

# High Technologies of Processing of Gourd Seeds

Derevenko V.V.

Kuban State Technological University "Institute of Food  
Technology Industry"  
Krasnodar, Russia  
e-mail: ekotechprom91@mail.ru

Kasianov G.I.

Kuban State Technological University "Institute of Food  
Technology Industry"  
Krasnodar, Russia  
e-mail: g\_kasjanov@mail.ru

Bakhmet M.P.

Kuban State Technological University "Institute of Food  
Technology Industry"  
Krasnodar, Russia  
e-mail: mbahmet@mail.ru

Kosenko O.V.

Kuban State Technological University "Institute of Food  
Technology Industry"  
Krasnodar, Russia  
e-mail: olga\_kosenko1980@mail.ru

Magomedov A.M.

Kuban State Technological University "Institute of Food Technology Industry"  
Krasnodar, Russia  
e-mail: bestbid@mail.ru

**Abstract** - Gourds include watermelons, melons, zucchini and pumpkins, which occupy large areas and belong to large-tonnage crops. To increase the efficiency of processing the fruits of gourds is possible due to the integrated processing of their seeds. The problem of rational processing of gourd seeds with the pressed oil, CO<sub>2</sub>-extracts and high-protein CO<sub>2</sub>-meals was stated. The aim of the work is to study the chemical composition of fruits and seeds of gourds, CO<sub>2</sub>-extracts and CO<sub>2</sub>-meals. To achieve this aim, it is necessary to determine the technological characteristics of selected objects: Astrakhanskiy watermelons, Tamanskaya melons, Aeronavt zucchini and Lazurnaya pumpkins. To determine the chemical composition, classical physicochemical methods were used: spectrophotometric, gas chromatographic, and thermophysical. The intermediate results of the research include an assessment of the chemical composition of the fruits of gourds. The main results include the qualitative composition of CO<sub>2</sub>-extracts from the seeds of melons and the chemical and amino-acid composition of CO<sub>2</sub>-meals. The results of the research will be useful to specialists of extraction enterprises.

**Key words**- gourds, watermelon, melon, zucchini, pumpkin, seeds, CO<sub>2</sub>-extracts

## I. INTRODUCTION

Gourds are voluminous in the cultivation and processing of gourds. Food and biologically active substances contained in fruits of watermelons, melons, zucchini and pumpkins have a beneficial effect on the vital activity of the human body. Considering the fertile Kuban climate, the cultivation of gourds is considered highly profitable.

Original sources of literature and patents are devoted to the cultivation and processing of gourds.

It was established that it is possible to increase the effective return from the cultivation and processing of gourds due not only to the use of fruit pulp, but also from the rational processing of seeds [3,5]. The staff of KSTU the complex use of pumpkin fruits and seeds [1]. The significant part of research is represented by studies on the chemical composition of seeds of gourds [2,4,6,7,10]. At the department of technological equipment and life support systems of KSTU, the processes of drying seeds were studied [8]. An important task in increasing the efficiency of processing gourd seeds is to obtain natural protein supplements [7,9]. The problem of rational processing of gourd seeds is relevant.

The aim of the work is to study the chemical composition of fruits and seeds of gourds, CO<sub>2</sub>-extracts and CO<sub>2</sub>-meal.

## II. METHODS AND MATERIAL

For the research, watermelons of the Astrakhanskiy variety, melons of the Tamanskaya variety, zucchini of the Aeronaut variety and Lazurnaya variety pumpkins were selected. To determine the chemical composition, the following equipment was used: a Kapel 105 M capillary electrophoresis device, an SF 56 spectrophotometer, a Tsvet-800 gas-liquid chromatograph.

III. RESULTS

Table 1 shows the chemical composition of the fruits of gourds.

TABLE I. CHEMICAL COMPOSITION OF FRUITS OF GOURDS, %

Species	Dry matter	Pectin	Gluten		Starch	Sugar amount
Watermelon	9.3	1.8	1.3	0	6.9	2.4
Melon	11.2	2.5	3.6	0	1.4	0.7
Zucchini	8.8	4.6	4.3	0.7	2.6	0.6
Pumpkin	9.6	5.6	6.2	0.8	2.9	0.7

As can be seen from the data of Table 1, the fruits of gourds include a relatively large amount of dry substances from 8 to 11%, pectin substances from 1.8 to 5.6% and the amount of sugars from 1.4 to 6.9%.

