

ANNOTATION

of dissertation work on the topic:
“Development of a technology for a novel medicinal product based on *Xanthium strumarium* L. (common cocklebur) native to Kazakhstan and its standardization” for the degree of Doctor of Philosophy (PhD) in the educational program 8D07201 – “Technology of Pharmaceutical Production”

Remetova Nazigul Serikovna

Relevance of the research topic. The relevance of the research problem addressed in this dissertation lies in ensuring the population of the Republic of Kazakhstan with high-quality, effective, and affordable domestic medicinal products, which is an important priority for the pharmaceutical industry.

In accordance with the Address of the Head of State to the People of Kazakhstan “Kazakhstan in New Conditions: Time for Action”, the National Development Plan of the country until 2025, the Order of the Prime Minister of the Republic of Kazakhstan “On the Comprehensive Plan for the Development of the Pharmaceutical and Medical Industry for 2020–2025”, as well as the Government Resolutions “On the Concept for the Development of the Manufacturing Industry for 2023–2029” and “On the National Project ‘Healthy Nation’”, the importance of developing domestic medicinal products using medicinal plants growing in the territory of the Republic of Kazakhstan is increasing. This also includes the development of a pharmaceutical cluster by increasing the competitiveness of domestic products and their entry into foreign markets.

In this regard, the search for approaches to more complete utilization of domestic resources of wild-growing and cultivated plant raw materials and the creation of original phytopharmaceuticals based on them is highly relevant.

Plants of the Asteraceae Dumort. family are of great scientific interest due to their wide spectrum of pharmacological activity resulting from biologically active compounds in their chemical composition. Such plants include common cocklebur (*Xanthium strumarium* L.), of which about 25 species are currently known. It is widely used in folk medicine in many countries as medicinal raw material.

Common cocklebur grows as a weed worldwide, except in the Far North regions. Its native areas are Europe, Asia, and North America, from where it spread to Africa, Australia, South America, India, China, Indonesia, and Malaysia. Two species of cocklebur are found in Kazakhstan. The most widespread (especially in southern regions) are common cocklebur or globe cocklebur (*Xanthium strumarium*) and spiny cocklebur (*Xanthium spinosum*).

The chemical composition of *Xanthium strumarium* L. includes many classes of compounds, such as mono- and sesquiterpenoids, di- and triterpenoids, steroids, phenylpropanoids, coumarins, flavonoids, higher fatty acids, vitamins, nitrogen-

containing compounds, and tannins. The most characteristic substances with antioxidant and anti-inflammatory activity are alkaloids, polyphenols, terpenoids, and flavonoids.

Due to its high content of vitamin C and iodine, the plant is used in folk medicine to stop bleeding and to treat colds and thyroid diseases. The presence of sufficient amounts of the phenylpropanoid ursolic acid and the sesquiterpenoid caryophyllene exerts a suppressive effect on the growth and spread of various types of cancer.

In this regard, the development of new medicinal products from *Xanthium strumarium* L. raw material growing in the territory of Kazakhstan to expand the range of dental products is promising and scientifically justified for the pharmaceutical industry of the Republic of Kazakhstan.

The purpose of scientific research. Development of a technology for obtaining a substance and a dental film based on *Xanthium strumarium* L. raw material and their standardization.

Objectives of study:

1. To conduct a pharmacognostic study of *Xanthium strumarium* L. herb.
2. To establish optimal parameters of the extraction process for obtaining a thick extract of common cocklebur under ultrasonic activation conditions.
3. To conduct pharmacological activity screening and select samples of *Xanthium strumarium* L. thick extract promising for the development of a new medicinal product.
4. To develop the composition and technology of a finished dosage form based on *Xanthium strumarium* L. thick extract.

Research methods: Pharmacopoeial, pharmacological, and biological methods.

Objects of study:

1. A sample of common cocklebur raw material collected at the fruiting stage in the vicinity of Baskunchi village, Panfilov District, Almaty Region. Collection period: August–September 2022; coordinates: 44°20'26" N, 80°22'56" E.
2. A sample of common cocklebur raw material collected in Agadyr village, Shet District, Karaganda Region. Collection period: August–September 2022; coordinates: 48°24'49" N, 72°83'75" E.

Subject of study: resource data, biomorphological features, diagnostic characteristics, and quantitative indicators of *Xanthium strumarium* L. herb raw material; thick extract obtained using ultrasonic exposure; chemical composition and biological activity of the thick extract; study of the biological activity of a dental film prepared on the basis of *Xanthium strumarium* L.; development of regulatory

documentation; and collection of final materials determining the theoretical and practical value of the dissertation.

