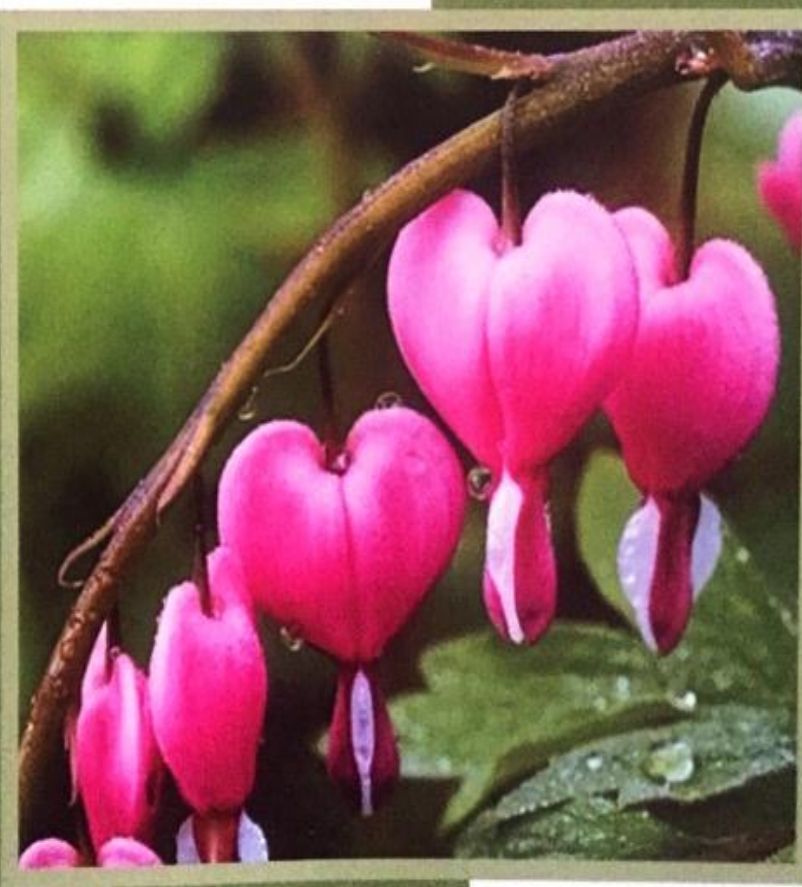


J. Jenis

CHEMISTRY OF NATURAL COMPOUNDS

Educational manual



Almaty 2016

UDC 54 (075.8)

LBC 24 я 73

J 41

Recommended for publication by the Academic Council of the Faculty of Chemistry and Chemical Technology, Editorial-Publishing Council, and Educational and methodical association of the Republic educational- methodical council of higher and postgraduate education of Ministry of education and science of the Republic of Kazakhstan on the basis of Al-Farabi of Kazakh National University (Protocol №1 from 07.10.2015)

Reviewer

Doctor of chemistry, Professor **B. Zh. Dzhiembaev**

Doctor of chemistry, Professor **K. Yu Valentina**

Doctor of chemistry, Professor **Zh. A. Abilov**

Doctor of chemistry, Professor **D.U. Korulkin**

Jenis J.

J 41 Chemistry of natural compounds: educational manual / J. Jenis
– Almaty: Qazaq universitety, 2016. – 134 p.

ISBN 978-601-04-1691-8

The educational manual performed a series of theory on chemistry of natural compounds which including explanation some important terms, classification, structure, biological properties, and the extraction, separation and identification of biologically active substances, together with practical comprehensive experiments and analytical studies such as qualitative and quantitative analyzing biological active compounds by chromatographic methods, and obtaining natural products from plant material in laboratory.

The educational manual on the discipline «Chemistry of natural compounds» is qualified standards in higher education and recommended for 3rd course students of faculty of chemistry and chemical technology.