Seeds of gourds have a high content of energy and biologically significant components. For example, watermelon seeds contain up to 19% fatty oil, melon seeds - up to 30%, zucchini seeds - up to 18 and pumpkin seeds - up to 40%. The largest in size are pumpkin seeds (2.5 cm), followed by zucchini seeds (1.7 cm), watermelon - (1.3 cm), and melons - (1.2 cm). Figure 1 shows the structure of the gourd seed husk. They have a husk and a core.

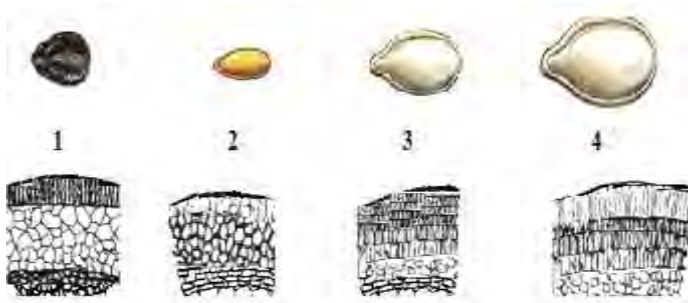


Fig. 1. Structure of seed husk of gourds: 1 – watermelon seed, 2 – melon seed, 3 – zucchini seeds, 4 – pumpkin seed

The three-layer husk of most seeds consists of an outer layer with thin-decked cells, followed by a spongy layer, and then a sclerenchymal solid layer. In the section, seeds of gourds have two cotyledons with a root and a bud located between them. Lipids and proteins are localized in the cells of the seedbed. Watermelon seeds contain up to 35% protein and up to 8% carbohydrates.

The mass of 1000 pieces of watermelons seeds of the Astrakhanskiy variety is 75g. The mass of melon seeds of the Tamanskaya variety is 42g. The mass of zucchini seeds of the Aeronavt varieties is 160g; and the mass of pumpkin seeds of the Lazurnaya variety is 210g.

Figure 2 shows the block diagram of the production of pressed oil, CO<sub>2</sub>-extracts and CO<sub>2</sub>-meals of gourds. The technological methods presented in the diagram make it

possible to extract oil from the seeds of watermelons, melons, zucchini and pumpkin by cold extrusion.

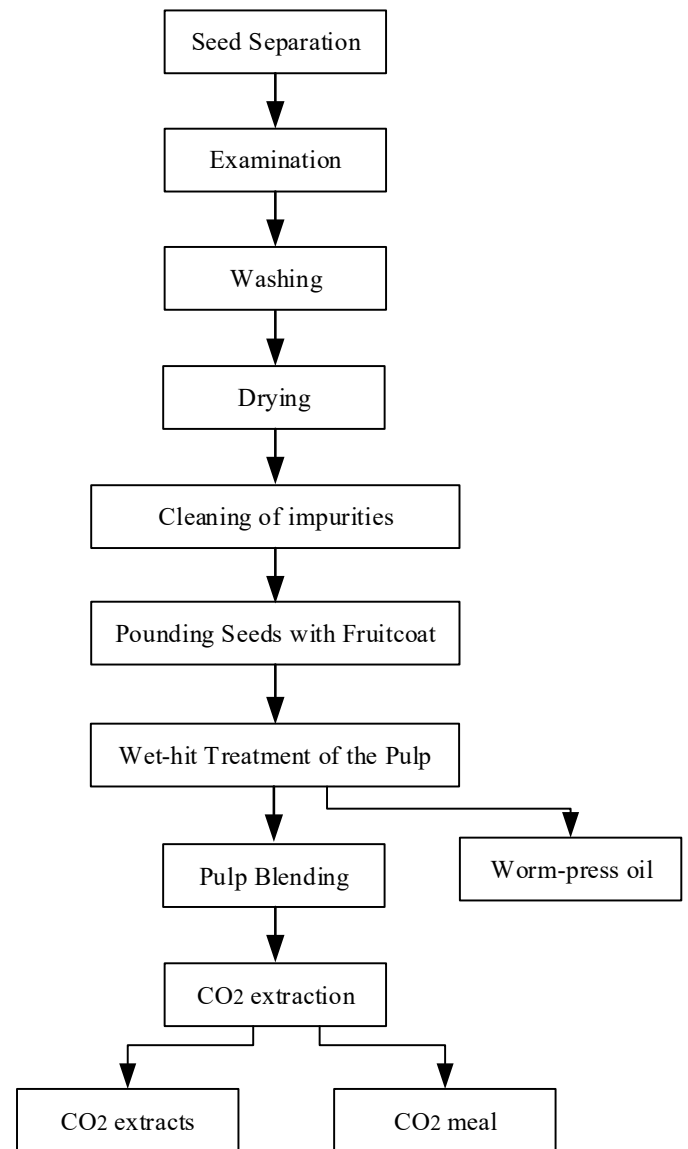


Fig. 2. Structural scheme of obtaining oil, CO<sub>2</sub>-extracts and CO<sub>2</sub>-meals of gourds.

