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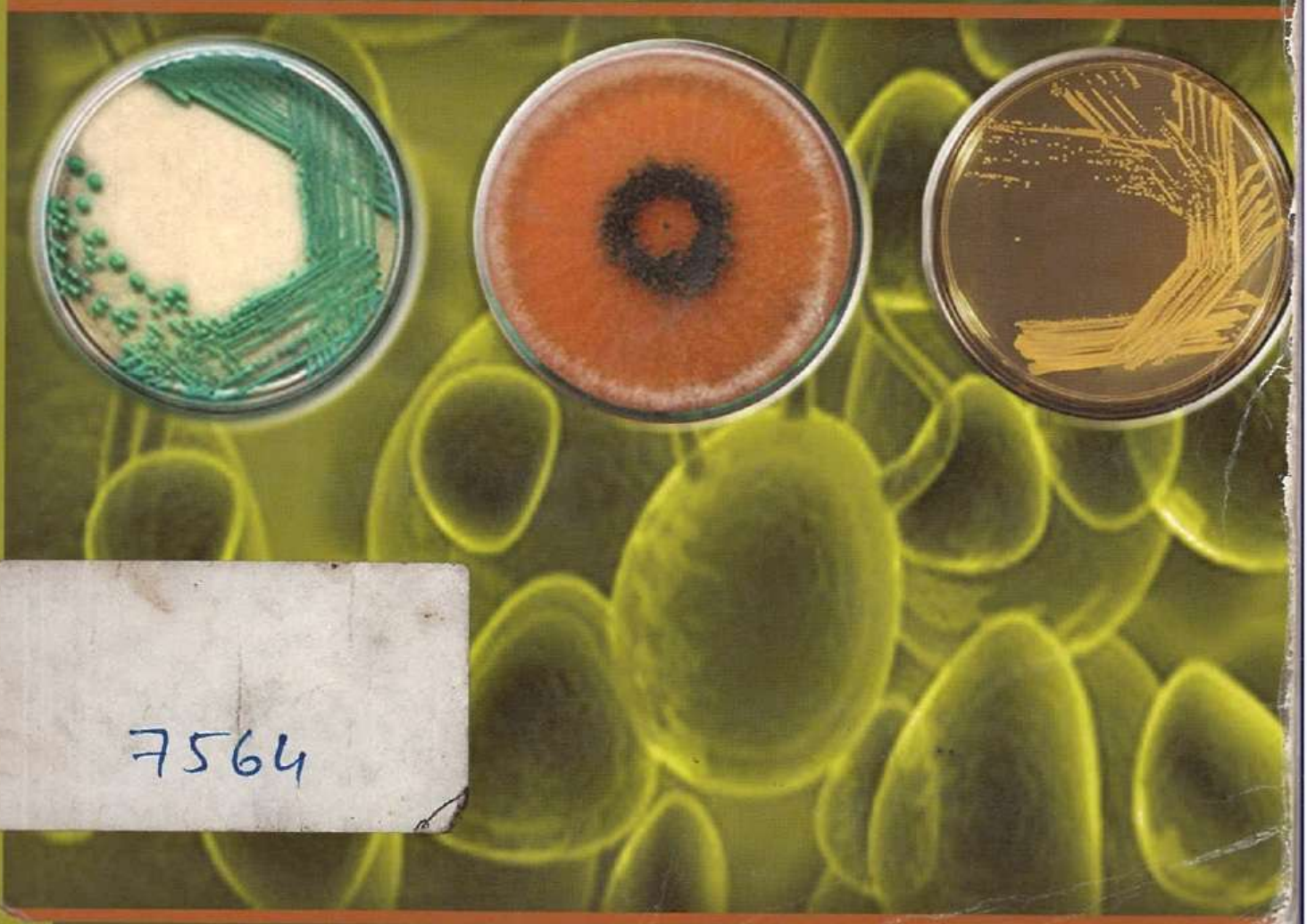
PHARMACEUTICAL MICROBIOLOGY

A COMPREHENSIVE APPROACH

Ravi Kumar Maddali



PHARMACEUTICAL MICROBIOLOGY

A COMPREHENSIVE APPROACH

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Contents

Chapter 2

Diversity of Microorganisms

Chapter 3

Nutrition and Growth

Chapter 4

Disinfectants and Antiseptics

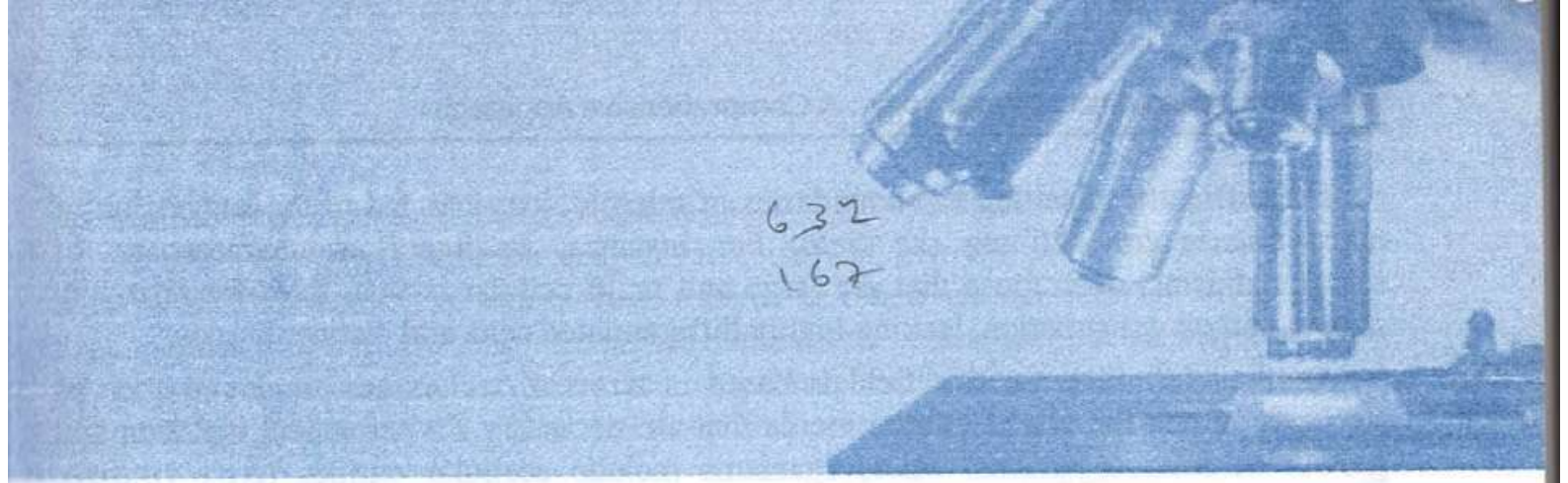
Chapter 6

Bacterial Genetics

Chapter 9

Applications of Microbes Pharmacy

Chapter 12
Miscellaneous Topics



1 INTRODUCTION

LEARNING OBJECTIVES

After studying the chapter the students familiarize themselves with the following concepts:

