

THE SHEETS STEVIA (*STEVIA REBAUDIANA BERTONI*) DETERMINATION OF BASIC INDEXES POROSITY

The method of determination basic indexes of sheets stevia (Stevia rebaudiana Bertoni) porosity is first presented. Neat liquid imers for implementation method and the mode vacuum standards of sheets stevia is worked out. The order of till findings is offered for determination of por maximal value, the porosity of opened, the closeness of imaginary, the surface of specific, the por of effective volume and the coefficient porosity of opened.

Keywords: porosity, sheets, technological quality, liquid imers, method of satiation

Introduction. Storage of raw material terms which this process is carried out for have a considerable role. From the technological estimation of digister depends planning of depository and technological equipment for its redoing, and also auxiliary and materials of packing. A technological estimation consists in determination of coefficient take in water, the pour of closeness, the factious of composition, friableness, the porosity of digister, the coefficient of well-educated internal juice, degree swelling of raw material. One of ponderable indexes of technological estimation there is porosity which determines hydrodynamic resistance and line-to-line effective surface. Distinguish internal (pores of inwardly particles of sheet) and external (volume between the particles of sheet in the certain thickness of layer).

Today the technological estimation of digister is carried out for corn and vegetable cultures, medical plants [1, p.147-149] in stove bread production for establishment of nourishing description [2, p. 39], oil receipt for establishment of optimum terms of extracting butter [3] and others like that. In addition, a value of porosity is considerable index of quality for cement, coal, fireproof materials [4, 5], hard type of fuel and others like that. For determination of technological estimation of stevia today there are not the proper methods, that is instrumental in their development and introduction.

Analysis of the last publications. At a porosimetry usually utilize methods: direct, optical, based on measuring of closeness, expansion of gas, the porosity of mercury, satiation and others like that [6, 7]. More acceptable is a method of satiation, which is based on the satiation of porous material a liquid imers, weighing dry a standard and additional mass at his liquid immers which he was saturated. In quality a liquid imers apply: water distilled, alcohol is ethyl, alcohol is izopropilov, geksan, kerosene, benzol, mercury and others like that. A liquid imers does not must during determination: to change basic properties a standard, to cause flowdown or removing a layer by the layer of particles and deformation a standard, to be toxic and too volatile. The water distilled is instrumental in swelling of sheet, and benzol or geksan have low coefficient volatility which will result in the high error of measure. Among possible liquids imers's more acceptable is an alcohol ethyl, a coefficient of volatility which 0,51.

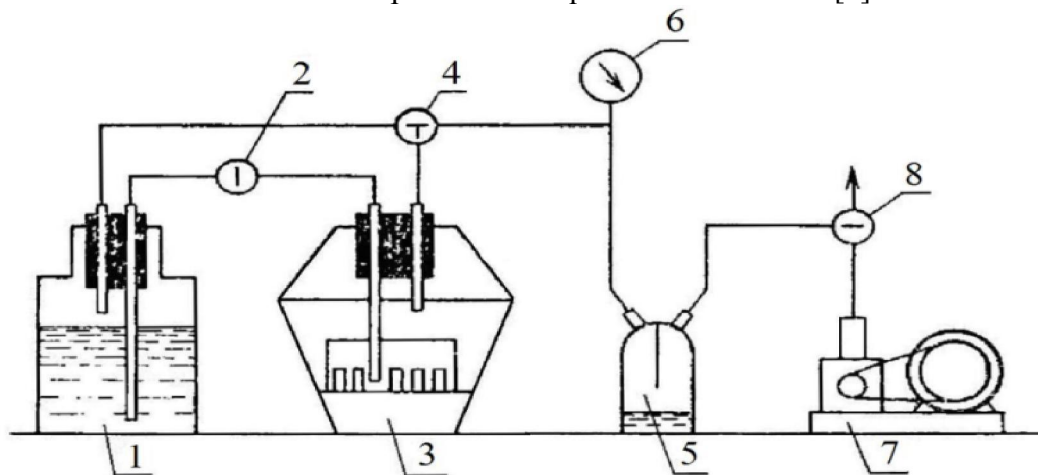
Taking into account existent experience in relation to determination basic indexes of porosity it is decided for development of method determination basic indexes of sheets stevia (*Stevia rebaudiana Bertoni*) porosity to apply the method of satiation with the use in quality the liquid imers is alcohol ethyl.

