

ANNOTATION

General description of work

This paper is devoted to studying the process of biotransformation of the chemical composition of a substance obtained from the aerial part of the plant *Tamarix hispida* of the family *Tamaricaceae*, with the aim of enhancing the biological activity of the original substance.

Evaluation of the current state of the problem being solved

Biocatalysis (biological transformation) is currently becoming a key component in the chemical process for obtaining new pharmaceuticals, intermediates and analytical reagents. Most biocatalytic reactions can be carried out under certain conditions of safety for health, the environment and the economy. The ability of biocatalysis to fully unlock the potential in pharmaceutical synthesis will require lower cost methods and full integration with chemistry. In addition, the screening method has significantly expanded the arsenal of promising microorganisms and enzymes, and now they are widely used in industry. Screening enzymes in combination with modern biotechnologies, such as biochemistry, cell engineering, and genetic engineering, will pave the way for the large-scale industrial use of microbial enzymes. In this context, the synthesis of individual enantiomers of drug intermediates and human metabolites is becoming increasingly important in the pharmaceutical industry. Biocatalysis opens up broad prospects for the highly selective synthesis of complex biologically active substances used in pharmacy, while fully responding to the principles of green chemistry. The advantage of biocatalysis is that the reactions catalyzed by the enzyme are stereoselective and regioselective and can be carried out at ambient temperature and atmospheric pressure. Different classes of enzymes can catalyze many types of chemical reactions and a wide range of chiral compounds. In recent decades, advances in biochemistry, protein chemistry, molecular cloning, random and directed mutagenesis, directed evolution of biocatalysts, and fermentation technology have opened unlimited access to a variety of enzymes and microbial cultures that can be used as tools in organic synthesis. Consequently, the integration of biocatalysis and organic synthesis will contribute to the creation of new synthetic strategies and open new technological boundaries, both in fundamental and practical terms.

The selection in the *Tamarix hispida* family of tamariks (*Tamaricaceae*) is caused by the fact that extracts from this plant have diuretic, diaphoretic, astringent, anesthetic and hemostatic effects. Infusion of flowers is useful in diseases of the gastrointestinal tract (GIT), decoction of branches is effective in diseases of the joints, an infusion of leaves and bark is prescribed for the treatment of diarrhea, bleeding and diseases of the spleen. Tamarix sprigs brew and use as a tonic and tonic.

The relevance of research

The creation of our own pharmaceutical industry and the earliest possible increase in the share of domestic drugs to 40-50% is indicated in the Government of the Republic of Kazakhstan No. 302 of April 14, 2010, as the top priorities of the country's economic development.

To solve this problem, the State Drug Policy Program of the country was created, which provides for the introduction of highly effective and affordable medicines obtained on the basis of domestic raw materials. Despite the fact that a number of drugs are used in clinical practice as immunostimulating and anti-inflammatory drugs, however, the search for and development of new effective drugs does not stop.

Special attention in this Program is paid to preparations of natural origin, for example, obtained on the basis of medicinal plants. As a rule, unlike synthetic ones, they are cheaper and do not have cumulative properties.

At the same time, methods of biocatalysis allow modifying drugs, increasing their activity and bioavailability. It should be noted that modification using cell cultures is much cheaper than purely chemical methods of enzymatic catalysis, since it does not require the production of native enzymes, but uses enzymes produced by the cell culture.

The degree of the problem

At the Department of Chemistry and Technology of Organic Substances, Natural Compounds and Polymers of Al-Farabi Kazakh National University under the guidance of Professor Zh.A. Abilov scientific studies were conducted to determine the chemical composition of polyphenolic substances and to study the chemical composition of plants of the genus *Tamarix* growing in Kazakhstan - *T. Ramosissima* (rower multicolor) and *T. Hispida* (comb bristle hair).

Sultanova N.A. the quantitative content of biologically active substances was determined, a scheme for their isolation and separation was developed. 26 compounds are highlighted. 4 phenolic acids identified. Identified substances with antimicrobial, fungicidal, antioxidant, antitumor activity. Optimal conditions for the isolation of biologically active metabolites from salt-tolerant plants and technological flow diagrams for their separation have been developed. Amino acids, saturated and unsaturated carboxylic acids, carbohydrates have been identified and identified. Chemotaxonomic markers of plants are amyryn pentacyclic triterpenoids, steroids, flavonoids, and phenolic acids. Complexes of biologically active substances and individual compounds from the studied species have antibacterial, antifungal, antioxidant, antidiabetic, immunomodulatory, cytotoxic, phytotoxic, insecticidal, growth-regulating activity. Individual triterpenoids of the olean series have an antibacterial effect. Ramnazine exhibits high antioxidant activity. Tamarixin and izotamarixen have a high inhibitory effect on the alpha-glucosidase enzyme. Phenoxychromanes and quercetin exhibit pronounced immunomodulating activity.

