Cercetări Agronomice în Moldova
Anul XXXX , Vol. 3 (131) / 2007

SWEET SORGHUM – NATURAL SWEETENER FOR FOODS

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Received February 5, 2007

ABSTRACT *– The paper pointed out the advantages of using natural sweeteners, as well as their utilization mode and conditions. The technological conditions of juice production and the existing possibilities for processing sweet sorghum by food industry were described. In the paper, they presented the results of research on developing the technology of sweet sorghum production and of food products, based on varieties of sweet sorghum with a high content of carbohydrates: drinks, jellies and biscuits.*

Key Words: sorghum, technological conditions, sweetener

REZUMAT *– **Sorgul zaharat – edulcorant natural pentru produsele alimentare.** In lucrare se arată avantajele utilizării edulcoranţilor naturali, precum şi modul şi condiţiile de folosire a acestora. Se prezintă condiţiile tehnologice de producere a sucului şi posibilităţile existente de procesare a sorgului în industria alimentară. De asemenea, în prezenta lucrare apar rezultatele cercetărilor privind dezvoltarea tehnologiei de producere a sorgului zaharat şi a produselor alimentare, obţinute din varietăţi de sorg zaharat, cu un conţinut ridicat de carbohidraţi: sucuri, jeleuri, biscuiţi.*

Cuvinte cheie: sorg, condiţii tehnologice, edulcorant

INTRODUCTION

Sweet sorghum is a prospective crop in the Republic of Moldova, being a cheap source of native raw material necessary for making food products. Being a valuable source of glucide, sweet sorghum is a prospective crop for obtaining juice and a diverse range of qualitative foods, required by the market.

As sweet sources for making food products, nowadays, sugar beet, maize grains and grape juice are used at industrial scale. An alternative source is sweet

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sorghum, which is grown today in 85 countries of the world, and represents a cheap dry resistant raw matter. Sweet sorghum accumulates at 1 ha, under the technological growing conditions from the Republic of Moldova, by 2-3 times more glucides (8-10 t/ ha) than sugar beet, and the juice of sweet sorghum, which may partially substitute the sugar syrup in food industry, contains macro and microelements (especially, K, Ca, Mn) and aminoacids, being a valuable nutritive product (Метлин, 1992; Морару, 2000; Муминов, 1998; Вахрушев, 1996).

Under conditions of the Republic of Moldova, sweet sorghum crops accumulate 14-18% of glucides in the juice of stalks and form until 25-30 t/ha of green mass.

The syrup, obtained from sweet sorghum, by its contents of biologically active substances and microelements, is like the natural honey. As a result of the investigations on physical-chemical characteristics and sanitary estimate of sweet products, obtained from sweet sorghum, a wide spectrum of their utilization in food industry, medicine and animal breeding was found (Моника, 1996; Morris et al., 1997; Rajvanshi, Nimbkar, 2001).

Data on the content of glucides from the syrup of sweet sorghum establish the prospect of its utilization in bakery and confectionery. In bakery, sugar may be replaced from 10 to 100% and in confectionery, from 10% for marmalade, 6% for jellies and 15% for caramel filling.

The syrup from sorghum has great prospects as concerns the partial or total replacement of sugar within the networks of producing fruit compotes and jams.

Within the Institute of Scientific Research and Technological Projects in Food Industry, the technology of obtaining and clearing the juice of sweet sorghum from selected varieties has been elaborated. The juice is been using in food industry.

MATERIALS AND METHODS

Establishing the technology of obtaining sweet sorghum juice was done for the subsequent juice utilization in different branches of food industry. The investigations conducted at the Institute of Scientific Research and Technological Projects in Food Industry have focused on getting sweet sorghum juice with high clearing degree. Research was carried out on sweet sorghum juice obtained from the Porumbeni 4 hybrid, grown on the experimental plots of the Porumbeni Association, which had been submitted to the analyses necessary to establish physical-chemical and organoleptic characteristics. Methods and materials that could clear juice have been investigated, removing by adsorption or sedimentation certain juice components, as starch, pectin and proteins. The juice obtained by sorghum pressing has been submitted to heat action, which had two aims: preventing juice fermentation during the clearing process and coagulation of granulated starch and albumins.

For removing the colloidal starch and other compounds, which make juice muddy, the following materials were used: bentonine, gelatine, kiselsol and activated charcoal.

More clearing variants were investigated and they established temperature, pH value, quantity of bentonine, gelatine, kiselsol and activated charcoal, necessary for obtaining juice with high organoleptic (taste and flavour), physical-chemical (glucide content, titrable acidity and clearing degree) and microbiological traits.

As the clearing degree depends greatly on temperature and pH size, the initial sorghum juice with pH of 5.6 has been acidilulated with citric acid until the pH value of 4.2.

The new types of tested materials (different brands of bentonine, gelatine, kiselsol and activated charcoal), coming from abroad, allow getting juice cleared at low temperatures, under the condition of pH stabilization within the limits which do not exceed 4.2. Clearing at low temperatures (maximum 40°C) will lead to a great economy of heat agents and will cheapen the fabrication process.

At the Wine-Making Factory from Scoreni, in collaboration with the Wine and Vine Institute and the "Porumbeni" Scientific Research Institute of Maize and Sorghum, the experimental group of juice was obtained from stalks of green sweet sorghum.

The juice obtained under experimental conditions was cleared. Organoleptic, physical-chemical and microbiological features have been determined in the laboratories of the Institute.

The technological scheme has been drawn according to the optimum technology of juice clearing.

