The 5th International Young Naturalists' Tournament

Municipal Autonomous Institution of General Education of the city of Novosibirsk «Gymnasium №12»

Problems № 12 «Milk»

Team *«12FM»*,

Novosibirsk

chnmk@mail.ru

Diana Ignatovich

Condition of the problem

Develop simple methods allowing determination of some of the important properties of milk. Suggest an investigation requiring comparison of various milk samples.

Objective

To offer ways to determine the properties of milk.

Hypothesis

If milk is a food product, then it must comply with the requirements of the State Standard 31450-2013 "Drinking milk".

Objectives of the study:

1. Carry out a literary study;
2. To analyze the milk in accordance with State Standard 31450-2013 "Drinking milk";
3. Consider industrial methods for determining the properties of milk;
4. To select the methods of determining the quality of the product that are most accessible for use in the school laboratory, at home;
5. Experimentally determine the properties of cow's milk, bought in the shops of the city;
6. Based on the results of the study, develop a "Customer's Memo".

Properties of milk

Organoleptic characteristics
State Standard 31450-2013 "Drinking milk"

The name of the indicator	Characteristic
Appearance	Opaque liquid. For products with a mass fraction of fat of more than 4,7%, insignificant sludge of fat is allowed, disappearing with stirring.
Consistency	Liquid, homogeneous is not viscous. Without protein flakes and lumps of fat.
Taste and smell	Without foreign flavors and odors, with a slight taste of boiling. For baked and sterilized milk - a pronounced taste of boiling. A sweetish taste is allowed.
Color	White, allowed with a bluish tinge for skim milk, with a light cream tint for sterilized milk, with a creamy tint for baked milk.

Physical and chemical indicators

The name of the indicator	The value of the indicator for a product with a mass fraction of fat,%, not less than				
	Defatted, less than 0.5	0,5; 1,0	1,2; 1,5; 2,0; 2,5	2,7; 2,8; 3,0; 3,2; 3,5; 4,0; 4,5	4,7; 5,0; 5,5; 6,0; 6,5; 7,0; 7,2; 7,5; 8,0; 8,5; 9,0; 9,5
Density, kg / m, not less than	1030	1029	1028	1027	1024
Mass fraction of protein,%, not less than	3,0				
Acidity, ° T, not more than	21				20
Mass fraction of dry non-fat milk residue,%, not less than	8,2				
Clean group, not lower than	I				
Product temperature when released from the enterprise, ° C: - pasteurized and melted, ultra-pasteurized (without aseptic filling);	4±2				
- ultra-pasteurized (with aseptic filling) and sterilized	2-25				
NOTE For a product made from whole milk, the mass fraction of fat is set in the process instruction as a range of actual values ("from .... to ....",%).					

Composition of milk

- Water- 87,2%,
- Dry substances - 12,8%,
- Fats - 3,9%,
- Protein - 3,4% (casein 80-87%, albumin 10-12%, globulin 3-6%)
- Lactose - 4,7%.

Rich milk vitamins A, D, and group B (B1, B2, B12), macro- and micro elements, such as calcium, potassium, phosphorus, magnesium, sodium, iron, fluorine, iodine, etc.

Types milk of animal origin

Animal	Protein, %	Fats, %	Lactose, %	Places of use
Cow	3,2	3,5	4,9	Everywhere
Goat	3,8	4,1	4,4	Everywhere
Horse	2,2	1,9	5,8	Peoples of the East
Buffalo	4,6	7,5	4,2	Italy, Georgia, India, Egypt, Azerbaijan, Kuban, Armenia
Camel	4,0	3,0	5,7	Peoples of the East
Sheep	5,1	6,2	4,2	Greece, Italy, the Crimea, Asia
Donkey	1,9	1,4	6,2	Greece, Cyprus
Deer	10,9	17,1	2,8	The inhabitants of the North

Forms of milk

Fresh milk - immediately after milking, many different microbes and bacteria; drink two hours after milking.

Pasteurized - milk, heated to 75 ° C, do not deteriorate for 2 weeks.

Baked milk – milk, subject to heat treatment at a temperature of 95 ° C for 3-4 hours.

Milk powder is a white powder produced by evaporating milk.

Sterilized milk is exposed to heating up to 145°C. All microbes and bacteria die. But reduce the useful properties of milk.

Condensed milk - milk, produced by evaporating moisture to a thick consistency and adding sugar.

Experiment 1. Organoleptic preferences. The questionnaire.

Milk name:			
Taste	Color	Smell	Consistency
Sweetish	White	Pleasant	There should be a thick, uniform liquid without sediment and clots
Bitter	Slightly yellowish	Unpleasant	
Salt	Yellow	What smells?	
Sour	Slightly bluish		
Your option:	Your option:		

The action was attended by 100 people, who after tasting filled the checklist.

