

Research Methodology in Chemistry

Edited by
Fiona N.-F. How, Ph.D



IIUM PRESS

INTERNATIONAL ISLAMIC UNIVERSITY MALAYSIA

RESEARCH METHODOLOGY IN CHEMISTRY

Edited by

Fiona N.-F. How, Ph.D



IIUM Press

2011

Published by:
IIUM Press
International Islamic University Malaysia

First Edition, 2011
©IIUM Press, IIUM

All rights reserved. No part of this publication may be reproduced, stored in a retrieval system, or transmitted, in any form or by any means, electronic, mechanical, photocopying, recording, or otherwise, without any prior written permission of the publisher.

Perpustakaan Negara Malaysia

Cataloguing-in-Publication Data

Fiona N.-F. How
Research Methodology in Chemistry
Fiona N.-F. How

ISBN 978-967-418-202-1

ISBN: 978-967-418-202-1

Member of Majlis Pencerbitan Ilmiah Malaysia – MAPIM
(Malaysian Scholarly Publishing Council)

Printed by :
IIUM PRINTING SDN. BHD.
No. 1, Jalan Industri Batu Caves 1/3
Taman Perindustrian Batu Caves
Batu Caves Centre Point
68100 Batu Caves
Selangor Darul Ehsan

Table of content

Preface

Contributor

Reviewers

Chapter – 1: Research Methodology: An Introduction (6467/19269)	X
Chapter – 2: Good Chemistry Research (6467/19275)	6

Part One: Chemical Synthesis Based Research

Chapter – 1: Chemical Synthesis in General (5980/19279)	11
Chapter – 2: Design and Methodology (5980/19283)	17
Chapter – 3: Instrumentations for Chemical Analysis (5980/19290)	24
Chapter – 4: Separation and Purification Methods (5980/19293)	29

Part Two: Natural Products Based Research

Chapter – 1: Introduction (5641/19299)	37
Chapter – 2: Research in Natural Products (5641/19305)	40
Chapter – 3: Methods in Natural Products Research (5641/19308)	46
Chapter – 4: Bioactive Principle from Plants (5641/19311)	55
Chapter – 5: Biological Activity of Natural Products (5641/19489)	62
Chapter – 6: Standardization Process and Plant Metabolomics in Natural Products Research (5641/19490)	67

Part Three: Polymer Based Research

Chapter – 1: Natural Polymers (6312/19492)	73
Chapter – 2: Synthetic Polymers (6312/19494)	77
Chapter – 3: Polymer Analysis and Characterization (6312/19497)	86

Part Four: Analytical Based Research

Chapter – 1: Introduction (5678/19500)	92
Chapter – 2: Selecting a Research Topic and Writing a research proposal (5678/19502)	97

Chapter - 3: Sampling, measurement and result analyses (5678/19505) 105

Part Five: Laboratory Safety Practices

Chapter - 1: General Laboratory Safety Practices (5777/19507) ~~111~~

Chapter - 2: Personal Safety Equipment (5777/19511) ~~117~~

Chapter - 3: Laboratory Safety Equipment (5777/19515) 122

Chapter - 4: Laboratory Equipment Safety (5777/19516) 129

CHAPTER – 3

INSTRUMENTATIONS FOR CHEMICAL ANALYSIS

Shafida Binti Abd Hamid

Infrared Spectrometer

Infrared (IR) light is situated between visible and microwave lights of electromagnetic spectrum. Infrared spectroscopy is a common tool for chemists as it can be used to identify the types of bonds or functional groups in a molecule (Figure 3.1). Some compounds (particularly organic compounds) absorb particular wavelengths of infrared radiation, and convert it to molecular vibration energy (bending and stretching). The instrument does not provide the detailed molecular structure of a molecule, thus, it is normally used complimentary to Nuclear Magnetic Resonance (NMR) spectrometer (Rouessac and Rouessac, 2007).



Figure 3.1 Infrared Spectrometer

The IR spectrum gives a plot of wavenumbers, $\bar{\nu}$ (cm^{-1} , X-axis) versus % transmittance, T (Y-axis) (Figure 3.2). The band intensities can also be expressed as absorbance (A), while wavenumbers can be represented as wavelength:

$$A = \log_{10}(I/T)$$