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STUDY OF PHYSICOCHEMICAL AND TECHNOLOGICAL PROPERTIES OF DRY EXTRACT FROM ROSA RUGOSA LEAVES

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Abstract

At the experimental and technological laboratory of the Institute of Plant Chemistry, a dry extract was obtained from the leaves of Rosa rugosa, containing the flavonoids quercetin-3-O-sophoroside and kaempferol-3-O-sophoroside. To substantiate the composition and technology of solid dosage forms, the physicochemical and technological properties of the dry extract were studied. As a result of experimental studies, the feasibility of incorporating a complex of auxiliary substances into the composition of the solid dosage form and utilizing the method of preliminary wet granulation was determined.

Keywords: *Rosa rugosa, dry extract, technological properties*

Introduction

Herbal medicines offer the advantage of providing a mild pharmacological effect, low toxicity, and are generally safer than synthetic drugs. However, developing solid dosage forms, such as tablets containing dry extracts, often presents significant challenges due to the unsatisfactory technological properties of the dry extracts. Therefore, studying the physicochemical and technological properties of these dry extracts is crucial for the accurate selection of the composition and technology of the drugs (Madrakhimov, Sh.N., Rakhimova et al., 2016). The aim of this study is to investigate the physicochemical and technological properties of the dry extract from Rosa rugosa leaves, which will help in determining the optimal selection of excipients for the development of the composition and technology of plant-based tablets.

Materials and methods

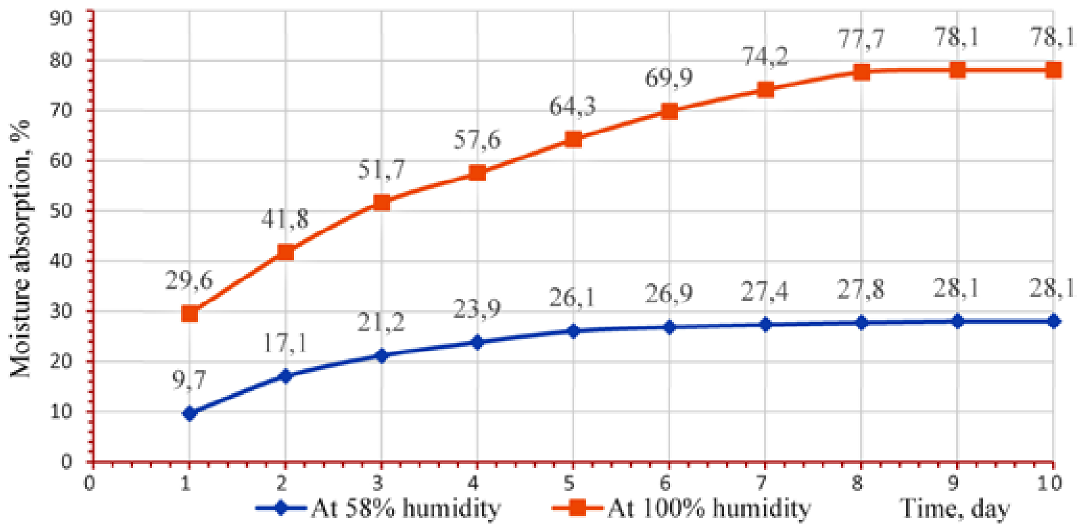
The object of the study was a dry extract from *Rosa rugosa* leaves, obtained using the following procedure: air-dried *Rosa rugosa* leaves were ground in a mill equipped with a 6 mm sieve. Ten kilograms of the ground raw material were loaded into an extractor, into which 200 liters of 70% ethyl alcohol were poured. The extraction process was carried out at a temperature of 70 °C for 6 hours. After this period, the first 180 liters of the extract were drained into a collector. Subsequently, a new portion of 200 liters of 70% ethyl alcohol was added to the extractor, and extraction was conducted under the same conditions as the first extraction. As a result, 380 liters of the combined extract were obtained, which were filtered and loaded in portions into a vacuum evaporator, where the extract was concentrated to a concentration of 0.12 g/ml at a temperature of 60–70 °C and under a vacuum of 0.04–0.08 MPa (0.4–0.8 kgf/cm²). The concentrate was then passed through a column filled with adsorption resin XAD-16N. The adsorption resin absorbed the flavonoids (quercetin-3-O-sophoroside and kaempferol-3-O-sophoroside), which were subsequently washed with distilled water in a volume ratio of sorbent to water of 1:5. Flavonoids were extracted from the purified sorbent using 50% ethyl alcohol in a volume ratio of sorbent to alcohol of 1:2. The alcohol solution of flavonoids was then concentrated using a rotary evaporator and dried in a drying cabinet at a temperature of 60–70 °C under a vacuum of 0.04–0.08 MPa (0.4–0.8 kgf/cm²). The resulting dry mass was ground in a mill and sieved, yielding 1.25 kg of dry extract.