The feature of the improved scheme is the further processing of press cake obtained by extrusion with gentle process conditions. In such a press cake there is a significant amount of valuable components that can be extracted by the method of subcritical CO<sub>2</sub> extraction. Table 2 shows the qualitative composition of CO<sub>2</sub>-extracts from the gourd seeds.

The improved technological scheme allows to obtain CO<sub>2</sub>-meal, which is a natural protein food supplement. Table 3 shows the chemical composition of CO<sub>2</sub>-meals.

**TABLE II. QUALITATIVE COMPOSITION OF CO<sub>2</sub>-EXTRACTS FROM GOURD SEEDS**

Measurements	Oil performance from seeds			
	<i>watermelons</i>	<i>melons</i>	<i>pumpkins</i>	<i>zucchini</i>
<i>Oxidation index</i>	5.05±0.08	5.25±0.08	5.50±0.08	4.90±0.08
<i>Iodine value</i>	116.0±2.3	126.0±2.5	124.0±2.5	130
<i>Carotenoids per β-carotin, mg %</i>	11.66±0.08	12.32±0.06	14.32±0.10	12.18±0.06
<i>Acid value</i>	1.05±0.02	0.39±0.01	0.62±0.01	1.05
<i>Unsaponifiables, %</i>	0.77±0.01	0.65±0.01	0.75±0.01	0.75±0.01
<i>Density at 20oC, g/cm3</i>	0.9170	0.9230	0.9240	0.8940
<i>Refractive index, n<sub>20D</sub></i>	1.4680	1.4595	1.4715	1.4689
<i>Free fatty acids, %</i>	0.448±0.006	0.175±0.004	0.284±0.004	0.187±0.003
<i>Tocopherols per α-tocopherol, mg%</i>	22.58±0.21	23.80±0.16	26.45±0.15	22.70±0.16
<i>Saponification value</i>	223.0±3.1	223.0±3.1	214.0±3.2	218.0±3.2

**TABLE III. CHEMICAL COMPOSITION OF CO<sub>2</sub>-MEALS, %**

Indicators	Name of meal			
	<i>watermelon</i>	<i>melon</i>	<i>zucchini</i>	<i>pumpkin</i>
<i>Moisture</i>	9,6	8,3	7,4	7,0
<i>Protein</i>	22,5	24,3	22,6	25,6
<i>Lipid</i>	6,7	9,6	12,5	13,5
<i>Carbohydrate</i>	33,1	28,6	37,1	35,7
<i>Dietary fiber</i>	25,1	24,2	17,2	15,2
<i>Minerals, including</i>	3,0	5,0	3,2	3,0
<i>K</i>	0,8	0,6	0,8	0,8
<i>Ca</i>	0,15	0,3	0,4	0,4
<i>Na</i>	1,7	1,6	1,3	1,3
<i>Se, mg/kg</i>	1,4	0,1	3,0	3,0
<i>P</i>	0,4	0,8	0,6	0,6

The main advantage of CO<sub>2</sub>-meals is the optimal content of proteins, fats and carbohydrates, in accordance with the norms of healthy eating. Because of the chemical composition of the meals, the high content of full-fledged proteins can be noted. It confirms their amino acid composition, presented in Table 4.

**TABLE IV. AMINOACID PROFILE OF CO<sub>2</sub>-MEALS**

Amino acid	Content, % to total protein			
	<i>watermelon</i>	<i>melon</i>	<i>zucchini</i>	<i>pumpkin</i>
<i>Alanine</i>	0,95	1,24	3,9	5,6
<i>Arginine</i>	2,52	3,53	7,8	10,3
<i>Aspartic acid</i>	1,73	2,34	8,5	9,7
<i>Valine</i>	0,92	1,34	2,9	3,6
<i>Histidine</i>	0,65	0,87	3,6	4,4
<i>Glycine</i>	1,12	1,69	4,9	8,8
<i>Glutamic acid</i>	3,44	4,83	12,6	15,3
<i>Isoleucine</i>	0,79	1,75	2,5	3,3
<i>Leucine</i>	1,30	2,00	6,2	8,1
<i>Lysine</i>	0,68	1,11	2,4	3,3
<i>Methionine</i>	0,67	0,83	1,6	1,8
<i>Proline</i>	1,02	0,93	1,5	1,4
<i>Serine</i>	0,97	1,39	5,6	7,2
<i>Tyrosine</i>	0,61	0,81	2,5	5,7
<i>Threonine</i>	0,66	0,97	1,8	2,4
<i>Phenylalanine</i>	1,10	1,48	4,2	5,5
<i>Cystine</i>	0,36	0,39	0,3	0,2

