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EVALUATION OF QUALITY INDICATORS OF PECTIN-CONTAINING EXTRACTS OF MELONS

S. AZIMOVA¹, M. KIZATOVA², G. ISKAKOVA, ¹Z. UIKASSOVA¹

(¹Almaty Technological University, Kazakhstan, Almaty

²Asfendiyarov Kazakh national medical University, Kazakhstan, Almaty)

E-mail: zaira_atu@mail.ru

The article investigated the analytical characteristics of pectin-containing extracts from pumpkin extracts of the "Karina" variety and melon of the "Torpeda" variety, their ability to form alkalis and complex. Based on the conducted experiments, pectins from melons are characterized by a low degree of esterification (34.7-36.8%), a high complexing capacity at the level of 240-290 mg Pb²⁺/g, which allows us to suggest the use of pectin products developed as natural detoxicants. On pectins of melon crops, the inverse relationship between the complexing abilities and the strength of the jelly was established.

Keywords: pectin, pectin extracts, analytical characteristics, alkali-forming and complex-forming abilities.

ОЦЕНКА КАЧЕСТВЕННЫХ ПОКАЗАТЕЛЕЙ ПЕКТИНОСОДЕРЖАЩИХ ЭКСТРАКТОВ БАХЧЕВЫХ КУЛЬТУР

С.Т. АЗИМОВА¹, М.Ж. КИЗАТОВА², Г.К. ИСКАКОВА¹З.С. УЙКАСОВА¹

(¹Алматинский Технологический университет, Казахстан, Алматы

²Казахский национальный медицинский университет им. С.Ж. Асфендиярова, Казахстан, Алматы)

E-mail: zaira_atu@mail.ru

В статье было проведено исследование аналитических характеристик пектинсодержащих экстрактов из тыквенных экстрактов сорта «Карина» и дыни сорта «Торпеда», их способность образовывать щелочи и комплексы. На основе проведенных экспериментов установлено, что пектины из бахчевых культур характеризуются низкой степенью этерификации (34,7-36,8%), высокой комплексообразующей способностью на уровне 240-290 мг Рb²⁺/г, что позволяет предложить использование пектинопродуктов в качестве природных

детоксикантов. На пектинах бахчевых культур установлена обратная зависимость между комплексообразующими способностями и прочностью студня.

Ключевые слова: пектин, пектиновые экстракты, аналитические характеристики, щелочеобразующие и комплексообразующие способности.

БАҚША DAҚЫЛДАРЫНЫҢ ҚҰРАМЫНДА ПЕКТИН БАР СЫҒЫНДЫЛАРЫНЫҢ САПАЛЫҚ КӨРСЕТКІШТЕРІН БАҒАЛАУ

С.Т. АЗИМОВА¹, М.Ж. КИЗАТОВА², Г.К. ИСКАКОВА¹, З.С. УЙКАСОВА¹

¹Алматы Технологиялық университеті, Қазақстан, Алматы

²С.Ж. Асфендияров атындағы Қазақ ұлттық медицина университеті, Қазақстан, Алматы)

E-mail: zaira_atu@mail.ru

Мақалада «Карина» сорты асқабақ сығындыларынан және «Торпеда» сорты қауынынан жасалған құрамында пектин бар сығындылардың аналитикалық сипаттамаларына, олардың сілікпе құраушы және кешенді қалыптастырушы қабілетіне зерттеу жүргізілді. Жүргізілген эксперименттер негізінде бақша дақылдарынан жасалған пектиндер этерификацияның төмен дәрежесімен (34,7-36,8%), 240-290 мг Pb²⁺/г деңгейінде жоғары кешен құраушы қабілеттілігімен сипатталады, бұл табиғи детоксиканттар ретінде әзірленген пектинөнімдерді пайдалануды ұсынуға мүмкіндік береді. Бақша дақылдарының пектинде-рінде сілікпенің кешен құраушы қабілеті мен беріктігі арасында кері тәуелділік орнатылған.