- *Introducing the subject Microbiology and significance of microorganisms*
- *Different varieties of microscopes their invention and constructions along with simplified ray diagrams*
- *Contribution of scientists for the development of microbiology*
- *Introducing various Branches of Microbiology*

The term Microbiology is coined with 3 Greek words (***Mikro*** **– small,** ***bios*** **- life,** ***logos*** **science**). In other words it is the study of organisms of microscopic size (microorganisms) including their culture, economic importance, pathogenecity, etc.) This study is concerned with their form, structure, reproduction, physiology, metabolism and classification. It includes the changes which microorganisms bring about in other organisms and in nonliving matter and their distribution in nature, their effects on human beings and on other animals and plants, their abilities to make physical and chemical changes in our environment and their reactions to physical and chemical agents. This study revealed the fact that there are many a great number of very tiny life forms all about us everywhere too small to be seen usually by the naked eye. These organisms are usually invisible to naked eye because they are in micron size. Our eye fails to perceive any object that has a diameter less than 0.1 mm, so it is necessary to use microscope to see these tiny forms of life.

However, some microorganisms, particularly some eukaryotic microbes, are visible without microscopes. For example, bread molds and filamentous algae are studied by microbiologists, yet are visible to the naked eye, as are the two bacteria ***Thiomargarita*** and ***Epulopiscioum***.

PHARMACOLOGY -FINGER TIPS

RAPAKA KISHORE

Contents

List of Figures

I. Introduction

Pharmacology: The study of the effects of drugs.

Drug : Any substance or product that is used or intended to be used to modify or explore the physiological system or pathological states for the benefit of the recipient

Receptor: Drugs binding sites. Ion Channels, G-Protein Coupled Receptors, Enzyme linked Receptors and Nuclear Receptors.

Agonist: *A* drug that show affinity towards receptor & produce maximal Pharmacological response.

Inverse Agonist: *A* drug that show affinity towards receptor & produce submaximal Pharmacological response.

Antagonist: *A* drug that show affinity towards receptor but will not produce any Pharmacological response.

Inverse Agonist: *A* drug that show affinity towards receptor & produce opposite Pharmacological response.

Affinity: Drug's Ability to bind with receptor.

Efficacy: Drug's ability to produce a pharmacological Response.

