Chemistry of Natural Compounds, Vol. 34, No. 4, 1998

EXTRACTION OF RUTIN FROM *Sophora japonica* BUDS USING SURFACE-ACTIVE AGENTS

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UDC 615.012:542.9

An increase in the yield of rutin from the extraction of Japanese pagoda tree buds on the use of surface-active agents because of a facilitation of the wetting process and an acceleration of the swelling of the raw material has been demonstrated.

Many publications have been devoted to methods of extraction [1, 2]. It is known that the initial stages of the process of extracting medicinal plant raw material is the penetration of the extractant into this material and its wetting of substances present within the cells [3]. According to Young's equation, the wetting of substances by the extractant depends on the surface tension, which can be lowered by surface-active agents (SAAs). Consequently, the use of SAAs will permit an intensification of the process of mass transfer and a faster and fuller extraction of biologically active substances from plant raw material.

It has been shown previously that under the influence of SAA solutions in the extraction of essential oils from plants the surface tension of water falls and the wetting, penetration, and swelling of the plant material are facilitated [4]. In the production of rutin from the buds of the Japanese pagoda tree, losses are connected with incomplete removal at the extraction stage. Thus, a single extraction under industrial conditions permits only about 60% of rutin to be isolated [5].

We have studied the influence of some SAAs on the extraction of rutin from Japanese pagoda tree buds. The swellability of the raw material was studied by the procedure of Lishtvan et al. [6]. In the experiments we used anionic (ASSAs), cationic (CSAAs), and nonionogenic (SAAs) surface-active agents in various concentrations.

It can be seen from the results presented in Table 1 that the total swellability of the buds amounted to 300% and was reached in 10-12 h in the absence of SAAs. The investigations showed that the degree of swelling and the time to reach equilibrium depend on the temperature. Thus, at 20°C equilibrium was reached in 10-12 h, and at 60°C after 2.5 h, the amount of water exceeding 215% of the initial weight.

The experimental results are well described by the equation

$$G = G_n(1 - e^{-k\tau/T}),$$

where G_s is the weight of raw material after saturation, k is a coefficient, and τ is the time.

To increase the rate of swelling we used SAA solutions with various concentrations. The maximum effect was achieved at concentrations of 0.25-0.3%. The swelling process has an exponential nature, with the rate of penetration almost doubling.

Thus, the preliminary wetting of plant material with an aqueous solution of an SAA promotes swelling, the opening up of a large number of cells, and an increase in the proportion of macropores, which considerably accelerates the processes of mass transfer in the system. It was established that with a twofold extraction of rutin from Japanese pagoda tree buds after the wetting of the raw material with a 0.25% solution of an SAA the yield of desired product amounted to 86.5%, as compared with 78.0% in threefold extraction by the existing technology.

EXPERIMENTAL

The swellability of the plant raw material was determined by wetting with water and with solutions of an SAA (alkylaryl sulfates [sic]). After steeping, the material was dried with filter paper and the increase in weight was determined.

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 0009-3130/98/3404-0448$20.00

TABLE 1. Swellability in Water of Japanese Pagoda Tree Buds at Room Temperature

Weight before swelling, g	Time of swelling, h	Weight after swelling, g	Increase in weight, %	Water on the initial weight of the raw material, %
		Absence of SAAs		
3.05	0.5	4.48	147	47
3.00	1.0	5.55	185	85
3.08	2.0	6.68	217	117
3.04	3.0	7.05	232	132
3.05	4.0	7.66	251	151
3.06	12.0	9.01	295	195
		Presence of an SAA		
2.00	0.15	2.90	145	45
2.00	0.50	3.84	192	92
2.00	0.75	4.64	232	132
2.00	1.00	5.36	268	168
2.00	1.25	5.68	284	184
2.00	4.00	6.10	305	205

Before extraction, the plant material was wetted with a 0.25% aqueous solution of an SAA at 25°C in a liquor ratio of 1:10 for 35 min. After the swelling of the raw material it was extracted twice. The extracts obtained were separated from the meal and combined. The temperature of extraction was 125°C [sic]. The combined extract was cooled to 14-16°C, whereupon a greenish yellow precipitate of technical rutin deposited. The precipitate was filtered off, dried at 85°C, and recrystallized from alcohol. The amount of rutin was determined spectrophotometrically.

REFERENCES

1. G. K. Goncharenko and E. I. Orlova, Med. Prom-st' SSSR, No. 6, 43 (1966).
2. V. D. Ponomarev, in: Improvement in the Theory and Technique of Extraction from Solid Materials with the Aim of Creating Highly Effective Automated Extractors [in Russian], Kiev (1974), p. 137.
3. V. D. Ponomarev, The Extraction of Medicinal Raw Material [in Russian], Meditsina, Moscow (1976), p. 204.
4. Kh. T. Avezov, S. I. Aminov, and R. S. Iskandarov, Kime va Farmatsiya, No. 1, 17 (1997).
5. The Industrial Rules for the Production of Rutin According to Uzkhimfarm [in Russian] (1984), p. 98.
6. I. I. Lishtvan, L. N. Maevskaya, N. V. Churaeva, and A. M. Lych, Kolloidn. Zh., **46**, No. 1, 29 (1984).