Негізгі сөздер: пектин, пектинді экстракттар, аналитикалық сипаттамалар, сілті түзуші және комплекс түзуші қабілеттер.

Introduction

Among the variety of environmental factors that effect the human body, the leading place is occupied by heavy metals. Among chemical pollutants, heavy metals are considered as a factor that is subject to severe environmental and biological consequences. They can long-term conservation of environmental objects, migration, accumulation in the human body and animals, cause changes in oorganisms and tissues and cause irreparable harm to health. Many heavy metals and their compounds, in addition to their toxic effects, become carcinogenic and mutagenic and cause significant long-term consequences [1,2].

Research in recent years has shown that substances in natural foods are used more effectively: they do not cause side effects and give a protective effect. Such substances include pectin, which has a favorable effect not only in conditions of strong exposure to metals, but also in long-term ingestion, which is typical for the environmental loads of the population of industrial zones and modern megalopolis.

It was found that modified citrus pectin significantly increased the excretion of lead in the urine of adults, and it is especially

recommended to use it as a safe and harmless chelator for children [3,4].

It should be emphasized that pectins are natural products and do not have a toxic effect on the human body. The main effect of the therapeutic action of pectin is associated with the peculiarities of its chemical structure. The polymer chain of polygalacturonic acid, the presence of chemically active free carboxyl groups and alcohol hydroxyl contribute to the formation of strong insoluble complexes with polyvalent metals, which remove heavy metals and nuclides from the body [5,6].

Pectin acts as a radioprotector and is recommended as an additive to food products to give them detoxifying properties. Thus, pectin and pectin-containing products can be attributed to therapeutic and preventive nutrition [7].

In addition, pectin can also be used as a drug, since it has bactericidal activity, antiviral action and adsorption ability [8]. Complex-forming properties of pectin substances are based on the interaction of pectin molecules with heavy and radioactive metal ions (for example, strontium, zirconium, plutonium). This valuable property of pectin attracts the attention of researchers and is associated with the search for special means that have radioprotective and detoxifying properties,

giving preference to substances of natural origin that do not have side effects in the human body. Due to its complexing properties, pectin is included in the diet of people in an environment contaminated with radionuclides and associated with heavy metals [9, p.222].

On the basis of pectins, dry therapeutic and prophylactic powdery mixtures are derived, which are effective for preventing intoxication with heavy metals and radionuclides [10-11].

In the case of radioactive contamination, the optimal dose of pectin for people in contact with heavy metals has been established. It is 15-16 g per day [12, p.218].

Pectin has antiseptic properties. Strictly individually reacting to bacteria, it shows antibacterial activity against unfair pathogens of food poisoning, dysentery bacteria, staphylococci and escherichia coli relative to relatively weak bacteria, suppresses rotten processes, promotes healing of defects in the colon mucosa. A decrease in the level of pectin methoxylation leads to an increase in its antibacterial activity [13].

The use of pectins in the food industry has reached a large scale. The main consumer of highly toxic pectin (about 80%) is the confectionery industry. The properties of pectin are used in the production of confectionery pastilomarmaladnoy group (marshmallows, marshmallows, jelly marmalade) and sweets with jelly and fruit and berry body [14-15].

The role of melons in human nutrition is difficult to assess. They are the main supplier of vitamins, mineral salts, organic acids and other biologically important substances that affect the metabolic processes in the human body. Therefore, it is not for nothing that they say that the level of development of gardening in the country depends on the level of health of the nation.

In difficult environmental conditions, when a number of enterprises are operating that are in contact with heavy people, including radioactive metals, as well as various toxic

substances, the need for inexpensive, environmental gardening products containing pectin, carotene, and dietary fiber has significantly increased. The highest content of such substances is pumpkin and melon [16-17].