RESULTS AND DISCUSSION

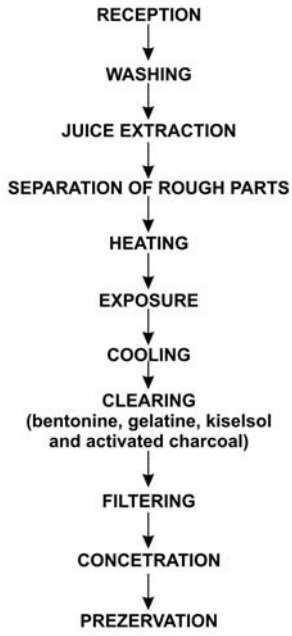

Fig. 1 - Scheme of the technological process of obtaining sweet sorghum juice

The highest quality syrup was obtained according to the scheme, which foresees the coagulation at high temperatures of non-sugar substances, changing of starch into gelatine, juice processing by means of enzymes, processing with activated charcoal and its filtering.

The technological scheme is shown in *Figure 1*. The scheme allows the best clearing of sorghum juice and is preferred from sanitary point of view, because no dissolvable chemical substances are used.

Table 1 shows the physical-chemical traits of juice at different stages.

Table 1

Characteristics of the quality of products obtained by processing sweet sorghum

Characteristics	Initial juice	Juice after heat treatment	Cleared juice	Concentrate juice
Percentage content of dry matter, %	14.80	14.70	14.45	72.25
Percentage content of glucides , inclusively:				
- fructose	2.48		1.64	7.6
- glucose	2.66		1.93	8.9
- sucrose	6.48		5.90	30.4
Clearing degree		-	91	-
Celluloses	0.006			
pH	5.15	4.30	4.27	4.13
Titrable acidity (calculated in malic acid)	0.24	-	0.38	1.72
Starch	2.95	1.87	-	-
Ethylic alcohol	0.17	-	-	-

Choosing the branches of food industry, where the utilization of juice obtained from cleared sweet sorghum (concentrate and non concentrate) could be possible, was done according to its physical-chemical and microbiological, but especially organoleptic traits.

Tables 2 and 3 present the organoleptic traits of cleared (concentrate and non concentrate) sweet sorghum juice and the physical-chemical traits of initial cleared juice and of the concentrate, obtained under laboratory conditions.

Table 2

Organoleptic characteristics of the cleared juice obtained from sweet sorghum

Characteristics	Conditions for:	
	Initial cleared juice	Concentrate juice
Aspect	Clear, transparent liquid	Non transparent syrup, with low sediments
Taste and flavour	Sweet, with specific taste for sweet sorghum juice	
Colour	Light yellow	Brown
Solubility	- // -	Total
Note: Taste and flavour of concentrate juice are established after its dissolving in water, in dilution of 1:5 (12^{o} Brix)		

Investigations have demonstrated that the concentrate juice of sweet sorghum was a valuable food product, which could be used in confectionery, bakery, milk and canned food processing, for making alcohol, citric acid, alcoholic and non alcoholic beverages and for bee feeding.

Table 3

Physical-chemical characteristics of the initial cleared and concentrate juice obtained from sweet sorghum

Characteristics	Initial cleared juice	Concentrate juice
Content of dry matter, %	14.45	72.25
Content of glucides (%) , inclusively:		
- fructose	1.64	7.6
- glucose	1.93	8.9
- sucrose	5.90	30.4
- other glucides	1.95	1.79
Clearing degree, %	91	-

Data concerning the composition of glucides from concentrate sweet sorghum allow its use as sugar substitute in food products, where sugar is added as syrup and does not influence significantly the product yield.

These products are juice, drinks, and compote, as well as bakery and confectionery products.

We have established that the sweetening degree of sweet sorghum was by 1, 2 times higher than the syrup sweetening degree of similar concentration. The syrup of sweet sorghum also had an increased biological value, because of the great contents in aminoacids and mineral substances (Метлин, 1992).

The biological value of the juice extracted from stalks of sweet sorghum has exceeded the biological value of other alternative juices obtained from fruits. For making juices and compotes, we recommend the use of juice obtained from sweet sorghum, having a content of DM of 14-16%. In the branches of food industry, where sugar is used under its usual shape (dry), for instance bakery, confectionery and dairy industry, the 70 % concentrate juice of sweet sorghum should be used.

For the selection of raw material for making food samples with sweet sorghum juice, we have taken into account the organoleptic characteristics of juice obtained from sweet sorghum: taste, colour, flavour and all their aspects – intensity of sweetness, of taste, compatibility between flavour and taste of used ingredients and sorghum syrup, as well as the synergic effect in case of partial sugar substitution.

For making drinks, the used raw material was traditional fruits, cultivated in the Republic of Moldova (apricots, sour cherries, peaches, apples and pears) and non traditional fruits (oranges and tangerines).

The substitution of sugar syrup with sweet sorghum juice in the degustation samples has represented 25 to 100%. The results of organoleptic assessment of drink samples, proposed for degustation, showed that fruits have combined harmoniously with sorghum juice taste, substituting (between 30% and 100%) the sugar syrup with juice of sweet sorghum, according to type of raw matter.

CONCLUSIONS

Sweet sorghum, cultivated in the Republic of Moldova, allows getting cleared juice for the use in different branches of food industry.

The technology can be made by means of the present technique, in different wine making societies, by their adapting to adequate technical requirements and the endowment with modern equipments.

The sweet sorghum juice can be used for drinks, made of fruits and jellies, without diminishing their organoleptic and physical-chemical characteristics.

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