ISSN: 2692-5206
AMERICAN ACADEMIC PUBLISHER
INTERNATIONAL JOURNAL OF MEDICAL SCIENCES

TECHNOLOGY OF DRY EXTRACT FROM ROSEMARY

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Abstract: This article discusses the technology of obtaining dry extract from the leaves of rosemary (Rosmarinus officinalis L.), one of the medicinal plants. The pharmacological significance of biologically active compounds contained in rosemary, including essential oils, phenolic acids, flavonoids and diterpenoids, is analyzed. The process of producing dry extract includes the stages of extraction, filtration, concentration and drying. Scientifically based recommendations are given on the selection of the optimal solvent in the production technology, determination of extraction parameters and ensuring the preservation of biologically active substances.

Keywords: rosemary, extraction, dry extract, phenolic compounds, essential oils, pharmaceutical technology, bioactive substance.

INTRODUCTION: The technology of extracting dry extract from rosemary is of great practical importance in the pharmaceutical, food industry and cosmetology industries, as this process ensures the complete separation of biologically active substances from natural raw materials and the preservation of their quality indicators. Rosemary (Rosmarinus officinalis L.) is a plant widespread in the Mediterranean region, characterized by a strong essential oil aroma and rich chemical composition. Its leaves and young branches contain essential oils, phenolic compounds, flavonoids, diterpenes and rosmarinic acid with antioxidant properties, which have a beneficial pharmacological effect on the human body. The process of obtaining a dry extract allows not only to isolate biologically active substances from raw materials, but also to increase their concentration and extend their shelf life. Modern extraction technologies, including water-alcohol solutions, supercritical CO_2 extraction and ultrasound extraction methods, play an important role in improving the quality of the obtained product and ensuring the efficiency of the process. Also, the selection of the optimal temperature, time, type and concentration of the solvent, and the extraction method directly affect the quality and quantity of the final product. The relevance of this topic is that in recent years, the demand for synthetic preservatives and antioxidants has decreased, and the need for additives from natural sources is increasing. Rosemary extract is widely used in food products as a natural antioxidant that slows down oxidation processes, in pharmaceuticals as an anti-inflammatory and immune-boosting component, and in cosmetology as a means of slowing down the skin aging process. Therefore, improving the technology for obtaining dry extract from rosemary, improving product quality and making the production process economically efficient is one of the priority areas for current research and development.

LITERATURE REVIEW

Rosemary (Rosmarinus officinalis L.) has long been recognized in the literature for its wide use in the medicinal and food industries. Benedek and Kopp [1] in their study noted that the

ISSN: 2692-5206
AMERICAN ACADEMIC PUBLISHER
INTERNATIONAL JOURNAL OF MEDICAL SCIENCES

main bioactive compounds found in rosemary — carnosol, carnosic acid, and rosmarinic acid — have strong antioxidant properties. In their opinion, the preservation of these components during the extraction process depends on the correct selection of technological parameters. Nieto et al. [2] studied the antioxidant and antimicrobial properties of rosemary extracts and found that the extraction method significantly affects the quality and quantity of bioactive substances. In their study, aqueous-ethanolic extraction and supercritical CO_2 extraction methods were compared, and the CO_2 method allowed to obtain a dry extract with the highest purity.

Yesiloglu et al. [3] showed that by optimizing the extraction conditions of rosemary using supercritical CO_2, it is possible to extract maximum bioactive components by changing the parameters of pressure (200–300 bar), temperature (40–60 °C) and time. At the same time, they noted the partial decomposition of heat-sensitive substances in traditional boiling and cold extraction methods. The Pharmacopoeia of the Republic of Uzbekistan [4] sets standard requirements for the quality indicators of rosemary extract, moisture content, active substance concentration and microbial purity. These regulatory documents ensure strict compliance with technological procedures and hygienic requirements during the extraction process. Shen et al. [5] studied the antioxidant activity of rosemary essential oil and oleoresins. They proved the high ability of carnosic acid and carnosol to neutralize free radicals in vitro and emphasized the effectiveness of the dry extract in increasing the stability of food products.