*Purpose of work is development of method determination basic indexes of sheets stevia (*Stevia rebaudiana Bertoni*) porosity/*

Materials and methods. Reared on the experimental area of Agrofirma «Veselinovka» (Kiev area) stevia mowed on September, 9-12 in 2013, purged from admixtures and dried. In research utilized the sheets of purpose (fresh and dried at different temperatures: 28-30, 40, 60, 70, 80 and 100 °C) and sheets of different dispersion (10 standards). Grindings down of sheets stevia carried

out on a mill, what to sift and got 10 standards of sheets stevia with different dispersion. Preparation of standards to the analysis was carried out by drying to permanent weight at a temperature 105-110 °C with their next cooling. During research applied a kapron filter-mass from which 3×7 see prepared sacs a size with filaments for stringing of different color.

Results of researches. The saturations of standards usually conduct a liquid imers by two methods: to do a vacuum or boiling with a liquid. As application of second methods will violate the structure of sheets stevia applied the method to do a vacuum. The principle chart of fluidizer satiation standards of sheets stevia it is presented a liquid imers on rice. 1 [8].



Rice. 1. Principle chart of satiation standards of sheets stevia by a liquid imers to do a vacuum: 1 - capacity for a liquid imers; 2 - faucet; 3 - capacity for the satiation standards; 4 - three motions faucet; 5 – trap for the drops of liquid; 6 - vacuum-gauge; 7 - vacuum pump; 8 - faucet to a vacuum pump and filling of the system by air.

Determinations of duration satiation carried out by selection of duration, for which the permanent index of the porosity of opened is got depending on factious composition (tabl. 1). The got results show that optimum general duration did a vacuum regardless of size sheet are 3 hours.

Table 1

The sheets stevia of influence duration for did a vacuum is on a porosity of value opened, %

Sheets	The time for did a vacuum, h				
	1	2	3	4	5
fresh	29,7	30,2	35,1	35,2	35,1
ground up:					
1< δ <2,5	32,1	33,4	35,8	35,8	35,7
0,4< δ <0,63	33,8	34,7	35,3	35,1	35,3
0,16< δ <0,25	33,5	35,1	36,5	36,5	36,5
0,05< δ <0,1	30,6	31,2	33,7	33,8	33,7

The method of determination of basic indexes of sheets stevia (*Stevia rebaudiana* Bertoni) porosity consists in the following. Hinge-plate ($1\pm 0,001$ g) geared-up the standard of sheets stevia (m'_1) placed in sac from a kapron filter-mass (m_m). In color filaments for stringing which was marked number probed to the standard. In glass were 4-5 standards geared-up and put in an air-tight capacity 3. From a capacity 1 filled glass with standards an alcohol ethyl so that standards were fully submerged in an alcohol. After 1 hour for did a vacuum recovered to the capacity 1 for a liquid imers and united a liquid through a faucet 2. Whereupon lifted the level of alcohol ethyl on a height not less than on 1 see higher surfaces to the standard and continued of vacuum. General duration of did a vacuum makes 3 hours. Whereupon took off a vacuum and slowly opened a faucet 8 and drew out glass with standards. The treated standards abandoned at atmospheric pressure for to the satiation duration of which made 30 minutes. From the got standards filtration paper took off a

surplus liquid imers and weighed within $\pm 0,001$ g (m'_2). Whereupon to dry at a temperature 105-110 °C in a drying closet, cooled and weighed standards within $\pm 0,001$ g (m'_3).

Calculation present after formulas 1-10.

The mass geared-up the standard m_1 to the analysis settles accounts after, g:

$$m_1 = m'_1 + m_M \quad (1)$$

The mass saturated the standard m_2 settles accounts after, g:

$$m_2 = m'_2 + m_M \quad (2)$$

The mass saturated dried up the standard m_3 settles accounts after, g:

$$m_3 = m'_3 + m_M \quad (3)$$

The porosity is opened Π_{op} . in percents settles accounts after:

$$\Pi_{op} = \frac{m_3 - m_1}{m_3 - m_2} \cdot 100 \quad (4)$$

The General porosity Π_a . in percents settles accounts after:

$$\Pi_a = \frac{\rho - \rho_b}{\rho} \cdot 100 \quad (5)$$

The porosity is closed Π_f in percents settles accounts after:

$$\Pi_f = \Pi_a - \Pi_{op} \quad (6)$$

The imaginary of closeness ρ_b in kg/m^3 settles accounts after:

$$\rho_b = \frac{m_1}{m_3 - m_2} \cdot \rho_1 \quad (7)$$

where: ρ_1 - closeness of liquid imers, kg/m^3 .

