation of candidate applying a range of routine chromatographic techniques • oral or written questioning of chemical principles and concepts, chromatographic techniques and enterprise procedures. In all cases, practical assessment should be supported by questions to assess underpinning knowledge and those aspects of competency which are difficult to assess directly. Where applicable, reasonable adjustment must be made to work environments and training situations to accommodate ethnicity, age, gender, demographics and disability. Access must be provided to appropriate learning and/or assessment support when required. The language, literacy and numeracy demands of assessment should not be greater than those required to undertake the unit of competency in a work like environment.
This competency in practice	Industry representatives have provided the case studies below to illustrate the practical application of this unit of competency and to show its relevance in a workplace setting. **Manufacturing** Technicians who conduct chemical synthesis frequently use chromatographic methods such as thin-layer chromatography (TLC), gas chromatography (GC), high performance liquid chromatography (HPLC) and other instrumental techniques to check the identity and purity of the material they have produced. For example, a technician reacted an amine with acetic anhydride to form the acylated amine to prepare a pilot batch of material for a new application. After completing the reaction, the technician collected the product in a

EVIDENCE GUIDE	
	Buchner funnel using vacuum assisted filtration, and used chromatographic techniques to purify the material. The product was then analysed by HPLC using a number of stationary phases and solvent systems. In each case, a reference standard was run. These tests confirmed the identity and purity of the material. **Biotechnology** Technicians in research facilities often prepare a protein by extracting it from tissue. This extraction process introduces impurities that must be removed before the purified protein is ready for use or the characterisation of its purity and molecular weight. Impurities such as salt, detergents and other proteins are sequentially removed by passing the protein extract through gel filtration columns of differing grades of chromatographic gel. For antibodies, the final column used is an affinity chromatography column. Demonstration of the purity of the protein is by the presence of one single band on an SDS-PAGE gel. The molecular weight of the protein can also be determined from the SDS gel. **Environment** An environmental protection authority was required to sample an oil slick off Australia's coast and to take oil samples from all ships which docked in Australian ports in the 48 hours after the discovery of the oil slick. The samples were analysed by column chromatography and compared with the oil slick 'finger print' of the oil samples from all ships which may have been in the area of the oil slick. Given that the analysis involved unknown oil samples and the results would be used in court proceedings, the analysts were careful to optimise the chromatographic system for the unknown samples, ensure that appropriate quality and control procedures were employed and that the sample and analyses were performed quickly before potentially polluting ships left Australian waters. The analysts were careful to ensure that all record keeping procedures would be able to stand up to court scrutiny.

Range Statement

RANGE STATEMENT	
The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.	
Codes of practice	Where reference is made to industry codes of practice, and/or Australian/international standards, it is expected the latest version will be used

Standards, **codes**, **procedures and/or enterprise requirements**	Standards, codes, procedures and/or enterprise requirements may include:
	• Australian and international standards, such as:
	  • AS ISO 17025-2005 General requirements for the competence of testing and calibration laboratories
	  • AS/NZS 2243 Set:2006 Safety in laboratories set
	  • AS/NZS 2982.1:1997 Laboratory design and construction - General requirements
	  • AS/NZS ISO 14000 Set:2005 Environmental management standards set
	  • AS/NZS ISO 9000 Set:2008 Quality management systems set
	  • AS ISO 1000-1998 The international system of units (SI) and its application
	• Eurachem/CITAC Guide CG4 Quantifying uncertainty in analytical measurement
	• Australian code of good manufacturing practice for medicinal products (GMP)
	• calibration and maintenance schedules
	• cleaning, hygiene and personal hygiene requirements
	• data quality procedures
	• enterprise procedures, SOPs and operating manuals
	• enterprise recording and reporting procedures
	• equipment startup, operation and shutdown procedures

RANGE STATEMENT	
	• incident and accident/injury reports • material safety data sheets (MSDS) • material, production and product specifications • national measurement regulations and guidelines • principles of GLP • production and laboratory schedules • quality manuals, equipment and procedure manuals • quality system and continued improvement processes • safety requirements for equipment, materials or products • sampling procedures (labelling, preparation, storage, transport and disposal) • schematics, work flows and laboratory layouts • statutory and enterprise OHS requirements • stock records and inventory • test procedures (validated and authorised) • training program contents • waste minimisation, containment, processing and disposal procedures
Routine chromatographic techniques	Routine chromatographic techniques include both analytical and preparative procedures, and may include: • standard sample introduction systems • paper such as ascending and descending • thin-layer such as ascending, high performance, radical and descending • column chromatography • affinity chromatography and gel filtration chromatography • gas liquid and gas solid chromatography • high performance liquid chromatography, such as liquid-liquid (LLC), liquid-solid (LSC), ion (IC) and size exclusion (SEC)
Tests	Tests may include methods for: • control of starting materials, in-process materials and finished products (e.g. manufacturing, petroleum and biotechnology)

RANGE STATEMENT	
	• selection of appropriate separation technique, such as suitable substrate and support solvent, buffer, temperature, flow rate, column length and detection method • forensic testing • environmental monitoring of pollutants in air, water and soil • troubleshooting enterprise processes
Sample preparation	Sample preparation may include: • identification of any hazards associated with samples and/or analytical chemicals • grinding, dissolving, extraction, filtration, refluxing, centrifuging, evaporation, washing and drying • determination of and, if appropriate, removal of any contaminants, impurities or interfering substances
Common procedure and equipment problems	Common procedure and equipment problems may include: • problems with interfering substances • poor resolution of peaks • inappropriate selection of column or operating parameters (flow rate and temperature) • unsuitable substrate or support solvent • lack of suitable reference standards
Hazards	Hazards may include: • electric shock • biohazards, such as microbiological organisms and agents associated with soil, air, water, blood and blood products, and human or animal tissue and fluids • transformed cultures/organisms and genetically altered organisms • chemicals, such as acids, phenol, benzene and ammonium persulphide • sharps and broken glassware • sources of ignition and hot surfaces, such as burners • aerosols from broken centrifuge tubes and pipetting

RANGE STATEMENT	
	• flammable liquids and gases (e.g. hydrogen) • cryogenics such as dry ice and liquid nitrogen • disturbance or interruption of services
Addressing hazards	Addressing hazards may involve: • use of MSDS • labelling of samples, reagents, aliquoted samples and hazardous materials • use of personal protective equipment, such as gloves, safety glasses and coveralls • use of fumehoods, direct extraction of vapours and waste gases • use of appropriate equipment, such as biohazard containers, laminar flow cabinets, Class I, II and III biohazard cabinets • use of Class PCII, PCIII and PCIV physical containment laboratories • handling and storage of all hazardous materials and equipment in accordance with labelling, MSDS and manufacturer's instructions
Occupational health and safety (OHS) and environmental management requirements	OHS and environmental management requirements: • all operations must comply with enterprise OHS and environmental management requirements, which may be imposed through state/territory or federal legislation - these requirements must not be compromised at any time • all operations assume the potentially hazardous nature of samples and require standard precautions to be applied • where relevant, users should access and apply current industry understanding of infection control issued by the National Health and Medical Research Council (NHMRC) and State and Territory Departments of Health

Unit Sector(s)

Unit sector	Testing

Competency field

Competency field	

Co-requisite units

Co-requisite units		