«М.А.Гендельманның 110 жылдығына арналған «Сейфуллин оқулары – 19» халықаралық ғылыми-практикалық конференциясының материалдары = Материалы международной научно-практической конференции «Сейфуллинские чтения – 19», посвященной 110 - летию М.А. Гендельмана». - 2023. - Т.I, Ч.I.- Р. 204-207.

UDC 65.63.03

WHEY PROCESSING AND PRODUCTION OF FOOD FROM IT

Sagandyk A.T.– Ph.D. student,
Zhakupova G.N.– candidate of technical science, associate professor
S. Seifullin Kazakh agrotechnical research university, Astana

Whey is a source of important valuable nutrients. It contains more than two hundred biologically active substances, including almost all water-soluble and finely dispersed components of milk (lactose, whey proteins, mineral salts, milk fat, vitamins and organic acids, enzymes, etc.). [1-2].

The whey contains most of the essential amino acids of milk, trace elements like calcium, potassium, magnesium and phosphorus, as well as vitamins B, C, A, E, nicotinic acid, choline and biotin. Also, some probiotic bacteria used in sourdough in the production of cottage cheese pass into the whey. It is worth to noting that all these components are in an easily digestible form [3-5].

Along with physiological value whey has a positive effect on the digestive, nervous and cardiovascular system of human, impact to the disease resistance of body health, so it has medicinal properties. Enzymes, vitamins, phospholipids and other biologically active substances of whey play an important role in human nutrition [6-7].

The development of a rational integrated waste-free technology for the whey food production will help to obtain useful for the population products, as well as will solve a number of economic and environmental problems.

Whey is divided into the following types according to the method of production:

- during separating milk, the production of sour cream, butter. natural cheeses, cottage cheese and milk protein by traditional technology are obtained by–products – skimmed milk, buttermilk and whey, which have a conditional generalizing term - secondary dairy raw materials. The previously used term – waste is unacceptable.

- during separating milk by non-traditional methods, an ultrafiltrate and a casein-free phase are obtained, which are classified as whey [8].

The main component in the whey composition is lactose, which is present 70-75% in dry matter. At the same time, there is slightly less lactose in curd whey due to fermentation into lactic acid, which increases the acidity of the whey. The degree of transition of individual milk components into whey is connected with the processes of gelation and syneresis. 6.3 – 12.4% of fat goes into whey, and

depending on the fat content of the feedstock and technology, its absolute content varies widely – from 0.05 to 0.5%.

Data on the whey physico-chemical composition are shown in the table 1.

Table 1 - Physico-chemical composition of whey

№	Name of value	Result
1	Titratable acidity, ^{0}T	70
2	Density, g/m^3	1020
3	Dry substances mass fraction, %,no less than	5,0
4	Protein mass fraction, %, no less than	0,4
5	Carbohydrates mass fraction, %: Mass fraction of sucrose Mass fraction of maltose Mass fraction of glucose	 31,72±0,55 2,68±0,20 18,52±0,5

The carbohydrate complex composition of whey includes monosaccharides, oligosaccharides and aminosaccharides. Curd whey contains 0.7 – 1.6% glucose, which is due to the hydrolysis of lactose in the production of cottage cheese.

The amino acid composition of individual fractions of whey proteins has the same qualitative composition, but differs in their quantitative ratio. Among the amino acids included in whey proteins, there are all essential amino acids that can satisfy or exceed them in the "ideal protein" (with the exception of aromatic, sulfur-containing and valine).

A comparative analysis of the amino acid composition of whey from cottage cheese made from cow's milk and whey from cheese made from sheep's milk is shown in Table 2.

Table 2- Amino acid composition of whey, mg/l

№	Name of value	whey from cottage cheese made from cow's milk	whey from cheese made from sheep's milk
1	Arginine	12±0,02	3,8±3,81
2	Lysine	3±0,01	8,254±8,25
3	Tyrosine	30±0,05	3,235±3,23
4	Phenylalanine	23±0,003	4,416±4,417
5	Histidine	9,1±0,02	2,531±2,53
6	Leucine	4,9±0,01	7,584±7,5
7	Isoleucine		4,36±4,3
8	Methionine	2,1±0,004	1,907±1,90
9	Valine	3,1±0,02	5,71±5,7
10	Proline	12±0,02	7,16±7,1
11	Threonine	3,6±0,01	3,9±3,90
12	Serine	2,70±0,003	4,67±4,68
13	Alanine	3,5±0,05	3,2±3,2

14	Glycine	2,6±0,03	1,88±0,2

The amino acid composition of curd and cheese whey differs in that curd whey contains 3.5 times more free amino acids and 7 times more essential free amino acids (mainly due to arginine, phenylalanine, tyrosine, proline). Whey from cottage cheese from cow's milk gives way in terms of the number of amino acids such as lysine, valine, serine, threonine. Despite the rich composition and high energy value, whey from sheep's milk cheese is difficult to obtain, due to the rare use of this raw material. Sheep's milk contains a lot of caprylic and capric acid, which give an unpleasant taste and smell to milk. Therefore, for further research and development of new types of dairy products, whey from cottage cheese from cow's milk was selected.

