

PRACTICAL PHARMACEUTICAL CHEMISTRY



Moji T. Bakare-Odunola
Ngaitad S. Njinga

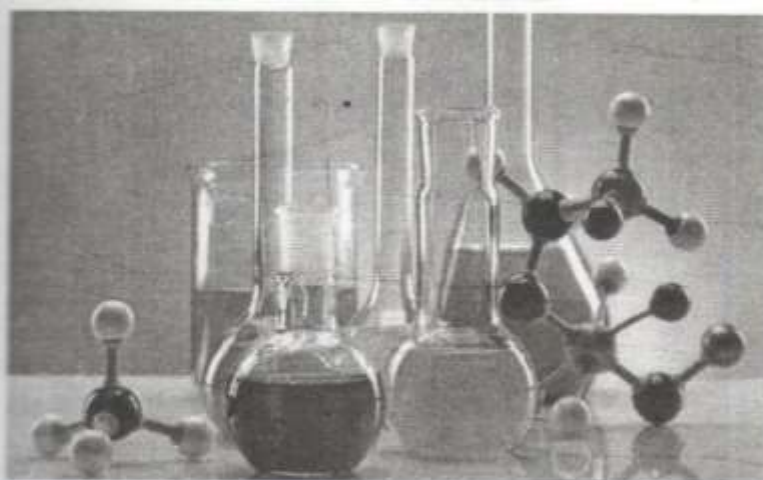
Sa'ad T. Abdullahi
Kudirat B. Mustapha

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**Moji T. Bakare-Odunola
Sa'ad T. Abdullahi
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PREFACE

Chemistry is an experimental science that cannot be effectively learned without practicing it. We have great pleasure in presenting this textbook of practical pharmaceutical chemistry for students of pharmacy and chemistry degree programmes in higher institutions. It also deals with all areas of pharmaceutical chemistry and covered quality control of pharmaceuticals with basic knowledge needed for instrumental analysis in a well simplified manner. The major goals of the book are to enable students to: 1) acquire basic chemical laboratory skills needed to become successful scientists as well as the acquisition of other (life-long) skills such as problem-solving, time management, organization etc. 2) learn and practice basic chemical principles by performing experiments in major fields of pharmaceutical chemistry such as organic, inorganic and physical chemistry. 3) become skilled in observing and documenting experiments. To achieve all these, we have selected simple experiments that can be easily conducted in a typical laboratory setting of a developing country with limited facilities. The scope of this textbook is distinct as it covers all aspects of the subject including instrumental methods of analysis and quality control. The book has been divided into seven parts. Part I as a way of introduction to practical classes focuses on some of the common experimental techniques used for carrying out experiments. It acquaints the students with laboratory precautions, and directives including use of reagents and report writing guidelines, identification and care of laboratory glassware. Part II looks at weighing and calibration of volumetric apparatus, melting point determination and purification of organic solid samples by recrystallization and simple synthesis leading to preparation of some salts as well as determination of alkalinity and total solids in water. Part III focuses on pharmaceutical qualitative inorganic chemistry with preliminary tests and systematic analysis of basic and acidic radicals. Part IV presents pharmaceutical analytical chemistry using chemical methods of analysis. Part V is on Pharmaceutical Organic Chemistry. It provides the systematic characterization and identification of organic compounds. Part VI is on instrumental methods of analysis mostly on UV-VIS Spectrophotometry, although Infra-Red, Nuclear Magnetic Resonance and Mass spectrophotometry were also included. Polarimetry, polarography and practical aspects of drug metabolism were included. Part

VII deals with Pharmaceutical Quality Control which involves identification and assay of some selected drug formulations based on British Pharmacopoeia.

Finally, simple experiments which can be carried out easily in any chemical laboratory were documented. Besides, provisions were made in the book for related experiments to permit selection/choice based on the available chemicals, reagents, cost and safety. *Exercises/Exercise* were provided at the end of each experiment(s) as a feedback mechanism to assess the level of understanding of the practical class by the students.