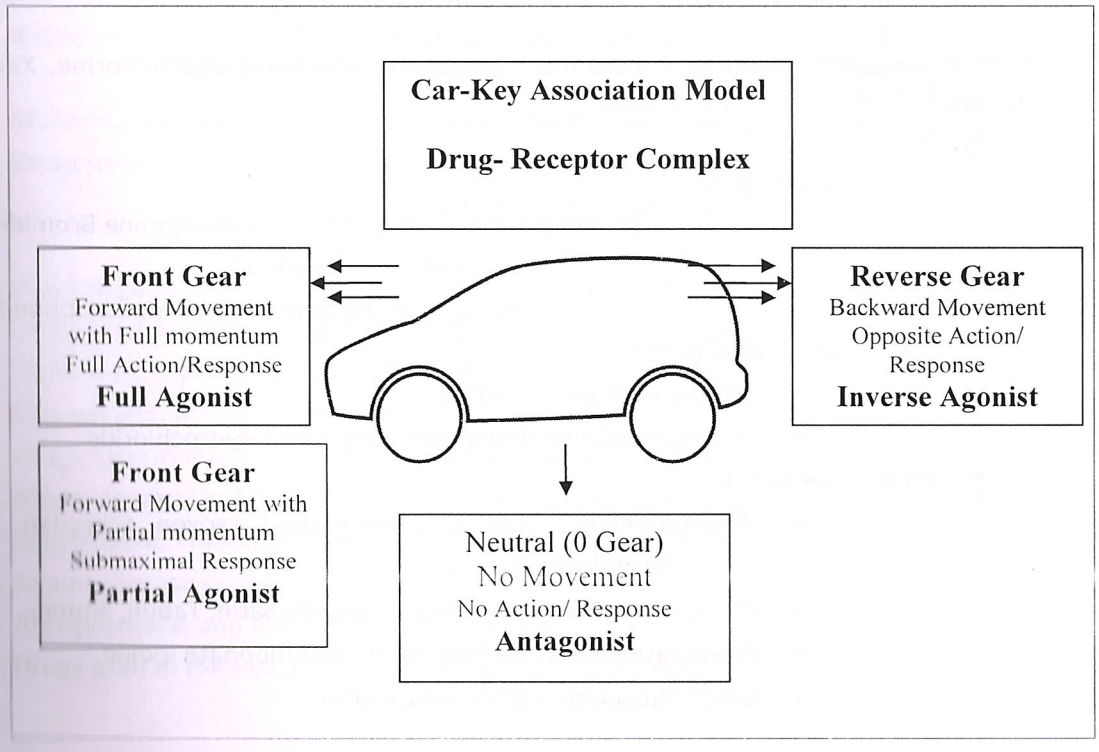


Figure 1 Drug-Receptor Complex

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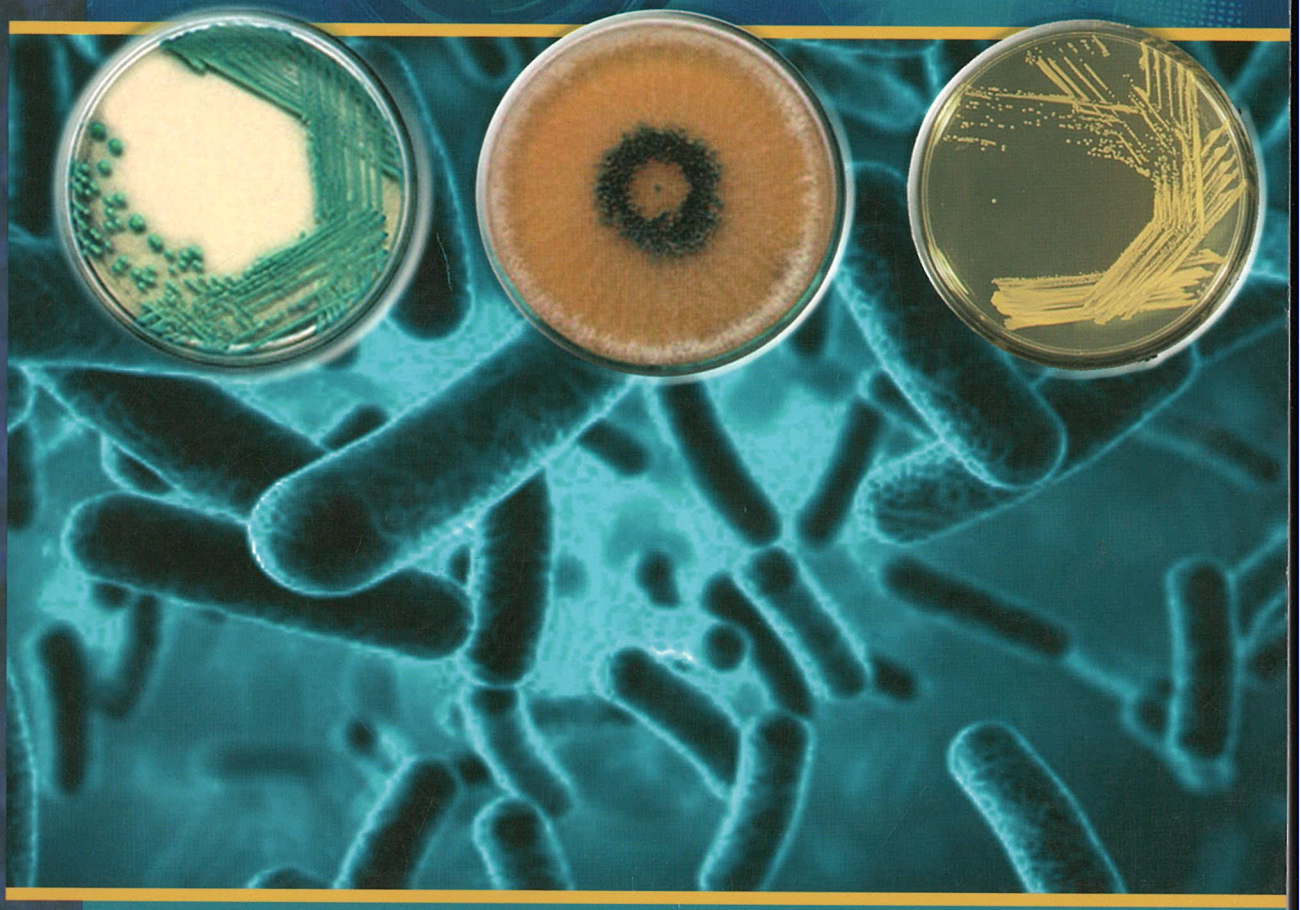
Pharmaceutical Microbiology

A Comprehensive Approach

SECOND EDITION

Ravi Kumar Maddali



PHARMACEUTICAL MICROBIOLOGY

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SECOND EDITION

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Contents

Chapter 2

Diversity of Micro-organisms

Chapter 10
Microbiological Assays

Chapter 11

Microbial Spoilage and Preservation of Pharmaceutical Products

Chapter 12

Miscellaneous Topics

Preface to Second Edition

Proper care has been taken to correct all minor errors like typographical errors, spelling mistakes, wrong heading numbers etc., that have been surfaced inadvertently in the first edition.

New topics like, Large scale sterilization equipments, Design of aseptic area, laminar flow equipments, and Different source of contamination and methods of prevention, Clean area classification have been included in Chapter 4 as per PCI syllabus for B.Pharmacy course.

Microbiological assays of Niacin (Vitamin B_3) and microbial assay of amino acids and assessment methods of new antibiotics topics have been included in chapter 10 titled microbiological assays.

In the Chapter 12 i.e. Miscellaneous Topics various biogeochemical cycles like carbon cycle, nitrogen cycle, phosphorus cycle and sulphur cycles have been redrafted with lucid explanation in this edition.

In the same chapter 12 a new topic on cell culture explaining procedure for cell culture, types of cell cultures and application of cell cultures in pharmaceutical industry and research have been added as per PCI syllabus.

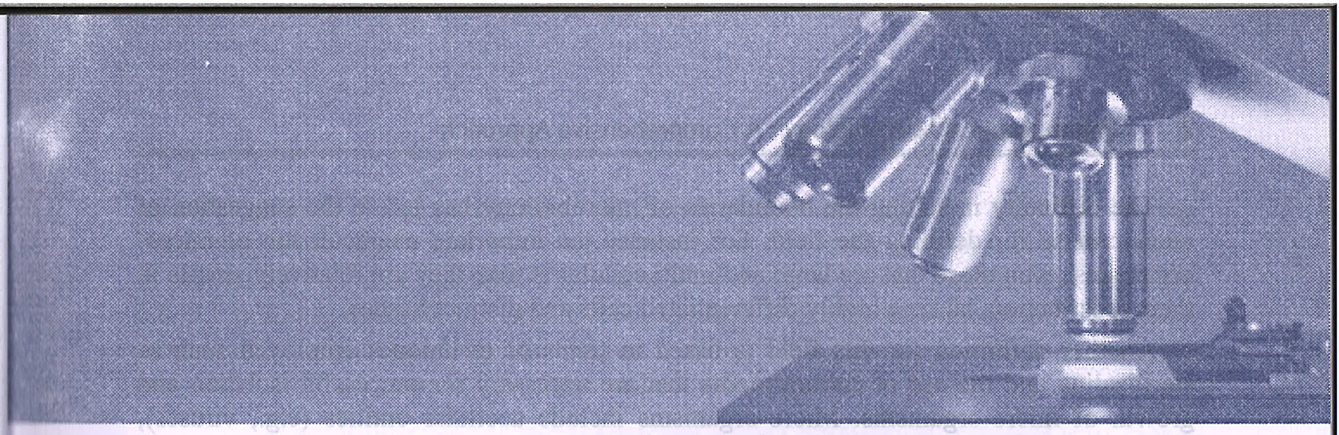
In chapter 5 .i.e. Immunology examples of allergenic extracts have been added.

In chapter 6 i.e. Bacterial genetics, a figure for specialized transduction has been incorporated.

I sincerely acknowledge my heartfelt thanks to the principals, teachers and students of various pharmacy colleges across the nation for giving me encouraging and appreciating feed back of the first edition of this book "Pharmaceutical Microbiology: A Comprehensive Approach" authored by me.

I am also grateful to senior authors and my colleagues who gave their valuable suggestions in preparing this second edition of this text book. It's a matter of pride that there has been a good response for this book from the students across the country. I thank all the teachers for prescribing this book for their students.

-Author



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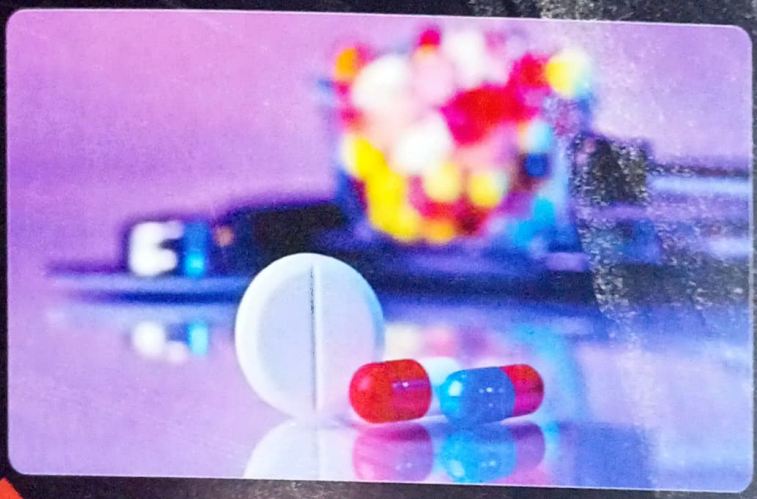
Hand Book of Physical Pharmaceutics

Dr. M Sudhakar and Dr. P. Neeraja



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Hand Book of Physical Pharmaceutics

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Contents

Unit - 1

Reaction Kinetics and Drug Stability

Reaction Kinetics

Reaction Kinetics: It is a branch of chemistry that deals with the rate of chemical reactions, with factors influencing such rates, and with applications of rate studies to elucidate the mechanism of reactions and compare order of a reaction.