According to the composition of whey, it can be concluded that this product can be used as the main raw material for the production of a number of fermented dairy products. World experience shows that whey has potential as a component of dairy products. The scientist V.A. Grunskaya developed a fermented drink from skimmed milk, whey and vegetable components in the form of syrup of white mulberry and sea buckthorn, rubbed with sugar [9]. For the development of the technology of fermented milk product M.I.Slozhenkina et al. uses cheese whey, natural vegetable products, spirulina, tarragon, mint and stevia sugar substitute to produce fermented milk product [10].

Among the whole range of fermented milk products, the yogurt segment is in great demand among consumers. These products have preventive and curative, as well as dietary properties that are caused by the presence of a "living" beneficial microflora [11]. Further research into the use of whey as one of the main components of the resulting product will help not only improve the beneficial properties of yogurt, but also solve the problem of whey processing, as well as expand the range of dairy products.

The presented research work was carried out within the framework of the planned-target program 23TF/ACM-23 BR10764998 "Development of technologies using new strains of beneficial microorganisms, enzymes, nutrients and other components in the production of special dietary foods", the subproject "Development of resource-saving technology of economy-class dairy products from whey (whey cheese, refreshing and tonic drinks).

Список использованной литературы:

1. Pandiyan, C., Gayathri Devi Kumaresan, R. Annal Villi and G. Rajarajan. Incorporation of whey protein concentrate in ice cream [Text]/ Pandiyan, C., Gayathri Devi Kumaresan, R. Annal Villi and G. Rajarajan.//Chemistry.-2010.- №8.- 563 p.

2. Ключникова Д.В. К вопросу использования подсырной сыворотки [Текст]/ Д.В.Ключникова //Международный научно-исследовательский журнал.-2015.-№4.-С.70-71.

3. Eveleva V.V. and others. Technological features of production of lactate-containing additives from milk whey fermented with lactic acid bacteria

[Text]/ V.V.Eveleva, T.M.Cherpalova1, E.A. Shipovskaya and N.A. Korshunova// Agronomy Research.- 2019.-17(6).- 2260–2268p, https://doi.org/10.15159/AR.19.201

4. Кузнецова Т.А., Иванченко О.Б.. Использование творожной сыворотки в технологии слабоалкогольных напитков брожения.[Текст]/ Т.А. Кузнецова, О.Б. Иванченко.//Вестник КрасГАУ. 2019.- № 12.- С.152-159. DOI: 10.36718/1819-4036-2019-12-152-159

5. Рощупкина О. Е. Перспектива сочетания вторичного сырья молочной промышленности и растительного сырья при создании кисломолочного продукта.[Текст]/ О. Е. Рощупкина//НАУЧНЫЕ ИССЛЕДОВАНИЯ.- № 1 (12).- 2017.-С.13-14

6. Теречик Л.Ф. Молочная сыворотка и физиология питания.[Текст]/ Л.Ф. Теречик //Сыроделие. - 1999.- №1.- С.15-18.

7. Вайнштейн Х.И. Молочная сыворотка, ее свойства и лечебное применение [Текст]/ Х.И. Вайнштейн // Челябинск: Южно-Уральское кн. изд-во- 1973. - 132с

8. Витушкина М.А. Использование молочной сыворотки в пищевой промышленности [Текст]/ М.А.Витушкина // Международный научный журнал «Вестник Науки».- №1 (34).Т.5.-январь 2021 г.-С.127-132

9. Грунская В.А. Влияние растительных наполнителей на качество ферментированных молочно-сывороточных напитков./ Молочнохозяйственный вестник, №2 (18), II кв. 2015-С.71-79

10. Slozhenkina M., Gorlov I., Kryuchkova V., Mosolova N., Bochkareva A., Serova O. Functional fermented milk whey product: assessment of quality and safety.[Text]/ M.Slozhenkina, I.Gorlov, V.Kryuchkova, N.Mosolova, A.Bochkareva, O.Serova // IOP Conference Series: Earth and Environmental Science.-Vol.548.-2020. -082030p. doi:10.1088/1755-1315/548/8/082030.

11. Zhakupova G.N., Sagandyk A.T. Development of technology of yoghurt by using acid whey[Text]/ G.N. Zhakupova, A.T. Sagandyk // N E W S OF THE NATIONAL academy of sciences of the republic of kazakhstan series chemistry and technology ISSN 2224-5286 -Volume 4, Number 442.- 2020ю- 51 – 57 p., https://doi.org/10.32014/2020.2518-1491.64