We hope you will find this book very useful. Authors will welcome constructive criticisms and suggestions for future improvement of this present effort.

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We are grateful to the Almighty God for giving us the strength, courage, wisdom and resilience to work and bring this endeavour to a successful completion.

In professional programmes such as pharmacy, it is imperative that students should be able to put into practice what they have learned in the classroom. As such we owe a deep sense of gratitude to all our students both past and present. We would also like to express our gratitude to authors of other practical pharmaceutical textbooks and the pharmacopoeias that served as our guide. There is no way in which we could have completed this textbook without their contributions.

We sincerely acknowledge our reviewers – Emeritus Professor Festus Adio Ogunbona (a retired professor of Pharmaceutical Chemistry, Obafemi Awolowo University, Ile-Ife) for his comments and constructive criticisms at different stages, and Professor Augustine A. Ahmadu (a serving Professor of Pharmaceutical and Medicinal Chemistry) for carefully reading, commenting and correcting this work. Despite their busy schedule, they both gave their valuable time to strengthen the textbook.

We would like to thank the Board and Management Team of Tertiary Education Trust Fund (TETFund), for approving the publication of this book. Thanks, must also go to all the staff of Department of Pharmaceutical and Medicinal Chemistry, University of Ilorin for providing the enabling environment, valuable moral and technical support that makes this type of endeavor possible. We extend our gratitude to the library and publication committee of University of Ilorin and the lecturers of Pharmaceutical and Medicinal Chemistry who have been disseminating knowledge in this field.

Last but not the least, we would like to express our gratitude to families, friends and colleagues who have helped us in seeing to the successful completion of this work. This textbook would not have seen the day's light without their unflinching encouragement, constant motivation and support.

CONTENTS

Preface.....	iii
Acknowledgements.....	vii
Contents	viii
 PART ONE: GENERAL INTRODUCTION	1
1.1 Introduction	1
1.1.1 Laboratory Precautions and Directives.....	3
1.1.3 Presentation of Practical Report.....	3
1.1.4 Suggestions for Work.....	3
1.1.5 Report-Writing Procedure	4
1.2 Identification, Washing and Drying of Glass-Wares.....	5
1.2.1 Laboratory Glass-Ware	5
1.2.2 Washing of Glass-Ware	5
1.2.3 Drying of Glass-Wares.....	6
1.2.4 Experiment	6
 PART TWO: VOLUMETRIC ANALYSIS	8
2.0 Weighting and Calibration of Volumetric Apparatus.....	8
2.1.0 Introduction.....	8
2.1.1 Measurement of Weight.....	8
2.1.2 Laboratory Balances	9
2.1.3 Errors in Weighing.....	9
2.2 Calibration of Volumetric Apparatus.....	10
2.3 Melting Point Determination	11
2.3.0 Introduction.....	11
2.3.1 Melting Point Determination	12
2.3.2 Mixed Melting Point.....	12
2.3.3 Procedure of Determining Melting Point.....	12
2.4 Purification of Organic Solid Sample by Recrystallization.....	13
2.4.0 Introduction.....	13
2.4.1 Procedure for Purification of Organic Solid Sample by Recrystallization	14
2.5 Preparation of Barium Chloride ($\text{BaCl}_2 \cdot 2\text{H}_2\text{O}$) and the Estimation of Water of Crystallization.....	16
2.5.0 Introduction.....	16