Results of the study 1. Organoleptic properties

	Sample 1	Sample 2	Sample 3	State Standard 31450-2013
Taste	Sweetish	Sweetish	Sweetish	Characteristic for milk, without foreign flavors and odors, with a slight taste of boiling.
Smell	Pleasant	Pleasant	Pleasant	
Color	White	White	White	White
Consistency	Normal (homogeneous, no precipitation)	Normal (homogeneous, no precipitation)	Normal (homogeneous, no precipitation)	Liquid, homogeneous is not viscous. Without protein flakes and lumps of fat.

Conclusion: all the milk samples are relevant to State Standard 31450-2013 "Drinking milk“ to taste, color, odor and consistency.

Experiment 2. Presence of impurities in milk

Objective: To determine whether soda and other chemical contaminants added to milk.

	Sample 1	Sample 2	Sample 3
Staining of the test strip	Light green	Light green	Light green
A comment	There are no chemical impurities	There are no chemical impurities	There are no chemical impurities

Conclusion : chemical contaminants weren't found in milk.

Experiment 3. Presence of starch in milk

Objective: To determine availability of starch in milk.

	Sample 1	Sample 2	Sample 3
The color of milk after adding iodine	Yellowish orange	Yellowish orange	Yellowish orange
A comment	Starch in milk is absent	Starch in milk is absent	Starch in milk is absent

Conclusion : there isn’t starch in the milk.

Experiment 4. Presence in milk of chalk

Objective: To determine availability of chalk in milk.

	Sample 1	Sample 2	Sample 3
Presence of foam	Foam is	Foam is	No foam
A comment	In milk there is chalk	In milk there is chalk	There is no chalk in the milk

Conclusion: The manufacturers of samples 1 and 2 added chalk to the milk.

Experiment 5. Determination of milk density

Objective : To determine the density of milk.

Example of calculation of milk density using a hydrometer.
Sample 1
Milk temperature: 24^0C
1)A(1)=19,5
2) 24 - 19,5=4,5 – The difference between milk temperatures and the table value.
3) 4,5*2=9
4) A(2)=20+9=29
Density = (1000+29) Kg / cm^3= 1029 Kg / cm^3= 1,029 G / cm^3

Determination of milk density

	Kg / cm³	G / cm³	State Standard 31450-2013
Sample 1	1029	1,029	For milk, with a fat content of 2,5% - not less than 1028 kg / m3 = 1.028 g / cm3
Sample 2	1026	1,026	
Sample 3	1030	1,030	

Conclusion: Index of sample number 2 density below is the allowable value.

Experiment 6. Filter paper

Objective: To determine the degree of dilution of milk with water.

	Sample 1	Sample 2	Sample 3
Drying time, min	25-30	60-70	60-70
A comment	Milk diluted in 30%	Milk diluted in 10%	Milk diluted in 10%

Conclusion: Sample 2 diluted with water on 30%. Samples 1 and 3 diluted with water on 10%.

Conclusion

- All milk samples of popular brands, meet the requirements of the State Standard 31450-2013 in terms of organoleptic qualities;
- A density of Sample 2 below the minimum level;
- Samples do not contain impurities starch and soda;
- In the samples 1 and 2chalk is detected.

List of references

1. Dairy industry // Encyclopedia "Krugosvet".
2. Fermented milk products / VD Kharitonov, VF Semenikhina, IV Rozhkova // The Great Russian Encyclopedia: [in 35 tons] / Ch. Ed. Yu. S. Osipov. - M.: The Great Russian Encyclopedia, 2004-.
3. Milk - article from the Great Medical Encyclopedia
4. Krus GN, Khramtsov AG, Volokitina EV, Karpychev SV Technology of milk and dairy products, Ed. A. M. Shalygina. - Moscow: Colossus, 2006. - 455 p. - (Textbooks and teaching aids for students of higher educational institutions). - ISBN 5-9532-0166-4.
5. Tverdokhleb GV, Sazhinov G. Yu., Ramanauskas RI Technology of milk and dairy products. - Moscow: DeLi print, 2006. - 616 p. - ISBN 5-94343-104-7.
6. Bredikhin SA, Kosmodemyanskiy Yu. V., Yurin VN Technology and technology of milk processing. - Moscow: KolosS, 2003. - 400 p. - ISBN 5-9532-0081-1.
7. Gisin IB, Sirin VI, Chepulaeva LV, Shalygina GA Technology of milk and dairy products. - Moscow: Food Industry, 1983. - 376 p.
8. GOST 31450-2013 Drinking milk. Specifications
9. Http://edaplus.info/drinks/milk.html
10. Http://chudesalegko.ru/moloko-poleznye-svojstva-i-protivopokazaniya/
11. Http://www.inmoment.ru/beauty/health-body/milk.html
12. Http://tumannyj.ru/p0102.htm