A Study into the Kinetics of a Chemical Reaction Is Usually Carried Out With Following Objectives

1. Analysis of the sequence of elementary steps giving rise to the overall reaction (reaction mechanism).
2. Determination of the absolute rate of the reaction and/or its individual elementary steps.

Molecularity

Molecularity: Is defined as number of molecules that come together to react in an elementary reaction and is equal to the sum of stoichiometric coefficients of reactants in this elementary reaction. Depending on how many molecules come together, a reaction can be unimolecular, bimolecular or tri molecular.

Unimolecular: In a unimolecular reaction, a single molecule rearranges atoms forming different molecules. This is illustrated by the equation

$$A \rightarrow P$$

It is described by the first order rate law

$$-\frac{dA}{dt} = -kr\,[A]$$

Where, [A] is the concentration of species A, t is time, and k, is the reaction rate constant.

As can be deduced from the rate law equation, the number of A molecules that decay is proportional to the number of A molecules available. An example of a unimolecular reaction is the isomerization of cyclopropane to propane:

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Research Article

FORMULATION AND EVALUATION OF GEL LOADED WITH MICROSPHERES OF APREMILAST FOR TRANSDERMAL DELIVERY SYSTEM

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Received: 29 August 2018, Revised and Accepted: 09 November 2018

ABSTRACT

Objective: The main objective of the present research work was to formulate and evaluate gel loaded with microspheres of apremilast to increase bioavailability and to reduce the dosing frequency and to improve patient compliance.

Methods: Gel loaded with microspheres of apremilast was prepared by solvent evaporation method by taking different ratios of polymers. Ethyl cellulose as a polymer, dichloromethane solvent is used as drug solubility, polyvinyl alcohol as a surfactant, and sodium alginate is used as gelling agent. Prepared gel loaded with microspheres was evaluated for drug interactions by Fourier transform infrared (FTIR), differential scanning calorimetry studies, and surface morphology by scanning electron microscopy (SEM), to select effective one among all formulations. The prepared formulations (F1–F6) were evaluated for pre-formulation studies, spreadability, viscosity, pH measurement, gel strength, homogeneity, drug content, *in vitro* diffusion studies, drug kinetics, and finally for stability studies.

Results: Differential scanning calorimeter studies confirmed that there is no drug interaction between drug and excipients. FTIR spectroscopy studies confirmed that there is compatibility between drug and excipients. Regular and spherical shape particles with smooth surface were observed in the SEM photographs. The optimized gel loaded with microspheres of F4 formulation (drug: polymer in 1:4 ratio) is more effective compared to all formulations. The prepared gel showed acceptable physical properties such as spreadability (5.86±0.54 g.cm/s), viscosity (568 cps), pH (6.33±0.55), gel strength (38 s) and drug content (90.00±0.71%). In vitro diffusion studies have shown 80.1±1.92% drug release in 10 h. Drug kinetics follows zero order kinetics and n value was found to be 0.721. Stability studies were done for 3 months.

Conclusion: All the results show that the gel loaded with microspheres of apremilast can be effectively used for the treatment of psoriasis and psoriatic arthritis.

Keywords: Apremilast, Dichloromethane, Ethylcellulose, Gel loaded with microspheres, Polyvinyl alcohol, Sodium alginate.

 DOI: http://dx.doi.org/10.22159/ajpcr.2019.v12i2.29374

INTRODUCTION

Psoriasis and psoriatic arthritis are a chronic skin disease of autoimmune system that is identified as patches of abnormal skin [1]. Apremilast inhibits the enzyme phosphodiesterase 4 which leads to spontaneous inhibition of tumor necrosis factor-alpha production from human rheumatoid synovial cell [2]. In addition, the application of oral drug delivery has numerous problems such as abdominal pains, upper respiratory, nasopharyngitis, and depression that often ends in lack of patient compliance [3]. Drugs that are not soluble in water can be entrapped in microsponge pores, which are extremely small, thus the drug functions as microscopic particles, producing a greater surface area and increasing the rate of solubilization [4].

Microspheres defined as solid spherical particles, approximately the size ranges from 1 to 1000 μm containing dispersed drug molecules either in solution or crystalline forms [5]. They are shallow spherical, free-flowing powders consisting of proteins polymers or synthetic polymers which are biodegradable in nature [6].

Microspheres are a polymeric matrix system which contains the drug in a state of uniform distribution throughout the matrix. Polymers such as ethyl cellulose are used for the preparation of matrix-type microspheres of water-soluble drugs to control the dissolution rate of drugs from the dosage forms [7]. Transdermal gels are a semisolid system, they prepared from a liquid which is thickened with other ingredients. The drug release through skin membrane and preparation of gelling agent sodium alginate is used [8]. The present work is to increase bioavailability and reduce the dosing frequency and improve patient compliance by designing formulation and evaluation of gel loaded with microspheres of apremilast for treating psoriasis and psoriatic arthritis.

MATERIALS AND METHODS

Materials

Apremilast (Gift sample by Alembic Pharmaceuticals Limited, Vadodara, India), It is a water-insoluble drug, so it is chosen as a main drug. Ethyl cellulose was used as a polymer (Qualikems Fine Chem Pvt., Ltd.). Polyvinyl alcohol is used as a surfactant (Qualikems Fine Chem Pvt., Ltd., Vadodara, India). Sodium alginate is used as a gelling agent (NR Chem, Mumbai). Dichloromethane is used as drug solubility (Qualikems Fine Chem Pvt., Ltd.).