2.5.1	Preparation of Barium Chloride.....	17
2.5.2	Estimation of Water of Crystallization in Barium Chloride.....	17
2.6	Preparation of Disodium Phosphate ($\text{Na}_2\text{HPO}_4 \cdot 12\text{H}_2\text{O}$)	18
2.6.0	Introduction.....	18
2.6.1	Preparation of Disodium Phosphate.....	19
2.7	Preparation of Double Salts	19
2.7.0	Introduction.....	19
2.7.1	Preparation $\text{CuSO}_4 \cdot (\text{NH}_4)_2\text{SO}_4 \cdot 6\text{H}_2\text{O}$ from Ammonium Sulphate and Cupric Sulphate.....	19
2.7.2	Preparation of $\text{CuCl}_2 \cdot 2\text{KCl} \cdot 2\text{H}_2\text{O}$ from Cupric Chloride and Potassium Chloride	20
2.7.3	Preparation of Tetramine Copper (II) Sulphate Monohydrate ($\text{Cu}(\text{NH}_3)_4\text{SO}_4 \cdot \text{H}_2\text{O}$).....	20
2.8	Determination of Alkalinity (CaCO_3) in Water	21
2.8.0	Introduction.....	21
2.8.1	Procedure for the Determination of Alkalinity (CaCO_3) in Water	21
2.9	Test for Hardness of Water.....	22
2.9.0	Introduction.....	22
2.9.1	Determination of Calcium Ion in Water	23
2.10	Determination of Total Solids.....	23
2.10.0	Introduction.....	23
2.10.1	Procedure for Determining Total Solids in Water	24
2.11	Determination of Chloride in Water	24
2.11.0	Introduction.....	24
2.11.1	Procedure for Chloride Determination in Water.....	25
PART THREE: INORGANIC QUALITATIVE ANALYSIS		26
3.0	Introduction.....	26
3.1	Preliminary Tests	26
3.1.1	Physical Appearance	26
3.1.2	Dry Heating Test.....	27
3.1.3	Flame Test.....	29
3.1.4	Borax Bead Test	30
3.1.5	Dilute Sulphuric Acid Test.....	31
3.1.6	Potassium Permanganate Test.....	33

3.1.7	Concentrated Sulphuric Acid Test	33
3.1.8	Caustic Soda Test	34
3.2	Analysis of Basic Radicals	35
3.2.1	Preparation of Solution of the Mixture of Substances	35
3.2.2	Group I Basic Radicals	36
3.3	Analysis of Group II Basic Radicals	37
3.3.1	Group IIA Basic Radicals	38
3.3.2	Group IIB Basic Radicals	41
3.3	Analysis of Group III Basic Radicals	43
3.4	Analysis of Group IV Basic Radicals	44
3.5	Analysis of Group V Basic Radicals	46
3.6	Analysis of Group VI Basic Radicals	47
3.7	Examination of Acid Radicals	49
3.7.1	Preparation of Solution of the Mixture	49
3.7.2	Analysis of Carbonate and Bicarbonate	50
3.7.3	Analysis of Nitrite and Nitrate Radical	51
3.7.4	Analysis of Sulphate, Sulphide, Thiosulphate and Sulphate Radicals	52
3.7.5	Analysis of Chloride, Bromide and Iodide Radicals	53
3.7.6	Analysis of Oxalate, Chromate, Phosphates, Borate, Arsenate and Arsenite Radicals	55
3.8	Identification of Unknown Substance	56
3.9	Analysis of Mixture of Substances	56
PART FOUR: PHARMACEUTICAL ANALYTICAL CHEMISTRY		57
4.0	Introduction	57
4.1	Choice of Acid-Base Indicators	57
4.2	Acid – Base Titration in Aqueous Medium	60
4.2.1	Determination of Mixture of Borax and Boric Acid	60
4.2.2	Assay of Sodium Salicylate	61
4.2.3	Assay of Acetyl Salicylic Acid (Aspirin)	62
4.3	Non – Aqueous Acid – Base Titration	63
4.3.0	Introduction	63
4.3.1	Standardisation of 0.1M Perchloric Acid and Assay of Adrenalin BP	63
4.3.2	Assay of Lidocaine (Lignocaine) Hydrochloride	64

