THE ANALISIS OF THE BURDOCK ROOTS DRYING PROCESS WITH HIGH FREQUENCY WAVES

***Rotari E., Lupaşco A., Bernic M., Bantea-Zagareanu V.**

Technical University of Moldova – Chişinău, Moldova

***Rotari E. emai-l: bragalenaa@mail.ru**

Abstract: This article suggests a new method of burdock roots drying with hihg frequency flow.The kinetics process was investigated by convection and combined methods.
It was found that the application of high frequency currents during the drying process the amount of electricity decreases.
Keywords: high frequency waves ,drying, roots of burdock, rehydratation.

Introduction

In nowadays the population increasingly resorts to different treatments, herb-based drinks. At the national level are know 3,700 plant species, having curative properties and about 370 pharmacodynamic effects.

The quality of medicinal and aromatic plants are determined by the content of chemical compounds. The composition of chemical compounds and their amount depends on ecological factors, harvest time and the method of processing.

One of decisive operation is drying, which influences the preserving of chemical compounds with increased value for the human body. The long drying process of traditional methods (convection, conduction, heleo) reduces the quality of the finished product.

That is why this work suggests a new approach for the burdock roots drying, namely the application of internal heat source – high frequency waves (S. H. F.). This method allows a significant hastening of the mass move in drying process at low temperatures that is peculiar for bordock root.

Bordock is a biennial plant, with a high of 1 - 2 m, tap-rooted , branched up to 60 cm length and 6 cm diameter. The leaves are large, triangular. It can be found growing in mountains, on flatlands, along roadsides etc.

According to its chemical composition, burdock roots contain 40 – 45 % inulin, 0,1 % essential oil, potassium salts, volatil oil and substances with microbial action. It contains also caffeic acid, palmitic acid, stearic acid, stigmasterol, B complex vitamins, protein 12.3%, hormonal and phytohaemagglutinin principles.

The bitter element is due to artiopicrine ($C_{19}H_{28}O_6$), which is an unsaturated lactose. It is used with success to ameliorate, in some cases, even to treat the following diseases: diabetes, eczema, psoriasis, ringworm, acne, Furunculosis, tonsillitis, poiree gingivitis rheumatism, gout, biliary dyskinesia, atherosclerosis, syphilis, measles etc. [7, 8, 9, 10].

1. Materials and Methods

With the purpose of kinetics study of drying burdock roots in S. H. F. in figure 1 [1] it was used the following plant.

This instalation allows the application of different drying methods : convenction, S. H. F field, unceasing, pulsating or combined (simultaneous convection with S. H. F.)

During the drying process mass lowering were recorded, the temperature of the product and the environment, the room humidity and the speed heat factor and of the hot air.

The initial weight was 150 ± 0,1 g. The test of vegetable plants were dry from the initial moisture content 458,7 % by the final moisture content of 6,1 ± 0,1%.

For the combined drying burdock roots were used 5 kinds of temperature of the heat factor located within 60 - 100 °C and 3 modes of oscillation of electromagnetic field 5 s/10 s, 10 s/10 s 15 s/10 s (where the first digit is the period of the application for high frequency currents, and the second is the duration of the break between impulses).

Speed remained constant 3.4 m/s. The force of the electromagnetic field was 2450 MHr. On the basis of experimental data were constructed drying curves and through mathematical calculations were obtained drying rate curves.

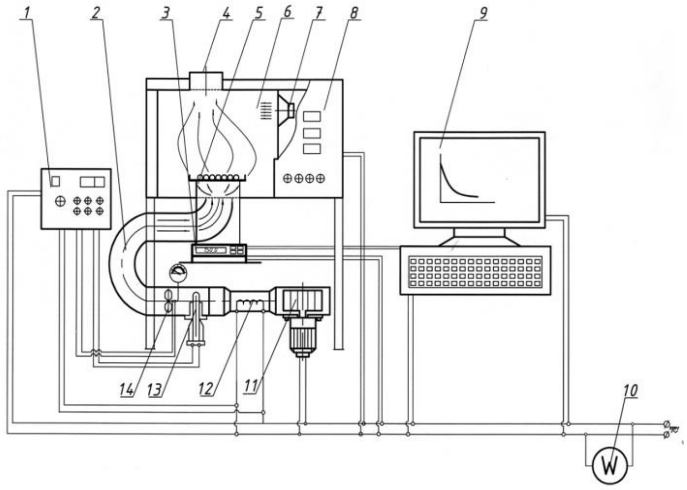

Fig. 1. The experimental drying scheme

1 – manage and control system; 2 - air duct; 3 - electric balance; 4 – air duct; 5 – product support; 6 – drying room; 7 - magnetron; 8 – control panel; 9 - computer; 10 - electric meter; 11 - fan; 12 - electric radiator; 13 - thermocouple; 14 – anemometer.

2. Results and Discussion

Analysing the drying curves (fig. 2 a.) [5, 6], we can see a drying time reduction once with intake increasing duration of S. H. F. So when the variation mode was 5 s/10 s the time drying was 135 min, when the oscillation regime was 10 s/10 s the time drying was 65 min, and when the oscillation were 15 s/10 s the time drying was 55 min.

