

CH9A1-10 Analytical and Polymer Laboratories

26/27

Department

Chemistry

Level

Taught Postgraduate Level

Module leader

Rachel Hand

Credit value

10

Module duration

10 weeks

Assessment

100% coursework

Study location

University of Warwick main campus, Coventry

Description

Introductory description

This module contains a combination of practical analytical and polymer chemistry experiments. The analytical components cover the fundamentals of qualitative and quantitative analysis and the laboratory sessions will include chromatography, titration and Inductively Coupled Plasma (ICP) analysis, (Infra-red (IR) and Raman spectroscopy and Nuclear Magnetic Resonance (NMR) Spectroscopy. The polymer component will introduce students to a range of polymerization techniques, including controlled radical, free radical, ionic and heterogeneous polymerization. The course will serve to introduce students to safety aspects of laboratory work and the students will gain experience and expertise in the use of research quality analytical equipment.

Module aims

MSc students on our Analytical and Polymer Science (APS) MSc degree (1 year full time, RSC accredited) are currently required to take analytical module CH915 (Techniques in Quantitative and Qualitative Analysis) in order to fulfil the practical aspects of their course. However, it would be beneficial for students to have the opportunity to gain experience of polymer chemistry alongside the analytical components. This module is designed to be an optional core (students are required to take this module or CH915) which students can opt to take. The practical work is

designed to retain the learning objectives related to the quantitative and qualitative analytical work in CH915. The module will introduce students from a range of backgrounds to laboratory practice, including techniques in Analytical Science and Polymer Science.

Outline syllabus

This is an indicative module outline only to give an indication of the sort of topics that may be covered. Actual sessions held may differ.

Lab Induction

Experiment I – Free Radical Polymerisation

Experiment II – Chromatography

Experiment III – Controlled Radical Polymerisation

Experiment IV – Titration & Inductively Coupled Plasma (ICP)

Experiment VI – Infra-red (IR) and Raman Spectroscopy

Experiment V – Nuclear Magnetic Resonance (NMR)

Experiment VII – Ionic Polymerisation

Experiment VIII – Heterogeneous polymerisation

Experiment IX – Analysis of heterogeneous polymerisation

Learning outcomes

By the end of the module, students should be able to:

- Analytical component: The module will equip students from a range of different backgrounds with essential quantitative and qualitative skills necessary for later modules, to include: • Principles of Chromatography • Titration and Inductively Coupled Plasma (ICP) • Infra-Red (IR) and Raman Spectroscopy • Nuclear Magnetic Resonance (NMR) spectroscopy
- Polymer component: By the end of the module, students should be able to: • Critically search literature prior to the lab work • Perform organic reactions for the initiator, monomer or catalyst synthesis • Display an advanced level of synthetic skill in handling polymerization reactions under inert atmosphere • Understand the advanced techniques to synthesize and characterize polymers • Understand how to report experimental findings in international journals

Subject specific skills

Analytical (A) and Polymer (P) skills

Subject knowledge and understanding:

- Show an advanced understanding of the principles behind classical analytical and spectroscopic methods, and the functions of various components in complex spectroscopic instrumentation (A)
- Discriminate between various analytical techniques, understanding the advantages, disadvantages and current applications of each (A)
- Demonstrate the ability to evaluate and interpret data from a variety of measurements (A)
- Display practical consideration for sources and treatment of experimental error (A)

Key Skills:

- Communicate scientific material verbally and in writing (A and P)
- Demonstrate numeracy (A)
- Independently use information technology: data-fitting software and spreadsheets (A)
- Locate and evaluate relevant information from outside sources/literature research (A)
- Demonstrate the ability to literature search and report experiments (P)
- Demonstrate polymer characterization skills (P)
- Demonstrate understanding of different polymer characterization techniques (P)
- Manage time effectively (A and P)

Cognitive Skills:

- Critically analyse experimental data (A and P)
- Comprehensively assess errors in data (A and P)
- Test hypotheses using experimental data Interpret results with aid of information from the literature. (A and P)
- Interpret results with aid of information from literature (A and P)

Subject-Specific/Professional Skills:

- Follow good and safe practice in the laboratory (A and P)
- Demonstrate sound laboratory and measurement skills (A and P)
- Produce clearly written and original scientific reports (A and P)
- Research and reference relevant literature. (A and P)

Transferable skills

Analytical (A) and Polymer (P) transferable skills

1 Critical thinking

- Recognise patterns, themes and key messages from sometimes confused and incomplete data (A)
- Make informed decisions on the value of a range of sources allowing an evidence based conclusion based on this analysis (A)

2 Problem solving

- Use rational and logical reasoning to deduce appropriate and well-reasoned conclusions (A and P)
- Retain an open mind, optimistic of finding solutions, thinking laterally and creatively to look beyond the obvious (A and P)
- Know how to learn from failure (A and P)

3 Self-awareness

- Actively seek opportunities for personal development in the context of employment and life (A and P)

- Aware of personal strengths and emotional intelligence (A and P)
- Reflect on learning, seeking feedback on and evaluating personal practices, strengths and opportunities for personal growth (A and P)

4 Communication

- Communicate orally in a clear and sensitive manner which is appropriately varied according to different audiences (A and P)
- Written: Present arguments, knowledge and ideas, in a range of formats. Active listening: questioning, reflecting, summarising (A and P).

5 Teamwork and working effectively with others

- Operate within, and contribute to, a respectful, supportive and cooperative group climate (A and P)
- Sensitive to the impact of actions on others (A and P)

6 Information literacy (research skills)

- Critical awareness of how information is gathered, used, managed and synthesised (A and P)
- Understanding of the relative value of different sources and the importance of provenance (A and P)
- The systematic collection, analysis and evaluation of information in the investigation of a topic (A and P)

7 Digital literacy

- Has the capabilities that enable living, learning and working in a digital society (A)
- Comfortable with using digital media to communicate, solve problems, manage information, collaborate, create and share content (A)

11 Professionalism

- Prepared to operate autonomously (A)

Study

Study time

Type	Required
Practical classes	9 sessions of 6 hours (54%)
Private study	46 hours (46%)
Total	100 hours

Private study description

Self-study, preparation and lab reports – 46 hours

Costs

No further costs have been identified for this module.

Assessment

You do not need to pass all assessment components to pass the module.

Assessment group A

Assessment component	Weighting	Study time	Eligible for self-certification
Assessed workshops and labs, written laboratory reports. A written laboratory report, a completed pro forma, or an experimental plan.	100%		Yes (extension)

Reassessment component is the same

Feedback on assessment

Written work will be annotated and returned to students. Feedback on laboratory and workshop performance will be provided verbally during the laboratory sessions.

Availability

Courses

This module is Core optional for:

- Year 1 of TCHA-F1PX Postgraduate Taught Analytical and Polymer Science