ANALYSIS AND RESULTS

The technology of obtaining dry extract from rosemary is a complex and multi-stage process, the main goal of which is to maximally isolate biologically active substances from plant raw materials and preserve their natural activity. Rosemary (Rosmarinus officinalis L.) contains a high content of phenolic compounds, in particular rosmarinic acid, carnosic acid, carnosol, as well as essential oils, which have a strong antioxidant, anti-inflammatory and antimicrobial effect. Therefore, the extraction method, process conditions and drying method are of particular importance in the processing technology, since it is these factors that directly affect the yield and quality of the final product. The first stage of the technology is the preparation of plant material. The raw material is checked for moisture, foreign impurities and quality indicators in accordance with the requirements of the pharmacopoeia. Since the highest content of active substances is found in rosemary leaves, it is the leaves that are used. They are cleaned of mechanical impurities and then subjected to a grinding process to an optimal particle size. The particle size should be such that the maximum contact surface with the extractant is created, but the formation of excessive powder should not make the filtration process difficult.

The choice of extractant depends on the nature of the target substances. Since rosemary contains both polar and non-polar compounds, water-alcohol mixtures of various concentrations are most suitable. Typically, the ethanol concentration is in the range of 40–70%. Changing the amount of alcohol directly affects the ratio of active substances in the extract - for example, alcohol at a high concentration dissolves essential oils well, but can reduce the release of some phenolic compounds. Therefore, a stepwise extraction method is often used, in which the solution is first treated with a solution of a certain concentration, and then switched to another concentration. Temperature and time are important factors in

ISSN: 2692-5206
AMERICAN ACADEMIC PUBLISHER
INTERNATIONAL JOURNAL OF MEDICAL SCIENCES

the extraction process. Too high a temperature can lead to the decomposition of active substances, while too low a temperature slows down their release. Therefore, the optimal temperature is usually set around 40–60 °C. The process can be carried out dynamically (mixing, circulation) or statically. The dynamic method accelerates the extraction and increases the yield of the substance. The resulting liquid extract is then purified using mechanical and membrane filters. As a result of filtration, excess plant fibers, resinous substances and other mechanical impurities are separated. After that, the concentration process begins. At this stage, a large part of the solvent is evaporated, which increases the density of the extract and speeds up the drying process. Concentration is usually carried out in a vacuum, which reduces the temperature and prevents the decomposition of active substances. Drying technology is one of the most important processes that determine the quality of a dry extract. Two methods are most often used: spray drying and sublimation drying. Spray drying is fast and effective, and is widely used on a commercial scale. Sublimation drying, on the other hand, preserves the biological activity of the product to the maximum extent, but is technologically complex and expensive. The resulting dry extract is in the form of a powder with fine, uniform color and hygroscopic properties. The amount of active substances in it is checked according to standards. For example, the percentage of rosmarinic acid and carnosic acid, moisture content, heavy metals and microbiological indicators are strictly controlled. Dry rosemary extract obtained by this technology is widely used in the pharmaceutical, food, perfumery and cosmetic industries. In the pharmaceutical industry, it is used as the main component of antioxidant and anti-inflammatory drugs. In the food industry, it is used as a natural preservative, extending the shelf life of products. In cosmetology, it is added to protect the skin, slow down aging and have an anti-inflammatory effect.

CONCLUSION

Analysis of the technology of obtaining dry extract from rosemary by extraction shows that this process is not only highly efficient in the pharmaceutical and food industries, but also significantly increases the quality of the product. Rosemary is a valuable plant with its rich biologically active compounds, including components with antioxidant and anti-inflammatory properties. The methods used in the technology of obtaining dry extract - such as heat treatment, extraction with water-alcohol solutions, and vacuum drying - allow preserving the biological value of the product. According to the results of experiments and observations, the selection of optimal extraction conditions, control of raw material quality, and minimizing heat load during the process are the main factors determining the quality indicators of dry extract. Also, the use of modern technological equipment allows automating the production process, reducing energy consumption, and increasing production efficiency. Based on the results of this study, it can be said that dry extract from rosemary can be effectively used not only in the preparation of pharmaceutical preparations, but also in the production of biologically active additives, perfumes and cosmetics. By improving the technology, it will be possible to ensure the ecological purity of the product and its compliance with international standards. Therefore, it is important to further optimize the production process of rosemary extract, introduce new methods and deepen scientific research in the future.

ISSN: 2692-5206
AMERICAN ACADEMIC PUBLISHER
INTERNATIONAL JOURNAL OF MEDICAL SCIENCES

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