The convection method took the highest drying time (at a temperature of 60 °C the length of the drying process – 210 min). Results that in order to obtain minimum period of drying system of oscillation 15 s/10 s at which it has obtained an intensification of 3,81 times compared to convection method.

Increasing the duration of application of the thermal agent causes the increase of maximum value of the drying speed fig. 2 b. So the convenction drying (theral agent temperature 60 °C) was recorded 9,0 %/min, but fot the variation mode 5 s/10 s – 9,7 %/min, 10 s/10 s – 10,5 %/min, 15 s/10 s – 10,7 %/min.

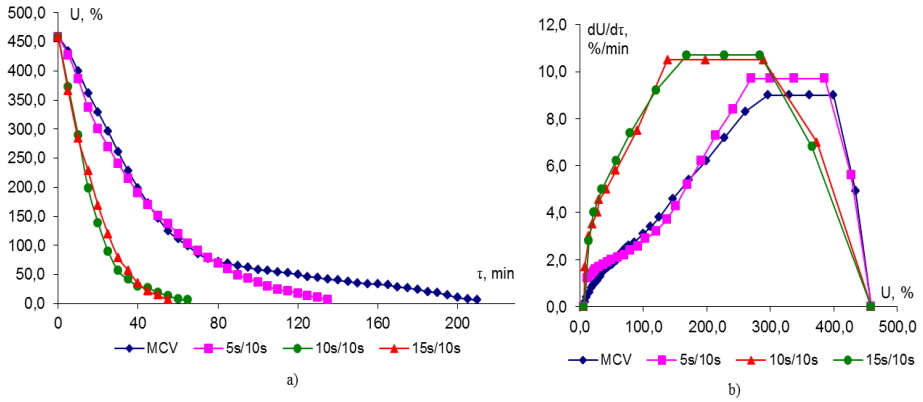

Fig. 2. The drying curves (a) and the speed drying (b) for burdock root through convection and oscillation method

While choosing the best way of drying one should pay attention to the energy consumption. So according to Table 1. the highest energy consumption for drying 1 kg of the product is 175 kW.

The raise of energy time application S.H.F. during one pulsation leads to the energy consumption reduction. So, when the energy intake time is raised from 5 s/10 s –to 154,26 kW, 10 s/10 s – 80 kW, and from 15 s/10 s – 66,66 kW, it was noticed a 2,31 time, but compared to convenction method 15 s/10 s it was noticed a 2,62 time decrease consumption. As regards to energy consumption with SHF, 15 s/10 s is the best

Tabelul 1. The energy consumption for the burdock roots drying

Oscilation regime	MCV	5 s/10 s	10 s/10 s	5 s/10 s
Energy consumption, kW·h/kg evaporated water	175,00	154,26	80,00	66,66

For root products such as Burdock root index rehydration, is important before use. That is why rehydration property of the dried burdock root was studied through all known methods. Rehydration measurements were made with Dogadkin's appliance, relying on the water volume measure during determinations.

Tabel 2. Rehydratation coefficient of burdock roots dried at different thermal temperatur

The temperature of thermal agent, °C	Rehydration coefficient, %			
	Convective Method	*5 s/10 s*	*10 s/10 s*	*5 s/10 s*
60	69,16±0,2	80,00±0,2	61,0±0,2	54,34±0,2
70	68,02±0,2	75,00±0,2	59,2±0,2	52,06±0,2
80	64,5±0,2	71,8±0,2	57,0±0,2	50,5±0,2
90	61,6±0,2	66,5±0,2	53,8±0,2	46,8±0,2
100	58,00±0,2	62,7±0,2	50,0±0,2	44,46±0,2

According to 2 table it is noted that enhanced property of rehydratetion possess the dried tests from the oscillation 15 s/10 s. [2]. Simultaneously according to table 2 and figure 3 when the oscilation regime is increased it is noticed a rehydratation raising for all the studied thermal temperature. The raising of rehydratation properties in this case it is determined by the reduction of rehydratation time.

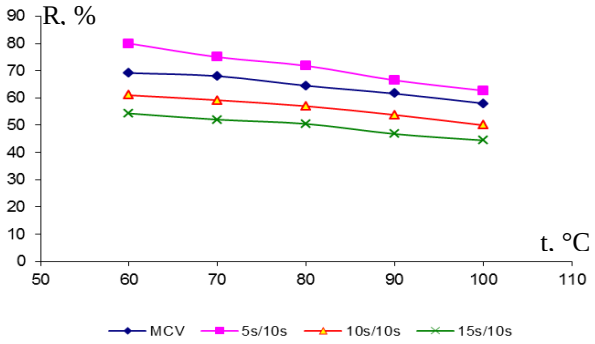

Fig 3. Dry burdock roots rehydratation coefficient dependence according the temperature of heat agent, using convective drying method oscillation regime (S.H.F.)

CONCLUSION

Analysing the obtained result of the burdock roots drying process with high frequesncy waves it was shown that the most favorable drying process is that combined through convenction and pulsating field S.H.F. with the heat temperature and oscillation regime 5 s/10 s. At this drying condition the drying time was 55 min. Energy consumption settling 66,66 kW·h/kg water evaporation and the rehydratation was 54,34 ± 0,2 for the heat temperature of 60 °C

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