Thus, the study allows to increase the processing efficiency of the fruits of gourds through the integrated processing of their seeds. The problem of rational processing of gourd seeds with the production of pressed oil, CO<sub>2</sub>-extracts and high-protein CO<sub>2</sub>-meals has been solved. The chemical composition of fruits and seeds of melons and gourds, CO<sub>2</sub>-extracts and CO<sub>2</sub>-meals has been investigated.

#### IV. CONCLUSION

It has been established that CO<sub>2</sub>-meals of gourd seeds contains 22-25% protein, 6-13% lipids and 28-37% carbohydrates. It allows them to be used to enrich catering dishes. The taste of butter from the gourd seeds is not worse than almond or olive. It can be used as a medical seasoning for any dish. Therefore, the processing of gourd seeds is an additional source of profit.

#### References

- [1] Vasil'eva, A.G., Kas'yanov, G.I., V.V. Derevenko, V.V., (eds), "Kompleksnoe ispol'zovanie tykvy i ee semyan v pishchevykh tekhnologiyah", [Integrated use of pumpkin and its seeds in food technology], Krasnodar: Ekoinvest, 2010.
- [2] V.V. Derevenko, G.H. Mirzoev, E.A. Kalienko, "The chemical composition of the seeds of melon variety Amira", Hranenie i pererabotka sel'hozsyrya, Storage and processing of agricultural raw materials, 6, 2014, pp. 21-22.
- [3] V.V. Derevenko, G.H. Mirzoev, A.V. Tagakov, 2014, "Universal technological line to produce vegetable oils from the seeds of melon crops", [14-ya Mezhdunarodnaya konferenciya «Maslozhirovaya industriya», Sankt-Peterburg - 14th International Conference Fat-and-Oil Industry, St. Petersburg. pp. 41-43].
- [4] V.B. Kovalev, A.V. Velikorodov, A.G. Tyrkov, S.B. Nosachev, E.V. Shchepetova, N.M. Abdurahmanova, 2015, "The chemical composition of melon crops seed oils of the Astrakhan region", selected by the method of supercritical fluid extraction, Fundamental'nye issledovaniya – Fundamental Research, 12, pp. 54-57.
- [5] A.P. Krygina, N.D. Zavodchikov, "Economic efficiency of cultivation of melon crops", Izvestiya Orenburgskogo gosudarstvennogo agrarnogo universiteta, Bulletin of the Orenburg State Agrarian University, 2, 2012, pp. 43-46.
- [6] Sh.R. Kurambayev, N.I. Bajzhanov, R.H. Sobirova, M.A. Sherov, "Features of pumpkin oil Atlant grown in the Khorezm region", Molodoj uchenyj, Young scientist, 27, 2016, pp. 95-97.
- [7] G.H. Mirzoev, V.V. Derevenko, A.V. Tagakov, (eds) "Improving the technology of vegetable oil and high-protein meal from melon seeds",

- Izvestiya vuzov, Pishchevaya tekhnologiya, Reports of universities, Food technology, 4, 2014, pp. 93-95.
- [8] S.A. Podgornyj, E.P. Koshevoj, V.S. Kosachev, A.A. Skhalyahov, "Statement of the problem of describing the transfer of heat, mass and pressure during drying", *Novye tekhnologii – New technologies*, 3, 2014, pp. 20-27.
- [9] O.V. Ul'yanova, E.V. Martovshchuk, G.H. Ovsep'yan, O.M. Berezovskaya, A.V. Zabolotnij, (eds) "The study of the composition of watermelon seeds as a raw material to produce nut substitutes", *Izvestiya vuzov, Pishchevaya tekhnologiya - Reports of universities, Food technology*, 2-3, 2006, pp. 24-25.
- [10] E.P. Franko, E.Yu. Mishkevich, A.V. Ganin, (2014) "Quality parameters of melon crops seeds", [V sb. mater. mezhdun. nauchno-prakt. konf. «Sovremennye problemy kachestva i bezopasnosti produktov pitaniya v svete trebovanij tekhnicheskogo reglamenta Tamozhennogo soyuza», 26 marta 2014; "Modern problems of quality and food safety considering the requirements of the technical regulations of the Customs Union", 26 March 2014, Krasnodar: Izd. KubGTU, pp. 13-15].