The study of the moisture absorption kinetics of the dry extract from *Rosa rugosa* leaves was conducted using the gravimetric method (Nosovitskaya, S.A. et al., 1969). Additionally, the following physical, chemical, and technological quality indicators were examined: crystal size and shape, solubility, particle size distribution, bulk density before and after shrinkage, flowability, residual moisture, compressibility, angle of repose, accompanying impurities, authenticity, quantitative content, and other necessary characteristics according to the methods outlined in the State Pharmacopoeia of the Republic of Uzbekistan. Bulk density was determined using a 545R-AK-3 device from the Mariupol Plant of Technological Equipment. The flowability of the materials was assessed using a VP-12A device. Compressibility was evaluated by measuring the resistance to crushing of standard pressings obtained on a hydraulic press at a pressure of 1200 kg/cm². The angle of repose was measured using a special ruler and scale. Residual moisture was determined using the infrared (IR) drying method, employing an IR moisture meter from Kett (Kedika, S.A., 2011).

Results and discussion

Initially, the size and shape of the crystals in the dry extract of *Rosa rugosa* leaves were assessed. The shape of the powder crystals can significantly affect the orientation of the particles, influencing characteristics such as flowability, solubility, compressibility, and compactness. Crystallographic studies revealed that the dry extract is amorphous.

Figure 1. *Kinetics of water absorption of dry extract of Rosa rugosa leaves under experimental conditions of 58% and 100% relative humidity*



The study of the moisture absorption kinetics of the dry extract showed that under experimental conditions-58% relative humidity for 5 days, and 100% for 24 hours – the moisture content of the extract increased to over 25%, turning it into a resinous mass. These results indicate that the dry extract of *Rosa rugosa* leaves is classified as a "very hygroscopic" substance (Fig. 1).

The study then proceeded to examine the technological properties of the dry extract, with the results presented in Table 1.

Table 1. *Technological properties of the dry extract of Rosa rugosa leaves*

№	Indicators to be checked	Units of measurement	Results obtained
1	Particle shape	–	amorphous
2	Fractional composition: + 1000 – 1000 +500 – 500 +315 – 315 +250 – 250 +160 – 160	microns.%	– 2.20 11.18 35.34 44.07 7.21
3	Flowability	10^{-3} kg/s	2.28
4	Natural angle of repose	degree	62.00
5	Bulk density	kg/m^3	479
6	Compressibility	H	72
7	Compaction coefficient	K	2.68
8	Residual humidity (70 °C)	%	4.48

Analyzing the results presented in Table 1, it can be concluded that the dry extract of *Rosa rugosa* leaves exhibits unsatisfactory volumetric characteristics and poor fluidity. The high compressibility coefficient further indicates poor flowability, as confirmed by the elevated angle of repose and the irregular shape of the powder particles. However, the dry extract does show satisfactory compressibility, which can be attributed to the complex shape of its particles, large contact surface area, and cohesive forces. Based on the crystallographic and technological studies of the *Rosa rugosa* dry extract, it was determined that when developing solid dosage forms, auxiliary substances should be incorporated to improve the flowability and compressibility of the formulation mass (Table 1).

Conclusions

Thus, we have studied the physicochemical and technological properties of the dry extract of *Rosa rugosa* leaves and identified the critical characteristics of the raw material that can impact the quality of the finished product. Experimental studies have demonstrated the necessity of incorporating a complex of auxiliary substances into the dosage forms and utilizing the method of preliminary wet granulation. The data obtained should also be considered when storing the dry extract of *Rosa rugosa* leaves.

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