Umbetova A.K. a chemical study of the eugalophytes of the family *Chenopodiaceae* of the genus *Comphorosma* (*C. monsepeliacum*) and *Tamaricaceae* of the genus *Tamarix* (*T. laxa* and *T. elongata*) was carried out. It

has been established that *C. monsepliacum* contains chromones, olean triterpenoids, hydrolyzable tannins, flavonoid sulfates. Fat and amino acids are identified. The mineral composition of the ash residues is determined. A scheme for the isolation and separation of biologically active substances has been developed. Antibacterial, fungicidal, antioxidant, anti-amnesic, antidiabetic, growth regulating activity

The issues of biotransformation are considered in the works of scientists from Pakistan, the USA, Kazakhstan and others. At the same time, the Center for Chemical and Biological Sciences at Karachi University occupies a leading position in this scientific direction.

So, prof. Choudhary, MI Extensive studies have been conducted on the biotransformation of glucopyranosides, hormones, terpenes and steroids by the strains of the fungi *Rhizopus stolonifer*, *Fusarium lini*, *Microphomina phaseoline*, *Glomerella fusarioides*, *Curvularia lunata*, *Cephalosporium aphidicola*, studied the chemism of the biocatalytic processes, studied biology, biocatalytic processes, and biologists and graduates, and biologists and graduates, and biologists and graduates of them and them and them, and them, and them, aspirers, and *Cephalosporium aphidicola*, hormones, hormones, terpenes, and steroids. An increase in antibacterial, inhibitory activity has been established.

Scientific novelty

The novelty of the investigation lies in the study of the biotransformation processes of the complex of biologically active substances of the alcoholic extract obtained from the supernatural part of the plants of the species *Tamarix hispida* under the influence of *Cunninghamella blakesleeana* ATCC8688A, *Microphomina phaseoline* KUCC 730, *Fusarium lini* NRRL 2204, *Glomerella fusarioides* ATCC 9552, *Curvularia lunata* ATCC 12017, *Cephalosporium aphidicola* ATCC 28300, *Rhizopus stolonifer* TSY 047, *Guoclodium viride* ATCC 10097 and several specific nutrient media, as well as the establishment and comparison of its biological activity with the activity of the original plant extract.

The novelty of the investigation also lies in the study of the qualitative and quantitative chemical composition and biological activity of the products of biotransformation.

Objects of study

The objects of study were microorganisms: *Cunninghamella blakesleeana* ATCC8688A, *Microphomina phaseoline* KUCC 730, *Fusarium lini* NRRL 2204, *Glomerella fusarioides* ATCC 9552, *Curvularia lunata* ATCC 12017, *Cephalosporium aphidicola* ATCC 28300, *Rhizopus stolonifer* TSY 047, *Guoclodium viride* ATCC 10097, by means of which the biotransformation of the substance obtained from the aboveground part of the plant *Tamarix hispida*, the substance obtained from the plant *Tamarix hispida*, and the plant material itself, the aboveground part of the plant *Tamarix hispida* of the family *Tamaricaceae* was carried out.

The purpose of the study is to study the processes of biotransformation of the extract obtained from the nasal portion of the species *Tamarix hispida*, and its comprehensive study.

To achieve the goal, the following tasks were set.

1. Development and optimization of the technological scheme for isolating a complex of biologically active substances by ethanol extract from plants of the species *Tamarix hispida* and drawing up a block of its receipt.

2. Development of the technology for obtaining the complex of biologically active substances of ethanol extract modified by the method of biocatalysis and the development of a block-circuit of its biotransformation.

3. The study of the qualitative and quantitative component composition of plant materials, as well as the substance obtained by biocatalysis, as well as the study of the biological activity of the fractions isolated from the substance.