UDC 54 (075.8)

LBC 24 я 73

ISBN 978-601-04-1691-8

© Jenis J., 2016
© Al-Farabi KazNU, 2016

CONTENTS

List of abbreviations.....	5
Introduction.....	7
1. Historically important natural products.....	9
1.1. Natural products chemistry, natural products, classes, and primary or secondary metabolism	11
1.2 Isolation and purification and structure elucidation of natural products	14
1.2.1. Extraction of plant material	15
1.2.2. Isolation and purification of natural products by using chromatography	21
2. Phenols and flavones.....	26
2.1. Classification, structures, and properties phenolic compounds.....	26
2.2. Flavanoids, classification, and biological activities	29
2.3. Galloylbergenin from Kazakh traditional medicinal plant of <i>Bergenia crassifolia</i> with anti- lipid droplet accumulation activity	34
3. Alkaloids.....	40
3.1. Introduction, occurrence , nomenclature and classification	40
3.2. Properties of alkaloids and distribution in nature	53
3.3. Extraction and isolation method for alkaloids.....	54
3.4. Dimer alkaloids.....	56
3.5. Applications of alkaloids	56
4. Terpens	59
4.1. Introduction and classification.....	59
4.2. Monoterpens, essential oils and the methods of extracting essential oils.....	64
4.3. Sesquiterpenes	68
4.4. Diterpens and sesterterpens.....	74
4.5. Triterpenoid and steroids.....	80
4.6. Carotenoids	88

4.7. Essential oils from Kazakh traditional medicinal plant of <i>Thymus altaica</i>	97
5. Laboratory works for course of chemistry of natural compounds.....	107
6. The examination questions for the course of chemistry of natural compounds.....	118
References.....	123

INTRODUCTION

The traditionally natural products have played an important role in developing of natural product chemistry which continues to expand to exciting new frontiers of great importance in medicine. Natural Products Chemistry is a course in the chemistry discipline area. We will explore the historical and contemporary role of secondary natural products in health care and commerce. We will learn how natural products are normally classified according to their biosynthetic origins and chemical properties. A special emphasis will be placed on how chemical structure affects the physiological function of various natural products. These "structure activity relationships" help us learn about the interaction of small molecules in living systems and pharmacology of drugs.

At present the own production of medical drugs in the Republic of Kazakhstan is 11% (including vaccines – 1.1%), veterinary drugs 78% (mainly the manufacture of drugs from imported substances), while other drugs are being imported into the country. The main problem is the lack of original domestic biotechnological drugs in the presence of perspective experimental developments. To date, virtually the production of genetically engineered drugs is not adjusted, while there are original domestic or joint developments that passed or passing phase of preclinical and clinical studies. In Kazakh traditional medicine, the plant resources have been efficiently used in the treatments of different kinds of diseases such as bronchitis, bronchial asthma, brohepatitis, urethritis, chronic rheumatoid arthritis, nephritis, urolithiasis, pharyngitis, periodontitis, stomach pain, hyperacidity, diarrhea, hemostasia, metrorrhagia, snakebite, cancer and so on. In Kazakhstan grow over six thousand

kinds of plants in which more than 6000 species of highest vascular plants, about 5000 species of mushrooms, 4851 species of lichen, more than 2000 species of seaweed are registered.

The study revealed that investigated plants belonging to family *Chenopodiaceae* is good sources for biologically active substances which include: saponins, triterpenes, organic acids, amino acids flavonoids, chromones and carbohydrates. The choice of plant species which belong to family of *Chenopodiaceae* due to the fact that on the territory of the Republic of Kazakhstan salt tolerant plants have a huge reserves and in depth studies not performed before which promotes the study of their chemical composition and biological activity for the purpose of development of new drugs needed for the domestic pharmaceutical industry which is one of the main priorities of socio-economic policy of the Government of Kazakhstan.

The plant kingdom offers a rich source of structural biodiversity in the form of a variety of natural products. By using the rich resources of medicinal plants from Kazakhstan to find new bioactive natural products which as new drug leads, new anticancer or anti-tumor drugs and to solve in our opinion with a success a problem of creation and introduction in the industry (medicine and agriculture) of Kazakhstan of new highly effective medical products.

Educational issue

Jenis Janar

**CHEMISTRY OF NATURAL
COMPOUNDS**

Educational manual

Computer page makeup
and cover designer: *N. Bazarbaeva*

IS No. 9132

Signed for publishing 02.02.16. Format 60x84 1/16. Offset paper.

Digital printing. Volume 8,37 printer's sheet.

Edition 100. Order No. 33

Publishing house «Qazaq universitety»

Al-Farabi Kazakh National University, 71 Al-Farabi, 050040, Almaty

Printed in the printing office of the «Qazaq universitety» publishing house