The main provisions for defense:

- Results of pharmacognostic analysis of *Xanthium strumarium* L. plant raw material growing in Kazakhstan and draft regulatory documentation;
- Method for obtaining a thick extract from *Xanthium strumarium* L. raw material using ultrasound and results of analysis of its component composition;
- Results of selecting an effective thick extract sample based on screening of pharmacological activity (antimicrobial, anti-inflammatory, and antioxidant);
- Development of the composition of a medicinal product in the form of dental films based on a plant extract with a therapeutic effect;
- Results of studies on the pharmacological activity of the developed dental film.

Scientific novelty of the research

- For the first time, pharmacognostic analysis and quality assessment of *Xanthium strumarium* L. medicinal plant raw material growing in Kazakhstan were carried out, and draft regulatory documentation was developed;
- For the first time, an assessment of raw material reserves of *Xanthium strumarium* L. herb in Kazakhstan was conducted;
- For the first time, a method for obtaining extracts from *Xanthium strumarium* L. using ultrasound was developed;
- For the first time, antimicrobial, anti-inflammatory, and antioxidant activities of experimental samples of thick extracts of common cocklebur obtained by ultrasound were studied;
- For the first time, a new medicinal product based on thick extract of common cocklebur (*Xanthium strumarium* L.) in the form of a dental film was developed;
- For the first time, quality control methods for the developed medicinal product were established, and its shelf life and storage conditions were determined.

The scientific novelty of the dissertation research is confirmed by a patent of the Republic of Kazakhstan for a utility model No. 9875 dated 15.08.2025, “Use of *Xanthium strumarium* L. (common cocklebur) as an antimicrobial agent.”

Practical significance of the obtained results

As a result of the conducted studies, raw material reserves of *Xanthium strumarium* L. herb in the Republic of Kazakhstan were determined. Technologies for harvesting plant raw material, quality specifications, and draft regulatory

documentation were developed. Using the ultrasonic method, an extract based on *Xanthium strumarium* L. was obtained, its chemical composition was determined and standardized. Based on the thick extract, a dental film was developed. According to acute toxicity studies, the thick extract showed no toxic properties and demonstrated anti-inflammatory, antioxidant, and antimicrobial activity. Laboratory regulations and draft regulatory documentation were developed for *Xanthium strumarium* L. herb, the thick extract substance, and dental films. The technological process for obtaining extracts using ultrasound has been introduced into the educational process of the School of Pharmacy of Karaganda Medical University, the Faculty of Biology and Geography of Karaganda University named after Academician E.A. Buketov, and the Department of Pharmacognosy and Botany of Bashkir State Medical University.

Personal contribution of a doctoral student

All experimental results presented in the dissertation were obtained personally by the author, confirming her personal contribution to pharmaceutical production technology. The author conducted studies of anatomical and morphological characteristics of *Xanthium strumarium* L., prepared and accumulated extracts obtained by ultrasonic cavitation with ethanol and water, identified their compositions using HPLC-MS analysis, developed methods for obtaining ultrasonic extracts, performed screening for antimicrobial, anti-inflammatory, and antioxidant activity, developed laboratory regulations for the substance and dosage form, and carried out statistical processing of the results.

Conclusions

The dissertation is devoted to the development of a technology for a new medicinal product with antimicrobial, anti-inflammatory, and antioxidant activity based on *Xanthium strumarium* L.

1. Studies of raw material distribution and prospects showed that *Xanthium strumarium* L. herb is a renewable source of plant raw material. Pharmacognostic studies of samples collected in Almaty and Karaganda regions identified diagnostic anatomical and morphological features for identification.
2. Quality parameters of plant raw material were determined and included in draft regulatory documentation.
3. For the first time, a technology for obtaining a thick extract was developed. The maximum yield was achieved by double ultrasonic extraction with 70% ethanol at 40 kHz for 30 minutes. The main components were flavonoids. Shelf life of the thick extract was established as 24 months. The extract demonstrated pronounced antimicrobial, anti-inflammatory, and antioxidant activity.

4. An optimal composition of phytodental films was developed, including dosage selection, technological justification, determination of physicochemical and biopharmaceutical parameters, and development of an HPLC method for quantitative analysis.
5. A feasibility study for obtaining an antimicrobial, anti-inflammatory, and antioxidant product from *Xanthium strumarium* L. thick extract was developed.

Approbation of the results of the dissertation

The results were presented at international and national scientific conferences in Kazakhstan, Uzbekistan, and Tajikistan from 2022 to 2025.

Publications

The main provisions of the dissertation are reflected in 10 publications, including 1 patent of the Republic of Kazakhstan, 2 articles in journals recommended by the Committee for Quality Assurance in Science and Higher Education, 2 articles indexed in Scopus (Q2, 50%), 4 conference abstracts, and 1 international conference report.

Scope and structure of the dissertation

The dissertation consists of 149 pages, including 45 tables, 38 figures, 159 references, and 18 appendices. It comprises seven sections: introduction, literature review, materials and methods, research results, and conclusion.