4.4	Redox Titration.....	65
4.4.1	Preparation and Standardization of 0.02M Potassium Permanganate Solution	65
4.4.2	Assay of Hydrogen Peroxide	66
4.4.3	Quantitative Determination of Calcium Gluconate by Redox Titration.....	67
4.4.4	Preparation of Standard Sodium Thiosulphate and Standardization of Iodine with Sodium Thiosulphate– Iodometry	68
4.4.5	Determination of the Percentage of Mercuric Chloride (HgCl_2).....	69
4.4.6	Quantitative Determination of Ascorbic Acid	70
4.4.7	Assay of Ferrous Sulphate	71
4.4.8	Preparation and Standardization of 0.1M Sodium Thiosulphate Solution and Assay of Copper Sulphate.	72
4.4.9	Assay of Copper Sulphate (CuSO_4).....	73
4.5	COMPLEXOMETRIC TITRATION.....	73
4.5.0	Introduction.....	73
4.5.1	Standardisation of Sodium Edetate	74
4.5.2	Analysis of Zinc Sulphate Eye Preparation	75
4.5.3	Determination of the Percentage Purity of Potassium Alum ($\text{KAl}(\text{SO}_4)_2 \cdot 12\text{H}_2\text{O}$).....	75
4.6	GRAVIMETRIC ANALYSIS.....	76
4.6.0	Introduction.....	76
4.6.1	Estimation of Chlorides	77
4.6.2	Determination of Aluminium as Aluminium Oxinate in Sample of Ammonium Alum.....	80
4.6.3	Determination of Percentage Na_2SO_4 in Sample of Sodium Sulphate.....	81
4.6.4	Determination of Calcium in Calcium Sulphate	81
4.6.5	Molecular Weight Determination	83
4.6.6	Gravimetric Determination of Atomic Weight of an Alkali Metal Sulphate	84
PART FIVE: PHARMACEUTICAL ORGANIC CHEMISTRY		86
5.0	Introduction.....	86
5.1	Systematic Characterization and Identification of Organic Compounds	87

5.1.1	Appearance and Smell	87
5.1.2	Determination of Elements in Organic Compounds.....	87
5.1.3	Lassaigne's Test for Organic Compounds.....	88
5.1.4	Action of Heat.....	90
5.1.5	Action of Soda Lime.....	90
5.2	Classification and Chemical Characterization of Organic Compounds	911
5.2.0	Introduction.....	91
5.2.1	Classification of Compounds According to Solubility.....	93
5.3	Determination of Functional Groups in Organic Compound	94
5.3.0	Introduction.....	94
5.3.1	Determination of Functional Group using Spectroscopic Method.....	94
5.3.2	Groups Containing C, H & O.....	95
5.3.3	Chemical Characterization of Functional Groups Containing C & H.....	99
5.3.4	Chemical Characterization of Functional Groups Containing Amines, Amides, Amino Acids	100
5.3.5	Chemical Characterization of Functional Groups Containing Ammonium Salts, Amides, Imides or Nitrites.....	101
5.3.7	Chemical Characterization of Functional Groups Containing C, H, O & Halogen	102
5.3.8	Chemical Characterization of Functional Groups Containing C, H, O & S	103
5.3.9	Chemical Characterization of Functional Groups Containing O & P	103
5.3.10	Chemical Characterization of Functional Groups Containing Halogen & Nitrogen.....	104
5.3.11	Chemical Characterization of Functional Groups Containing Halogens, O & S	104
5.3.12	Chemical Characterization of Functional Groups Containing C, H, N, O & S.....	104
5.3.13	Chemical Characterization Of Functional Groups Containing H, N, O & P.....	105
5.4	Separation of Mixtures of Organic Compounds.....	105
5.4.0	Introduction.....	105