Information on metrological support and methodological base

Chromato-mass spectra of volatile fractions of substances were taken on an Agilent Technologies 7000 GS / MS instrument (USA)

Chromato-mass spectra of non-volatile fractions on an Agilent Technologies 6400 Series Triple Quadrupole LC / MS instrument

Instruments involved in work related to the reference bases of the NIST and Wiley spectra at the base of the Center for Chemical and Biological Sciences of the University of Karachi (Karachi, Pakistan)

Biological activity was determined on the basis of the Dr. Panjwani Center for Molecular Medicine and Drug Research - Karachi, Pakistan.

UV spectra to determine the quantitative composition of the groups of biologically active substances were recorded on an Agilent Sagu 60 instrument.

Provisions for protection

- The developed technological scheme makes it possible to effectively isolate the complex of biologically active substances in the form of an ethanol extract from the plants of the *Tamarix hispida* species and the preparation of a block of its preparation.

- The developed technology for obtaining a biomodified complex of biologically active substances from the original substance is able to have greater biological activity than the original

- The obtained products of the reaction of biocatalytic transformation have a different chemical composition from the original substance and exhibit greater biological activity

Approbation of work

According to the results of the research, 3 articles were published in journals recommended by the Committee for Control of Education and Science of the Ministry of Education and Science of the Republic of Kazakhstan, 3 articles in journals indexed in the Scopus and Thomson Reuters (Clarivate Analytics) databases, four theses.

The results of the work were presented at the International Scientific and Practical Conference of Students and Young Scientists al-Farabi Alema (2017); International Conference "Scientific Forum: Medicine, Biology and Chemistry" (Moscow 2018); International Scientific and Practical Conference of Students and Young Scientists Al-Farabi Alema 2017; at the III International Scientific Conference of Students, Postgraduates and Young Scientists "Chemical Problems of the Present" (Donetsk, May 14-17, 2018).

Articles in journals recommended by the Committee on the Control of Education and Science of the Ministry of Education and Science of the Republic of Kazakhstan:

1. "Chemical composition and growth regulating activity of tamarix hispida substance" Chemical Journal of Kazakhstan 1 (61) 2018;
2. "Analysis of some of the primary and secondary aspects of hispida" Chemical journal of Kazakhstan 1 (61) 2018
3. "Analysis of the cytotoxic activity of *tamarix hispida*" Chemical journal of Kazakhstan 1 (61) 2018г

Articles in journals indexed in the Scopus and Thomson Reuters (Clarivate Analytics) databases:

1. "Investigation of the components of hexane extract from a plant comberator by gas chromatography" Izv. universities. Chemistry and Chem. technology. 2018. T. 61. Vol. 6, s. 83-87
2. "Chemical compositional analysis", Journal of Applied Engineering Science 16 (2018) 233 - 241
3. "Study of the chemical composition of dichloromethane extract *Tamarix hispida*" Bulletin of Karaganda University. Chemistry series No. 1 (89) / 2018.

Theses:

1. "Жер үсті білігінегіі *tamarix hispida* phytopreparation negizidegii transdermaldy дәрілік formalar" / Abstracts of the international scientific-practical conference of students and young scientists al-Farabi Alema 2017;
2. "New polymeric materials based on carbopol for use in pharmaceuticals" / Abstracts of the international scientific-practical conference of students and young scientists al-Farabi Alema 2017;
3. "Biotransformation of plant extract using *glomerella fusarioides*" / Proceedings of the international conference "Scientific forum: medicine, biology and chemistry";
4. "Increasing the biological activity of plant phytocomplex through biotransformation" / III International Scientific Conference of Students, Postgraduates and Young Scientists "Chemical Problems of the Present", Donetsk, May 14-17, 2018

The theoretical significance of the study is to study the patterns of the influence of various biocatalytic processes on the chemical composition and biological activity of total ethanol extracts of plant origin. A block diagram of the biomodification of a complex of biologically active substances of a plant extract in

suspension media of microorganisms using selective nutrient media has been developed.

Practical significance

The ethanol extract obtained from the nasal part of *Tamarix hispida*, contains the main groups of biologically active substances and is distinguished by high biological activity. However, with the biological modification of this extract, it was possible to achieve an increase in its anti-inflammatory and immunostimulating activities using relatively affordable, low-cost and environmentally friendly methods, which would be more appropriate to use for obtaining new effective herbal medicines based on plant raw materials of Kazakhstan.

Technical data of the dissertation

The doctoral thesis work consists of 124 pages, includes 37 tables, 4 figures, 30 chemical formulas and 8 applications, in the process of writing the dissertation work 319 sources were used