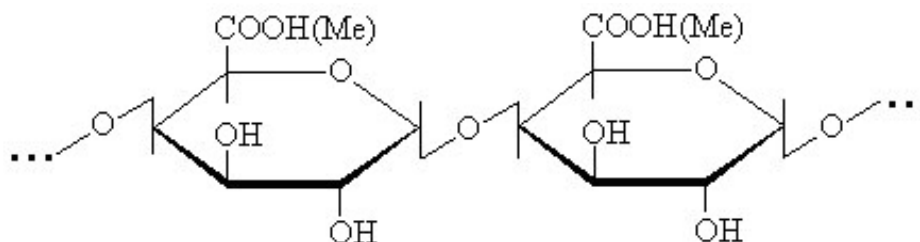
Pumpkin (*Cucurbita*) is an annual plant in the Pumpkin family. The fruits are large meat pumpkins with numerous flat yellowish-white seeds. It is worth noting the good resistance of pumpkins to drought. The fruit pulp of pumpkin contains dry substances (15-18%), sugar (8-10%), pectin substances, nitrogen compounds, salts of potassium, calcium, magnesium, iron, vitamins C, B, B2, PP and provitamin A; in rocks - fatty oil (36-52%), phytosterols, organic acids, resins, fiber (0.7%), slightly organic acid.

The value of melon is based on its excellent taste properties and its ability to accumulate easily absorbed sugar. It contains 82-96% water and 4-18% dry matter, which contains 90% of soluble carbohydrates, i.e. sugar. The rest of the polysaccharides are cellulose, hemicellulose, starch, and pectin substances.

Melon is evaluated for its high content of valuable flammable carbohydrates and proteins, as well as mineral salts.

The main component of pectin substances is polygalacturonic acid (up to 65%), non-branched polymer blocks are the Foundation of pectin macromolecules. Polygalacturonic acid can be partially esterified by methoxyl groups, and free carboxyl groups can be partially or completely neutralized by sodium, potassium, and ammonium ions. Pectin substances contain insoluble protopectin, soluble pectin polysaccharides and accompanying galactans, arabinans and arabinoga-lactans [18,19, p. 126]

Pectin polysaccharides (pectins) are part of a large group of polysaccharides of glycanohalacturonic acid plants, of which the main sequence of carbohydrates is 1,4- α -D-linked galacturonic acid residues (Fig. 1):



where: Me-methyl or metal ion

Figure 1-Structure of the pectin molecule

and food industry. The choice of raw materials as the object of research depends on their low cost and availability.

To assess the quality indicators of pectin-containing extracts of the «Karina» variety from pumpkin extracts and melon of the «Torpeda» variety, their analytical characteristics were determined, as well as the ability of the gelatinous and complexing components.

The degree of esterification is the ratio of the number of esterified carboxyl groups to the total composition of carboxyl groups in pectin (esterified and ethified). The lower the degree of esterification of pectin (more carboxyl groups), the higher its detoxification activity.

for determining the properties of pectin substances alkaline forming and complex forming substances are determined by the Sosnov method [21-22].

Results and their discussion

Based on previous studies, it was found that melon varieties «Torpeda» and «Karina» are quite suitable for obtaining pectin-containing extract by the total composition of pectin and the removal of the extract.

The results of analytical characteristics of extracts with pumpkin extract of the «Karina» variety and melon of the «Torpeda» variety, their alkali-forming and complex-forming abilities are shown in table 1.

Table 1 analytical characteristics of pectin products from pumpkin and melon, in terms of absolute dry weight %

Name of the indicator	Extract with compressed pectin	
	Pumpkin «Karina»	Melon «Torpeda»
The composition of the free carboxyl groups,%	3,0	2,9
Composition of methoxylated carboxyl groups,%	1,9	1,8
Degree of esterification,%	34,7	36,8
Complex-forming capacity, mg Pb ²⁺ / g	290	240
The strength of the alkali, 0 SAG	95	110

Thus, from table 1, the composition of free carboxyl groups corresponds to 3.0 and 2.9%, while the degree of esterification was 34.7 (pumpkin) and 36.8% (melon), respectively. Consequently, the resulting pectin extract is characterized by a low degree of esterification, which allows us to suggest the use of pectin products developed as natural detoxicants. The table shows that the bark extract, which forms a

complex consisting of melon, is lower than the pumpkin extract.