Methods

Formulation of gel loaded with microsphere

Preparation of apremilast microspheres

Using solvent evaporation method, apremilast microspheres were prepared. By taking ethyl cellulose as a polymer and solution of dichloromethane solvent were used with combination to get perfect dissolution of drug in it. Initially, formulation was developed to select a best-suited solvent system for selected solvent evaporation method. The drug and polymer ratio concentration was remained constant for the formulation F1–F6. Desired quantity of ethyl cellulose polymer was dissolved in 10 ml dichloromethane solvent. Calculated drug was added

PHARMACOLOGY
- FINGER TIPS

By
R. NAGA KISHORE

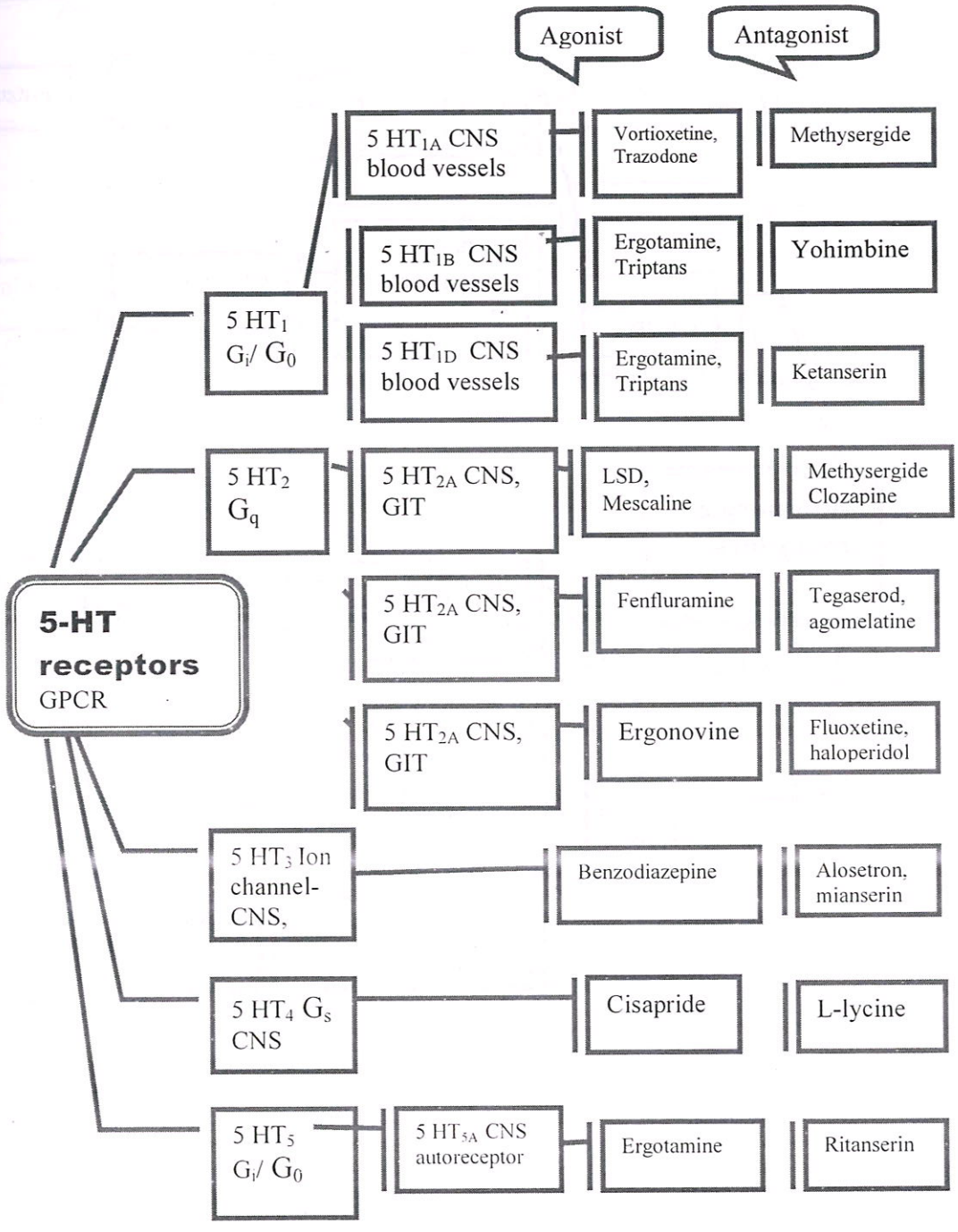
Contents

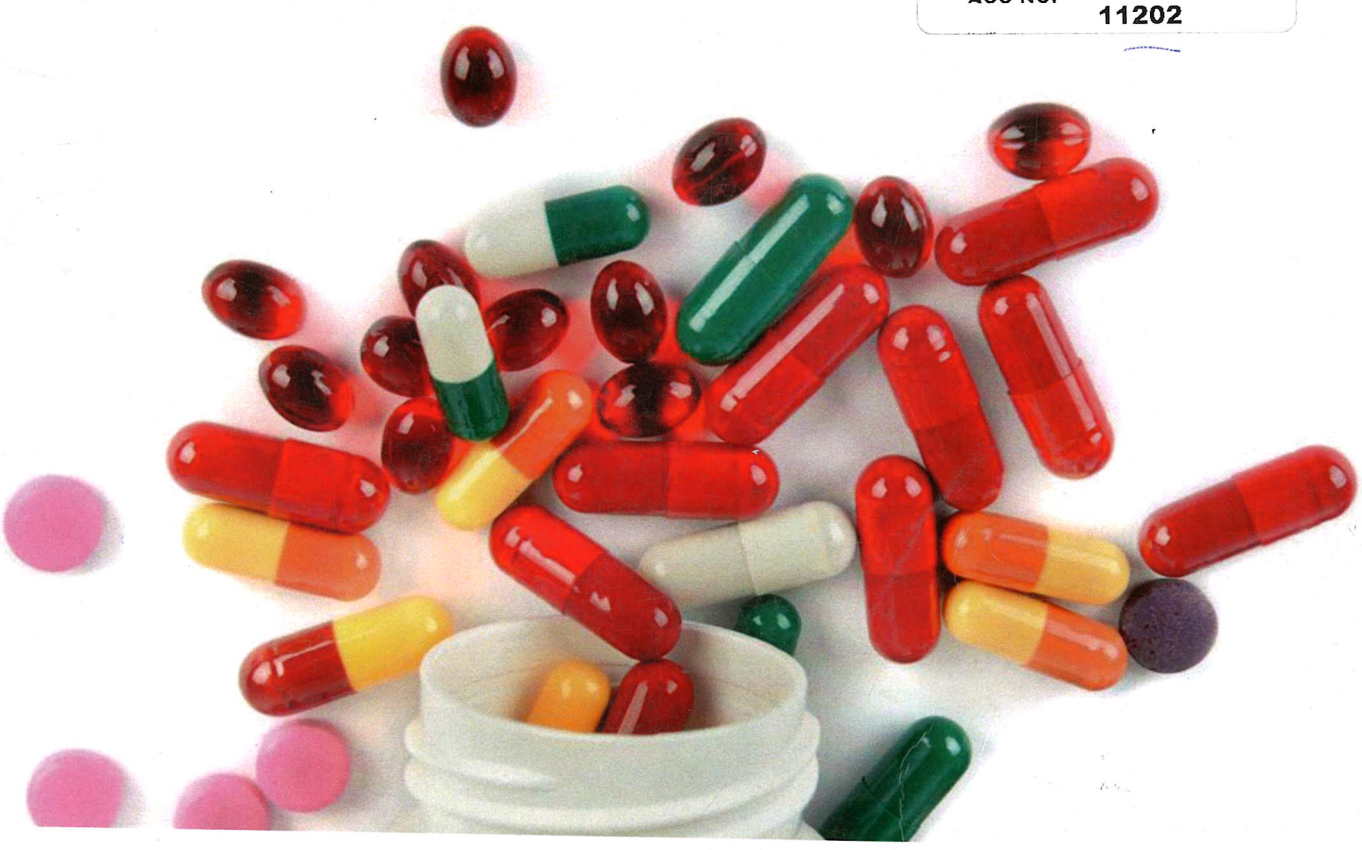
I Types of Receptor

II Pharmacological Classifications

III Pharmacological Action of Drugs

5-HT Receptors:





Mangilal Teelavath

Advances in Drug Delivery Systems

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Contents

Chapter-1

Concept and Models for Novel Drug Delivery System, Carriers for Drug Delivery

1.1 Pharmaceutical Polymers Introduction

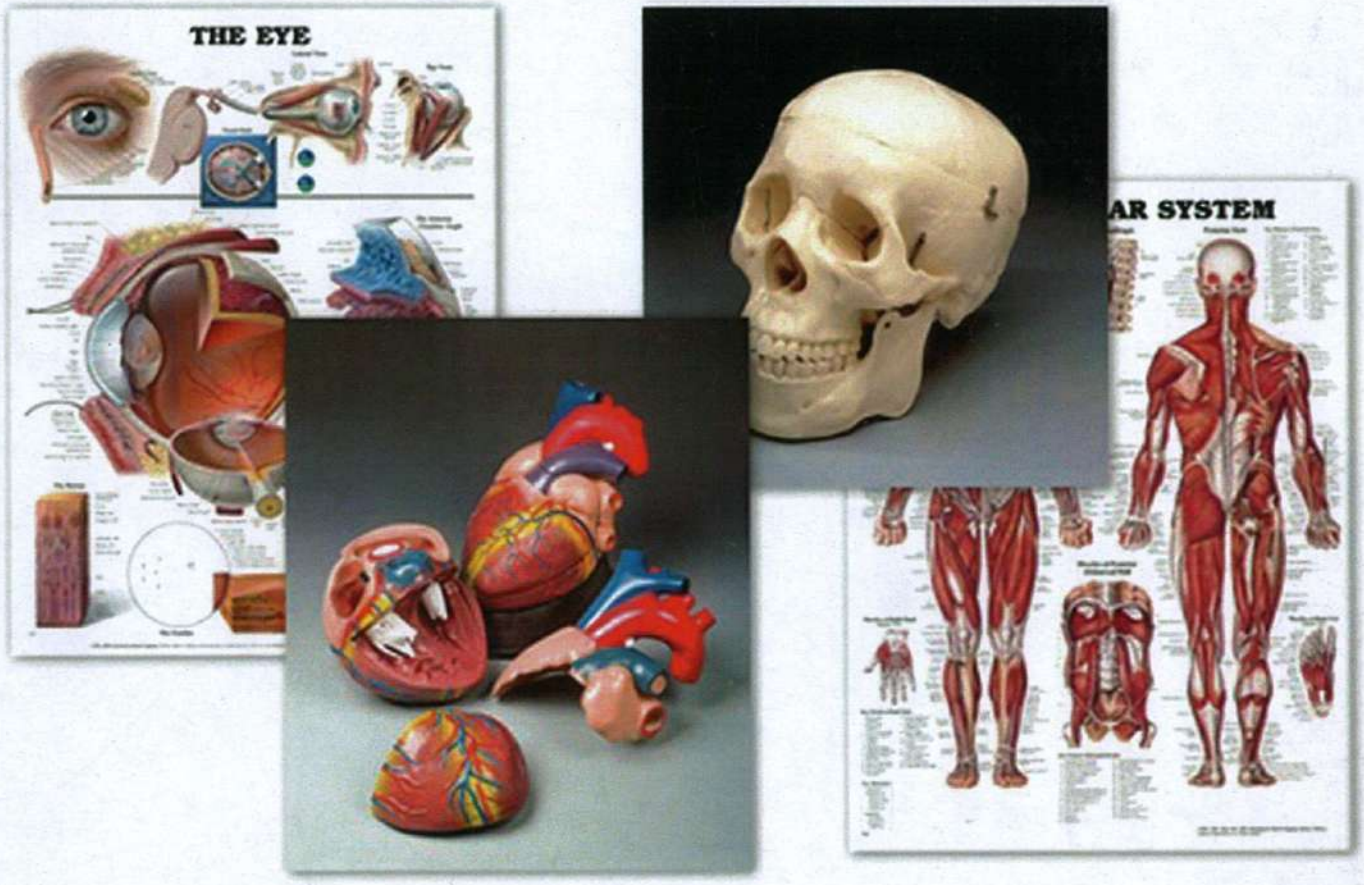
Polymers are long chain organic molecules assembled from many smaller molecules called monomers. Synthetic and natural-based polymers have found their way into the pharmaceutical and biomedical industries and their applications are growing at a fast development. Understanding the role of polymers as ingredients in drug products is important for a pharmacist or pharmaceutical scientist who deals with drug products on a routine basis. Having a basic understanding of polymers will give us the opportunity to not only familiarize ourselves with the function of drug products but also possibly develop new formulation or better delivery systems. The basic concepts of polymer chemistry, polymer properties, types of polymers, polymers in pharmaceutical and biomedical industries, and reviews of some polymeric products in novel drug delivery systems and technologies covered in this section.

History of Polymers

Polymers have a wide-ranging impact on modern society. Polymers are more commonly referred to as "plastics" since people are more familiar with plastic products that they encounter around the house than any other type of polymeric product. Plastics have the ability to be molded, cast, extruded, drawn, thermoformed, or laminated into a final product such as plastic parts, films and filaments. The first semi-synthetic polymer ever made was guncotton (cellulose nitrate) by Christian F. Schonbein in 1845. The manufacturing process for this polymer was changed over the years due to its poor solubility, process ability and explosively resulting in a variety of polymers such as Parkesine, celluloid (plasticized cellulose nitrate), cellulose acetate (cellulose treated with acetic acid) and hydrolyzed cellulose acetate soluble in acetone.