5.4.1	Water Soluble + Insoluble Compounds.....	105
5.4.2	Organic Acid and Organic Base	106
5.4.3	Organic Acid, Organic Base and Neutral Organic Compound.....	106
5.5	Preparation of Derivatives for Characterization of Unknown.....	107
5.5.0	Introduction.....	107
5.5.1	Carboxylic Acids	107
5.5.2	Amines (Primary and Secondary)	109
5.5.3	Tertiary Amines	110
5.5.4	Alcohols	110
5.5.5	Aldehydes and Ketones.....	112
5.5.6	Amides, Esters and Nitriles.....	113
5.5.7	Nitro Compounds.....	113
5.5.8	Picrates of Aromatic Hydrocarbons.....	113
5.5.9	Nitration of Aromatic Compounds	113
5.6	Organic Synthesis	114
5.6.0	Introduction.....	114
5.6.1	Preparation of Benzyl Alcohol using Cannizaro's Reaction	115
5.6.2	Preparation of Benzoin (Benzoin Condensation)	116
5.6.3	Nitration of Acetanilide	116
5.6.4	Hydroxylation of Oleic Acid	117
5.6.5	Bromination of Cinnamic Acid.....	117
5.6.6	Preparation of Acetyl Salicylic Acid (Aspirin).....	118
5.6.7	Preparation of Methyl Salicylate (Oil of Winter Green)	118
5.6.8	Synthesis of Sulphanilic Acid.....	118
5.6.9	Synthesis of Phenolphthalein	119
5.6.10	Synthesis of Sulphacetamide	120
5.6.11	Preparation of Acetanilide from Aniline.....	120
5.6.12	Synthesis of Sulphanilamide from Acetanilide.....	121
PART SIX: INSTRUMENTAL METHODS OF PHARMACEUTICAL ANALYSIS.....		124
6.0	Introduction.....	124
6.1	The Effect of Cuvette Material and Stray Light on Absorption Curves	126
6.1.0	Introduction.....	126

6.2	Effects of Solvents, Nature of Sample and pH on the UV Absorption Spectra	128
6.2.0	Introduction.....	128
6.3	Qualitative Ultraviolet Spectrophotometry.....	131
6.3.0	Introduction.....	131
6.4	Colorimetry Determination of Copper Sulphate.....	132
6.4.0	Introduction.....	132
6.5	Infra Red Absorption Spectrophotometry.....	133
6.5.0	Introduction.....	133
6.5.1	Interpretation of Spectra	134
6.6	Nuclear Magnetic Resonance Spectroscopy (NMR)	138
6.6.0	Introduction.....	138
6.7	Mass Spectrometry.....	141
6.7.0	Introduction.....	141
6.7.1	Principal Type of Ions in Mass Spectrum.....	141
6.8	Determination of Specific Optical Rotation of Sucrose	142
6.9	Potentiometry	144
6.9.0	Introduction.....	144
6.9.1	Determination of pH of some Mixtures using Potentiometer or any pH Meter.....	146
6.10	Polarography	146
6.10.0	Introduction.....	146
6.11	Practical Aspects of Drug Metabolism	149
6.11.0	Introduction.....	149
6.11.1	Paper Chromatography	150
6.11.2	Thin Layer Chromatography.....	151
PART SEVEN: QUALITY CONTROL.....		153
7.0	Introduction.....	153
7.1	Identification and Spectrophotometric Determination of Paracetamol Tablets	153
7.1.1	Assay of Paracetamol.....	154
7.2	Identification and Assay of Aspirin Tablets	155
7.2.1	Assay of Aspirin	156
7.3	Dissolution Rate Test.....	156
7.3.0	Introduction.....	156

7.4 Quality Control of Oral Liquids using Paracetamol Syrup.....	158
7.4.0 Introduction.....	158
7.5 Assay of Paracetamol Capsules	1600
7.5.0 Introduction.....	160
7.6 Identification Test and Spectrophotometric Determination of Chloramphenicol Capsules	161
7.6.1 Assay of Chloramphenicol Capsules	162
7.7 Assay of Parenteral Preparations	162
7.7.0 Introduction.....	162
7.8 Analysis of Packaged Water	163
7.8.0 Introduction.....	163
7.9 Quantitative Determination of Identified Heavy Metals using Titrimetric Method.....	164
7.9.1 Determination of Ferrous Ion (Fe^{2+}).....	164
7.9.2 Determination of Lead (Pb) using Xylenol Indicator	165
7.10 Limit Test for Chlorides.....	165
References.....	165

PART ONE

GENERAL INTRODUCTION

1.1 Introduction

The subject of chemistry cannot be learned from books alone. Many important facts can only be learned in the laboratory. Generally, laboratory experiments are essential for a realistic understanding of science, since they are of great value in furnishing background for the critical judgment needed in reading the work of others, which is one of the most important sources of information for practicing experimental and theoretical sciences.

