USE OF SILVER IONS IN PASTEURIZED MILK PRODUCTION

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Received October 3, 2012

ABSTRACT

The means of pasteurized milk shelf life prolongation by electro-chemical diffusion of silver ions has been introduced. Three samples of pasteurized milk were test subjects. In the course of study the following data have been examined: organoleptic, physicochemical, microbiological parameters of check samples and pilot samples of raw and pasteurized milk. Its shelf life has been determined. It has been determined that the test results of raw and pasteurized milk samples processed by various concentration of silver ions showed minor difference in organoleptic, physic-chemical, microbiological parameters and shelf life span. In this connection it appears reasonable to use the smallest concentration of silver ions – 50 micrograms per liter for milk shelf life prolongation as it is considered the least harmful for person's organism. Infusion of silver ions in the concentration of 50 micrograms per liter allows to prolong raw and pasteurized milk shelf life by two days.

KEY WORDS

Raw milk; Pasteurized milk; Silver ions; Electro-chemical method; Organoleptic parameters; Physicochemical parameters; Microbiological parameters; Shelf life.

Intensive development of the nutrition science is connected with the improvement of epidemiological methodology, expansion of human notions of their nutrient needs, stating of the role of biologically active food components, development of the foodstuff chemical composition surveys, development and introduction of their new kinds.

Numerous published works on Russian population nourishment prove its poor condition. Redundant consummation of high-energy products lacking micronutrients is as widespread as macronutrients misbalance. Alimentary illnesses are mostly caused by vitamin, calcium, iron and other micronutrient deficiencies. Silver is one of such micronutrients. Low silver tolerance of most pathogenic germs, low toxicity, lack of proved immunogenic properties of silver and high silver tolerance of most people caused high interest in this micronutrient all over the world. Contemporary notions of silver consider it as not just a simple metal able to kill microbes but also as a microelement that makes a necessary and integral part of any animal and vegetable organism tissues. High biological activity of metal microelements in an organism is connected first and foremost with their part in ferment, vitamin and hormone synthesis. Silver ions collaborate in metabolism. Depending on concentration silver cations can stimulate or inhibit ferment activity. Silver doubles the intensity of oxidative phosphorylation in brain mitochondria and raises the level of nucleic acid which is vital for brain functioning. Thus, according to contemporary notions silver is considered a microelement necessary for proper viscera and system functioning and a powerful means to enable immune system and to affect malignant bacteria and virus. Another urgent problem is finding ways to preserve milk and dairy products which is necessary for economic efficiency.

In order to originate medicinal preventive pasteurized milk with prolonged shelf life a lot of surveys on it manufacturing were conducted.

MATERIALS AND METHODS

Silver ions diffusion was implemented with the colloid silver ions generator "Georgiy". The device is used for receiving ion and colloid silver solutions, it has two automatic time modes and allows getting solutions with silver ions of wide range of known concentrations (Technical certifi-

cate 066619.003 РЭ Colloid silver ions generator "Georgiy").

The following samples compiled test subjects: sample 1 – check sample of pasteurized milk; sample 2 – milk pasteurized with Ag+ concentration 50 microgram per liter; sample 3 – milk pasteurized with Ag+ concentration 150 microgram per liter.

Physicochemical and organoleptic rates of pasteurized milk were detected in the cause of experiments. In order to reveal the effect of silver ions on milk microflora microbiological studies were held on the first and on the fourth day of storage. Shelf life was determined by the organoleptic evaluation and titrate acidity.

RESULTS AND CONSIDERATION

Raw milk was the main subject material; colloid silver ions were the additional subject material. Inspection test of the input milk was based on the State Standard parameter P 52054 – 2003 "Natural cow milk – raw material".

In order to choose the most suitable colloid silver ions concentration for pasteurized milk shelf life prolongation organoleptic and physicochemical parameters of test samples and microbiological control of the milk were tested throughout the whole approximate shelf life of milk. Organoleptic evaluation of pasteurized milk showed that during the first three days of shelf life check and test samples have homogeneous consistence without protein flakes and fat clots; they are clean, with pleasant smell and flavor; sweet with little boiling aftertaste; have even white color. On the fourth and fifth day organoleptic properties of check sample change: on the fourth day fat sedimentation is detected; on the fifth day fat sedimentation and protein flakes are detected; milk got sour taste and smell and uneven white and yellow colour. Organoleptic rates of test samples remain the same during the forth and the fifth day of storage. Thus test samples of milk remain fresh when check samples show signs of spoiling. That proves bacteriostatic effect of silver ions.

Then the effect of colloid silver ions on physicochemical rates of pasteurized milk during the storage was tested. The data shown proves that colloid silver ions diffusion almost does not change fat and protein content of pasteurized milk.

Table 1 – Physicochemical rates of pasteurized milk at the storage temperature of 4±2 ˚C, n=3 (M ± m)

Indicator	First 24 hours			Fifth 24 hours		
	Sample 4 (check)	Sample 5	Sample 6	Sample 4 (check)	Sample 5	Sample 6
Protein, %	2,70±0,03	2,69±0,05	2,73±0,02	2,71±0,01	2,75±0,08	2,68±0,09
Fat, %	3,01±0,01	2,98±0,06	3,04±0,04	3,21±0,02	3,08±0,03*	3,13±0,01*
Density, kg/m^3	1027,47±0,43	1027,94±0,26	1027,04±0,31	1024,50±0,15	1026,52±0,18**	1026,14±0,21**

Discrepancy is statistically valid: * - P 0,05; ** - P 0,01

In the issue of check and test samples shelf life survey it was stated that the storage of check and test samples of pasteurized milk made three and five days respectively. In order to detect anti bacteriological influence of silver ions, microbiological analysis was undertaken. The results showed, that by the fifth day general bacteriological sowing was lower by 40% and 60% respectively in comparison to check samples; the amount of pathogenic germs was lower by 20,8% and 25% respectively. Microbiological tests show that silver ions reduce microbe cells and prolong milk shelf life.

Since it has been determined that test results of milk samples processed by various concentration of silver ions showed minor difference in organoleptic, physic-chemical, microbiological parameters and shelf life span it appears reasonable to use the smallest concentration of silver ions – 50 micrograms per liter for milk shelf life prolongation as it is considered the least harmful for person's organism.

CONCLUSION

Colloid silver ions diffusion in pasteurized milk does not have negative influence on its organoleptic and physicochemical properties and shows obvious signs of general microbiological reduction. Concentration of silver ions at 50 micrograms per liter is considered the most reasonable concentration in prolongation of milk shelf life by two days in comparison to check samples.

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