Method for determining the properties of milk

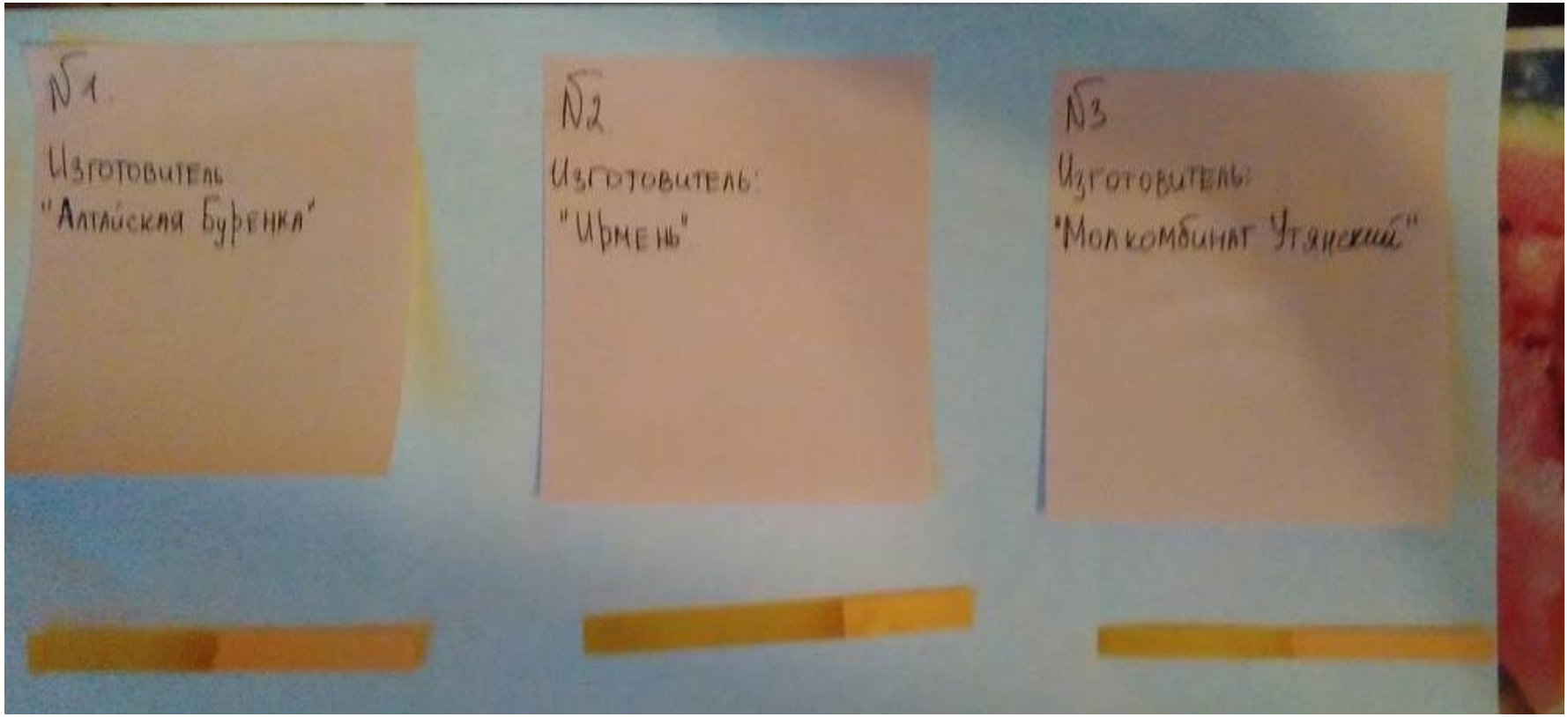
1. Taste, color, smell, consistency - organoleptic studies.
2. Density - using a hydrometer.
3. The presence of starch - with the help of iodine.
4. Presence of soda - using the indicator "bromtimol blue".
5. The presence of an impurity of water - with the help of filter paper

Виды молока растительного происхождения

- **Миндальное молоко.** Богато омега-3, магнием, фосфором. В миндальном молоке меньше калорий, белка и кальция, чем в коровьем.
- **Рисовое молоко.** Не очень питательно 1г белка и 2% дневной нормы кальция на стакан.
- **Соевое молоко.** Содержит растительную клетчатку, витамин B12. В одном стакане 6г белка и 45% ежедневной нормы кальция.
- **Кокосовое молоко.** Содержит 27% жиров, 4% белка. Содержит витамины C, B1, B2, B3.
- **Маковое молоко.** Содержит железо, магний, витамин E. Используют в качестве успокаивающего, болеутоляющего средства.
- **Тыквенное молоко.** насыщено витаминами и имеет низкую калорийность. Молоко богато минеральными веществами и способно укрепить иммунитет

Приложение 1.

Приложение 2.



Приложение 3.