The main objective of laboratory experiments is to identify the various constituents of a substance and to find the quantities of each constituent in that substance. Identifying the constituents is called qualitative analysis while finding how much of one or more constituents are present in a given amount of substance is called quantitative analysis.

1.1.1 Laboratory Precautions and Directives

1. Remember at all times that the laboratory is a place of serious work.
2. Create habits of careful observation and accurate deductions, tidiness and cleanliness.
3. Try to understand the procedures of the experiment intelligently, making out the special precautions to be observed.
4. Always be certain that a test tube, beaker or a dish that is about to be used is clean and will contain only what you have put into it.
5. Do not spill powders or acids on the desk. Wipe immediately any which accidentally drop. Do not touch chemicals with bare hands unless directed to do so. Never taste anything in chemistry laboratory.
6. Arrange the required apparatus on the bench. Avoid littering your bench with an array of unrelated bottles and remove stoppers by holding the test tube in the left hand and with the aid of the little finger of the same hand remove the stopper from the reagent bottle.

Procedure:

Test sample	Standard compound
Specific weight of compound is dissolved in water or solution is prepared as directed in the pharmacopoeia and transferred in Nessler cylinder	Take 1ml of 0.05845 % W/V solution of sodium chloride in Nessler cylinder
Add 1ml of nitric acid	Add 1ml of nitric acid
Dilute to 50ml in Nessler cylinder	Dilute to 50ml in Nessler cylinder
Add 1ml of AgNO_3 solution	Add 1ml of AgNO_3 solution
Keep aside for 5 min	Keep aside for 5 min
Observe the Opalescence/Turbidity	Observe the Opalescence/Turbidity

Observation: Test opalescence is not more intense than standard opalescence, or test opalescence is more intense than standard opalescence.

Report/Result: The given sample passes limit test for chlorides or the given sample fails limit test for chlorides

Exercise

- 1) Compare the value with the value obtained from standard calibration curve of chlorine concentration
- 2) Define water?
- 3) Give the pH of your water samples?
- 4) Why do we chlorinate water?
- 5) What are the factors affecting the bactericidal efficiency of chlorine?
- 6) What are the effects of excess chlorine in water?

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About the **BOOK**

This *Practical Pharmaceutical Chemistry* book deals with all areas of Pharmaceutical Chemistry in a well simplified manner. Some important features of the book include theoretical background of each experimental procedure and steps to be taken in the preparation of reagents. The book is divided into seven parts namely: General Introduction, Volumetric Analysis, Inorganic Qualitative Analysis, Pharmaceutical Analytical Chemistry, Pharmaceutical Organic Chemistry, Principles of Pharmaceutical Analysis and Quality Control. Part I focuses on basic experimental techniques.

It acquaints the students with laboratory precautions, identification and care of laboratory glassware. Part II looks at weighing and calibration of volumetric apparatus, melting point determination and purification of organic solid samples by recrystallization and simple synthesis leading to preparation of some salts as well as determination of alkalinity and total solids in water. Part III focuses on pharmaceutical qualitative inorganic chemistry with preliminary tests and systematic analysis of basic cations and acidic anions as well as their applications in medical practice. Part IV presents pharmaceutical analytical chemistry using chemical methods of analysis. Part V is on Pharmaceutical Organic Chemistry. Part VI is on instrumental methods of analysis. Part VII which is the last part deals with Pharmaceutical Quality Control which involves identification and assay of some selected drug formulations based on official methods.

The book is written in a simple and concise form to enable the students have a better understanding. It also allows choice of experiment depending on availability of reagents. The book is recommended for Undergraduate and Postgraduate students of Pharmacy, Chemistry and Biochemistry programmes.

ABOUT the **AUTHORS**

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