In 1872, Bakelite a strong and durable synthetic polymer based on phenol and formaldehyde was invented. Polycondensation based polymeric products such as Bakelite and those based on phenoxy, epoxy, acrylic and ketone resins were used as cheap substitutes for many parts in the auto and electronics industries. Other synthetic polymers were invented later including polyethylene (1933), poly (vinyl chloride) (1933), polystyrene (1933), polyamide (1935), Teflon (1938), and synthetic rubbers (1942). Polyethylene was used to make radar equipment for aeroplanes. The British air force used polyethylene to insulate electrical parts of the radars in their airplanes. Synthetic rubber, which could be made in approximately 1 hr as compared to 7 years for natural rubbers, was used to make

A Practical Book of Human Anatomy and Physiology



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First Edition

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CONTENTS

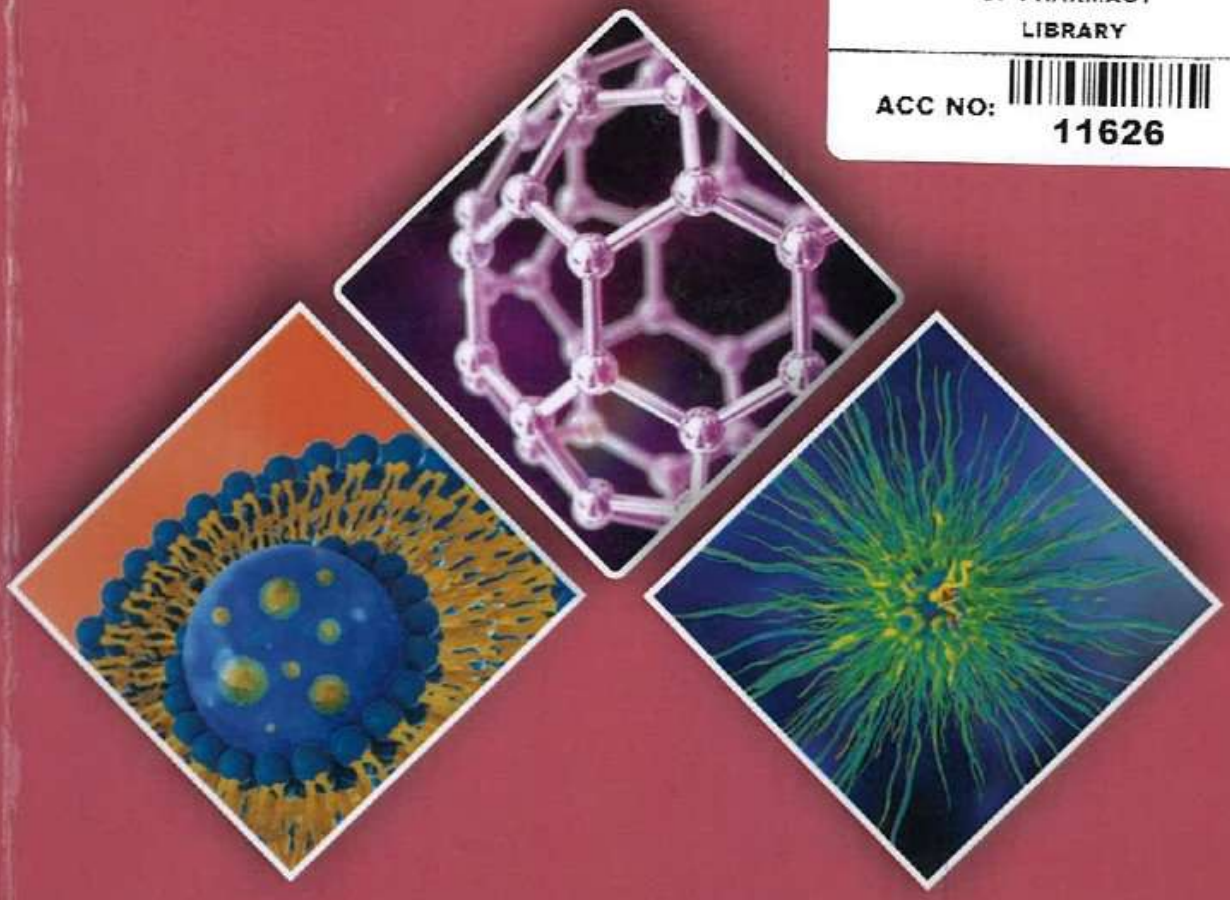
INTRODUCTION

Anatomy is the science of the structure of the body. When used without qualification, the term is applied usually to human anatomy. The word is derived indirectly from the Greek anatome, a term built from a, meaning "up," and tome, meaning "a cutting" (compare the words tome, microtome, and epitome). From an etymological point of view, the term" dissection" (dis-, meaning" asunder, " and secare, meaning "to cut") is the Latin equivalent of the Greek anatome.

Anatomy is the scientific study of the structure of organisms including their systems, organs and tissues. It includes the appearance and position of the various parts, the materials from which they are composed, their locations and their relationships with other parts. Anatomy is quite distinct from physiology and biochemistry, which deal respectively with the functions of those parts and the chemical processes involved. For example, an anatomist is concerned with the shape, size, position, structure, blood supply and innervations of an organ such as the liver; while a physiologist is interested in the production of bile, the role of the liver in nutrition and the regulation of bodily functions.

The discipline of anatomy can be subdivided into a number of branches including gross or macroscopic anatomy and microscopic anatomy. Gross anatomy is the study of structures large enough to be seen with the naked eye, and also includes superficial anatomy or surface anatomy, the study by sight of the external body features. Microscopic anatomy is the study of structures on a microscopic scale, along with histology (the study of tissues), and embryology (the study of an organism in its immature condition). Anatomy can be studied using both invasive and non-invasive methods with the goal of obtaining information about the structure and organization of organs and systems. Methods used include dissection, in which a body is opened and its organs studied, and endoscopy, in which a video camera-equipped instrument is inserted through a small incision in the body wall and used to explore the internal organs and other structures. Angiography using X-rays or magnetic resonance angiography is methods to visualize blood vessels.

The term "anatomy" is commonly taken to refer to human anatomy. However, substantially the same structures and tissues are found throughout the rest of the animal kingdom and the term also includes the



Dr. Shiva Kumar Yellanki

Basic Concepts of Nanotechnology Nano Sized Drug Carriers and Applications

blications
Delhi

Contents

Chapter - 1

Introduction to Nanotechnology

1.1 Basic Introduction

Nanotechnology is the term given to those areas of science and engineering where phenomena that take place at dimensions in the nanometer are utilized in the design, characterization, production and application of materials, structures, devices and systems. Although in the natural world there are many examples of structures that exist with nanometer dimensions (hereafter referred to as the Nano scale), including essential molecules within the human body and components of foods, and although many technologies have incidentally involved Nano scale structures for many years, it has only been in the last quarter of a century that it has been possible to actively and intentionally modify molecules and structures within this size range. It is this control at the nanometer scale that distinguishes nanotechnology from other areas of technology.