The pores of effective volume V_{nop} in cube centimetre settles accounts after:

$$V_{nop} = \frac{m_3 - m_1}{\rho_1} \quad (8)$$

The surface of specific S in sm^2/g settles accounts after:

$$S = \frac{(m_3 - m_1) \cdot N_A \cdot \omega_m}{M \cdot m_1} \quad (9)$$

where: M – molecular mass of liquid imers;

N_A – number of Avogadro;

ω_b – molecular plane of molecule liquid imers.

The pore of maximal value d in mikrometres was expected after:

$$d = \frac{4 \cdot 10^3 \cdot \delta_t}{P - \rho_t \cdot g \cdot h} \quad (10)$$

where: δ_t – pull superficial, N/m;

P – pressure, after which vacuum is conducted, Pa;

ρ_t – closeness of liquid imers, g/sm^3 ;

g – acceleration of the free falling, m/s^2

h – height of column of liquid imers above a standard, mm.

The results of measurings are resulted for a whole sheet in a table 2, sheet of different dispersion in a table 3. Ekspermentals got information show that on the basic indexes of porosity has a considerable influence temperature of drying and factious composition. In a table 2 the results of change basic indexes of porosity are presented from the temperature of drying, control is sheets of fresh. Values are close to control a standard the dried have three standards of sheets at temperatures from 28 to 60 °C, the general porosity which makes from 77,4 to 83,8 %. Thus, the por of maximal value makes 9,4-10,2 mkm, a specific surface (S) makes 1104,1- 1286,9 sm^2/g . The por of effective value (V_{nop}) makes 9,2-10,5 sm^3

Table 2

The sheets stevia (*Stevia rebaudiana Bertoni*) of porosity from value of basic indexes depending on the terms of drying

Sheets	The por of value maximal, (d) mikrometre	The porosity is opened (Π_{op}), %	The general porosity (Π_a), %	The porosity is closed (Π_f), %	The imaginary of closeness, (ρ_b), g/sm ³	The specific of surface, (S), sm ² /g	The por of effective volume, (V_{nop}), sm ³
Fresh	9,8	39,2	81,6	42,4	0,611	1375,02	10,8
Dried:							
- 28-32 °C	9,4	45,2	79,4	34,2	0,573	1216,4	9,2
- 40 °C	9,4	33,4	77,4	44,0	0,616	1104,1	10,5
- 60 °C	10,2	35,7	83,8	48,1	0,667	1286,9	9,21
- 70 °C	10,1	31,0	67,5	36,5	0,661	1068,5	9,76
- 80 °C	9,6	30,3	58,9	28,6	0,688	1046,1	9,43
- 100 °C	9,3	23,3	55,9	32,6	0,621	930,7	9,35

Table 3

The sheets stevia (*Stevia rebaudiana Bertoni*) of porosity from value of basic indexes depending on dispersion composition

Sheets	The por of value maximal, (d) mikrometre	The porosity is opened (Π_{op}), %	The general porosity (Π_a), %	The porosity is closed (Π_f), %	The imaginary of closeness, (ρ_b), g/sm ³	The specific surface, (S), sm ² /g	The por of effective volume, (V_{nop}), sm ³	The coefficient of the porosity is opened, %
$\delta > 2,5$	10,52	33,8	79,4	45,6	0,78	1128,7	7,1	0,41
$1 < \delta < 2,5$	19,2	35,4	82,8	47,4	0,903	1213,4	11,4	0,87
$0,63 < \delta < 1$	16,9	43,5	86,8	43,3	0,803	1485,6	12,6	0,84
$0,4 < \delta < 0,63$	9,76	35,1	87,9	52,8	0,62	1208,8	17,5	0,81
$0,315 < \delta < 0,4$	10,41	49,7	89,4	39,7	0,623	1587,7	19,2	0,71
$0,25 < \delta < 0,315$	10,28	40,8	82,1	41,3	0,61	1374,2	15,9	0,70
$0,16 < \delta < 0,25$	12,24	36,5	81,1	44,6	0,59	1283,1	17,0	0,71
$0,1 < \delta < 0,16$	15,12	37,7	69,3	31,6	0,67	1393,4	18,2	0,72
$0,05 < \delta < 0,1$	9,14	33,7	64,7	31,0	0,68	1128,5	11,2	0,8
$0,05 > \delta$	13,81	22,8	68,0	45,2	0,81	993,9	12,5	0,73

Growth of drying temperature does not influence on por of effective value, however reduces the value of opened and the general porosity, accordingly specific surface of por sheets.