Conclusion

On the basis of studies of the analytical characteristics pectinesterase extracts extracts of pumpkin varieties «Karina» and melons of a grade «Torpedo», they delebrately and complexing ability of pectin from melons are characterized by a low degree of esterification (34,7-36,8%), high complex component level 240-290 mg Pb²⁺/g,

1221 [in Russian]

2. Alibaeva B.N., Omarova A.S., Tsitsurin V.I., Esdaulet B.K., Adambekova M.R., Seralin E.B. The content of heavy metals in the body as an indicator of the environmental load of places of residence and the possibility of effective correction of the health of the population of a modern metropolis on the example of Almaty // International Journal of Experimental Education: Publishing House "Academy of Natural Sciences" (Penza).-2015.-№2.- Pp.70-75. [in Russian]

3. Sears M.E. Chelation: Harnessing and enhancing heavy metal detoxification-A review. // The Scientific World Journal/ - 2013, Articles ID 219840. P.13.

4. Azimova S. T., Kizatova M.J., Akhmetova S.O., Donchenko L.V., Admayeva A.M. Towards food security through application of novel scientific findings// Security and Sustainability issues. – 2017. - № 6(4). – P.-719-729

5. Lara-Espinoza, C.; Carvajal-Millán, E.; Balandrán - Quintana, R.; López-Franco, Y.; Rascón-Chu, Pectin and Pectin-Based Composite Materials: Beyond Food Texture. // *Molecules* 2018, 23, 942. <https://doi.org/10.3390/molecules23040942>

6. Martins Z., Pinho O., Ferreira I. Food industry by-products used as functional ingredients of bakery products// *Trends in Food Science & Technology*, 2017. - Vol. 67.- P. 106-128.

7. Golubev V. N. et al. Food and biologically active additives: Manual for university students.-M.: Academy, 2003.-202 p. [in Russian]

8. Kolmakova N. Unusual in familiar: pectin as a useful food supplement // *Food Industry*. -2004. - №8.-C. 77-78. [in Russian]

from frozen semi-finished products / N.V.Kenijz, N.V. Sokol // *European Online Journal of Natural and Social Sciences*. – 2013. – № 2. – C. 253- 261.

15. Kulichenko A.I., Mamchenko T.V., Zhukova S.A. Modern technologies for the production of confectionery products using dietary fiber // *Young scientist*. – 2014. – №4. – Pp. 203-206. [in Russian]

16. Neumyvakin I.P. *Pumpkin*. -M.: Ozon.ru, 2015. – 224 p. [in Russian]

17. Kabirova L.V., Nussupova A.O. *Summer squash* - Almaty: Kainar, 2000.- 50 p. [in Russian]

18. Donchenko L.V., Firsov G.G. *Technology of pectin and pectin products*. – Krasnodar: KFAV, 2006.-279 p. [in Russian]

19. Fleming C., Russcher H., Brouwer R., Lindemans J., de Jonge R. Evaluation of Sysmex XN-1000 High-Sensitive Analysis (hsA) Research Mode for Counting and Differentiating Cells in Cerebrospinal Fluid. *Am J Clin Pathol*. 2016; 145: p.299 – 307.

20. Donchenko L. V. *Technology of pectins and pectin products: textbook*. - M.: DeLi, 2000. -- 255 p. [in Russian]

21. Melnikov A.B., Mikhailushkin P.V., Poltarykhin A.L., Dibrova, Z.N. The Economics of Addressing Food Security: A Case Study, *Entrepreneurship and Sustainability Issues*.7 (1): 595-602., 2019. [https://doi.org/10.9770/jesi.2019.7.1\(41\)](https://doi.org/10.9770/jesi.2019.7.1(41)) [in Russian]

22. Donchenko L.V., Sokol N.V., Krasnoselova Ye.A. // *Food Chemistry. Hydrocolloids: textbook. manual for STR /editor L.V. Donchenko.-2nd ed., Rev. and additional*. - M.: Юрайт, 2018.-180 p. [in Russian]