Clearly the various forms of nanotechnology have the potential to make a very significant impact on society. In general it may be assumed that the application of nanotechnology will be very beneficial to individuals and organizations. Many of these applications involve new materials which provide radically different properties through functioning at the Nano scale, where new phenomena are associated with the very large surface area to volume ratios experienced at these dimensions and with quantum effects that are not seen with larger sizes. These include materials in the form of very thin films used in catalysis and electronics, two-dimensional nanotubes and nanowires for optical and magnetic systems, and as nanoparticles used in cosmetics, pharmaceuticals and coatings. The industrial sectors most readily embracing nanotechnology are the information and communications sector, including electronic and optoelectronic fields, food technology, energy technology and the medical products sector, including many different facets of pharmaceuticals and drug delivery systems, diagnostics and medical technology, where the terms Nano medicine and bio nanotechnology are already commonplace. Nanotechnology products may also offer novel challenges for the reduction of environmental pollution.

A PRACTICAL BOOK OF
MEDICINAL CHEMISTRY

(Strictly as Per New PCI Regulations)

Second Year B. Pharmacy Semester–IV

&

Third Year B. Pharmacy Semester–VI

Narender Boggula
Dr. Jithendar Reddy Mandhadi
Umadevi Racha

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Contents

EXP. 1: Preparation of Antipyrine

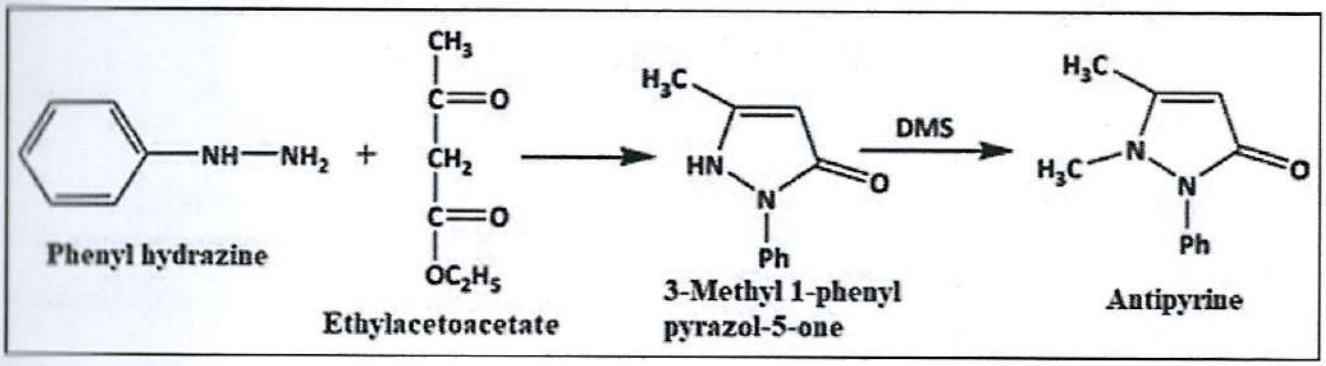
Aim: To prepare and submit antipyrine and report its percentage yield.

Apparatus: Conical flask, beaker, glass rod, round bottomed flask, reflux condenser, filtering funnel, heating mantle.

Chemicals: Ethyl acetoacetate, phenyl hydrazine, ether, distilled water, ethanol, NaOH, methanol, dimethyl sulphate (DMS), benzene.

Principle: Antipyrine/Phenazone is a derivative of pyrazole, generally pyrazoles are synthesized from dicarbonic compounds by reaction with hydrazines. In this synthesis, ethyl acetoacetate is used along with hydrazine. Ethyl acetoacetate is heated with an equal quantity of phenyl hydrazine to form corresponding phenyl hydrazine, on further heating ring formation occurs with loss of ethanol, resulting compound is ethyl phenyl hydrazone which is obtained as colourless crystals.

This pyrazolones is having an active portion is easily replaced by methyl group. By using dimethyl sulphate as methylating agent in the presence of strong base, in the first step unreacted substances are removed by using non polar solvents like ether. 3-methyl 1-phenyl pyrazol-5-one on methylation in presence of methylating agent will form antipyrine.



Procedure

Step-1: Preparation of 3-methyl 1-phenyl pyrazol-5-one

1. Mix together 50g (40 ml) of redistilled ethyl acetoacetate and 40g (36.5 ml) of phenyl hydrazine in a clean and dry large evaporating

Chapter 1
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Optimization of Diabetes by Herbal Medicine

Yasodha Krishna Janapati[1*], Sunil Junapudi[2] and Sudharshan Reddy Dachani[3]

DOI: 10.9734/bpi/tipr/v6/2277E

ABSTRACT

Plant-based medicinal products have been acknowledged since ancient times. Several medicinal plants and their products have been used to control diabetes in the traditional therapeutic systems of many cultures worldwide. The plants provide a potential source of hypoglycemic drugs because many plants and plant-derived compounds have been used to treat diabetes. Several synthetic oral hypoglycemic agents are the primary forms of treatment for diabetes. However, prominent side-effects of such drugs are the main reason for an increasing number of people seeking alternative therapies that may have less severe or no side effects. Still, little toxicological information exists concerning traditional antidiabetic plants. The present paper attempts to list the plants with antidiabetic and related beneficial effects originating from different parts of the world and Polyherbal formulations. History has shown that medicinal plants have been used in traditional healing worldwide for a long time to treat diabetes. Such herbal plants have hypoglycemic properties and other beneficial properties, as reported in scientific literature. This book chapter portray, the importance of herbal plants and polyherbal formulations in the treatment of diabetes mellitus. The effects of these plants may delay the development of diabetes and its complications due to their chemical constituents.

Keywords: Optimization; diabetes; herbal medicine.

1. INTRODUCTION

Diabetes mellitus is a heterogeneous metabolic disorder characterized by altered carbohydrate, lipid, and protein metabolism caused by insulin deficiency, often combined with insulin resistance. It is considered one of the five leading causes of death in the world. About 150 million people are suffering from diabetes worldwide and it is almost five times more than the estimated ten years ago, which may be doubled by 2030 [1]. Further, the International Diabetes Federation predicts that by 2045 the number of individuals effected with diabetes will increase to 629 million [2]. It is projected that the total global economic burden will escalate from the U.S. $ 1.3 trillion in 2015 to $ 2.5 trillion in 2030, which represents a staggering increase in costs as a share of global GDP from 1.8% in 2015 to 2.2% in 2030 [3]. Despite considerable progress in the treatment of diabetes by oral hypoglycemic agents, the search for newer drugs continues because the existing synthetic drugs have several limitations. The herbal medicines with antidiabetic activity are yet to be commercially formulated as modern medicines, even though they have been acclaimed for their therapeutic properties in the traditional systems of medicine. The plants provide a potential source of hypoglycemic drugs because many plants and plant-derived compounds have been used to treat diabetes. Many Indian plants have been investigated for their beneficial use in different types of diabetes, and reports are evident in numerous scientific journals. Ayurveda and other traditional medicinal systems for the treatment of diabetes describes numerous plants used as herbal drugs. Hence, they play an indispensable role as an alternative medicine due to fewer side effects and low cost. The active principles present in medicinal plants have been reported to possess the pancreatic beta cells re-generating, insulin-releasing, and

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