The study basic indexes porosity of different factious composition of sheets stevia shows the difference of standards after general and opened porosity and por specific surface. The general porosity of maximal values (81-89,4 %) have standards with dispersion from 0,16 to 2,5 mm which testifies to high efficiency of subsequent leadthrough of process extracting. Shallow factious have lower general porosity (64-69,3 %). Thus almost all of standards have a high meaning por of effective value, that characterizes intensity of passing «breathing processes» at their storage.

Conclusion. Neat liquid imers and method of determination basic indexes of sheets stevia (*Stevia rebaudiana Bertoni*) porosity. The algorithm of determination basic indexes of porosity such is exhaust as: por of value maximal, the porosity of opened, the general porosity, the imaginary closeness, the por of specific surface, the por of closed, the por of effective value and coefficient of the porosity is opened. The developed method is utilized for determination basic indexes of sheets stevia porosity whole and ground up. Set, that the temperature of drying influences on the general porosity of sheets, reducing it on 30%. Influence of factious composition of sheet stevia is rotined on the value of basic indexes porosity.

References

1. Государственная фармакопея СССР. – Вып. 2. Общие методы анализа. Лекарственное сырьё. – [11-е изд.]. – М.: Медицина, 1990. – 385 с.
2. Методы исследования качества хлебобулочных изделий: уч.-метод. пособие для вузов / С.Я. Корячкина, Н.А. Березина, Е.В. Хмелёва. – Орёл: Орёл ГТУ, 2010. – 166 с.
3. МВВ 24/13-00334882-01 Методика виконання вимірювань визначення відкритої пористості, удаваної щільності, ефективного об'єму пор і питомої поверхні макухи олійних культур / В.В. Гірман, О.В. Мазур, С.Л. Євтушенко, Н.Г. Катасонова. – Харків: УкрНДІОЖ НААН, 2013. – 15 с.
4. «Материалы порошковые. Метод определения величины пор» ГОСТ 26849-86 чинний від 01.10. 1989 р.
5. «Огнеупоры. Метод определения кажущейся плотности, открытой и общей пористости, водопоглощения» [текст] ГОСТ 2409-93 чинний від 01.07. 1998 р.
6. Грег С. Адсорбция, удельная поверхность, пористость / С. Грег, К. Син – М.: Мир, 1984. – 186 с.
7. Плаченев С.Д. Порометрия / С.Д. Плаченев, Т.Г. Колосенцев. – М.: Химия, 1988. – 176 с.
8. «Породы горные. Метод определения коэффициента открытой пористости жидкостенасыщением» [текст] ГОСТ 26450.1-85 чинний від 01.07. 1986 р.

Анотація

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Визначення основних показників пористості листків стевії (*Stevia rebaudiana Bertoni*)

Вперше представлено методику визначення основних показників пористості листків стевії (*Stevia rebaudiana Bertoni*). Підібрано імерсійну рідину для виконання методики та опрацьовано режим вакуумування зразків листків стевії. Запропоновано порядок обробітку отриманих даних для визначення максимального значення пор, відкритої пористості, удаваної щільності, питомої поверхні, ефективного об'єму пор та коефіцієнту відкритої пористості.

Ключові слова: пористість, листки, технологічна якість, імерсійна рідина, метод насичення

Аннотация

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Определение основных показателей пористости листьев стевии (*Stevia rebaudiana Bertoni*)

*Впервые представлено методика определения основных показателей пористости листьев стевии (*Stevia rebaudiana Bertoni*). Подобрано иммерсионное вещество для выполнения методики и отработано режим вакуумирования образцов листьев стевии. Предложено последовательность обработки полученных данных для определения максимального значения пор, открытой пористости, кажущейся плотности, эффективного объёма пор и коэффициента открытой пористости.*

Ключевые слова: пористость, листки, технологическое качество, иммерсионное вещество, метод насыщения