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ANALYSIS OF MILK QUALITY AND ITS IMPORTANCE FOR MILK PROCESSORS

ANALIZA CALITATII LAPTELUI SI IMPORTANTA SA PENTRU PROCESATORI

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The paper aimed to present some aspects regarding milk quality and its importance for milk processors , taking into account a study case at FLAV O'RICH DAIRY INC,USA. The study analyses how milk quality is checked from the bulk milk to final product according to the Milk Quality Program in force. The main aspects concerning raw milk selection criteria such as : antibiotic test, temperature, bacteria, organoleptic properties , acidity, somatic cell count , but also main milk components such as water, butterfat , total solids, protein, lactose , solids non fats , minerals, acids have been approached . Also a comparison for 7 butterfat producers for East Fluid Group has been done . Milk processing assures the destruction of human pathogens , the maintenance of product quality without significant loss of flavor, appearance, physical and nutritive properties and the selection of organisms which may produce unsatisfactory products.
Keywords: milk quality , importance , milk procesors , Flav O'Rich Dairy Inc

Introduction

Milk is very important due to its special nutritive value and important role for human and animal health. It has all the substances needed by organisms in its easiest assimilable form . Its has high value proteins (casein, lactalbumine and lactoglobuline providing essential aminoacids) , fat provinding energy (9.3 kcal /g), a low melting point (29-34 °C) , small globules stimulating an easy assimilation, A and D vitamins playing an special role in Calcium and Phosphorus fixation in bones , low cholesterol compared to other foods of animal origin (fresh milk 10, skimmed milk 3, butter 280, fat cheese 150-200, pork 100-120, egg yolk 1400 mg/100 g product). Milk or milk sugar , due to the bacteria living in the intestine is transformed in lactic acid with a benefic influence upon our body. Minerals are also very important (Calcium , Phosphorus etc) . Due to its nutritive value, milk is recommended to young and old people ,

being considered a complete food. The nutritive and energetic value of one milk kilogram corresponds to the ones of 0.5 Kg beef or 8-9 eggs. One kilogram of milk contains : water 84-90 %, fat 2-6 %, protein 3-4 %, lactose 4-5 %, minerals < 1 % and supplies about 668 Kcal. Therefore , milk is a very important raw material for food industry. There are estimated to be some 8 to 10,000 different types of milk products produced in the world . Dairy industry is considered a large and dynamic economic branch of many nations and consumption of dairy products continues to increase throughout the world. A new definition of "high-quality" milk has been imposed and Quality Management System has appeared as a compulsory tool for assuring milk quality from cow udder to consumer's cup . In this context, the present paper approaches milk quality aspects in the USA according the standards in force giving an example how milk quality is checked by milk processors in close relationship to the quality of milk products at FLAV O'RICH DAIRY INC, London, Kentucky.

Materials and Methods

The paper was carried out at FLAV O'RICH DAIRY INC, in order to present how milk quality is checked from the bulk milk to final product according to the Milk Quality Program in force in the USA. Important aspects concerning raw milk selection criteria such as : antibiotic test, temperature, bacteria, organoleptic properties , acidity, somatic cell count , but also main milk components such as water, butterfat , total solids, protein, lactose , solids non fats , minerals, acids have been approached . Also a comparison for 7 butterfat producers (F 1, F2, F3, F4, F5, F6, F7) belonging to East Fluid Group has been done.

Results and Discussion

Production of quality milk is the concern of dairymen, veterinarians, state regulatory departments, milk and milk product processors, retail distributors (super markets) and consumers of dairy products . In order to assure the delivery of safe quality products to consumers , the regulatory control of milk and milk products is run under the milk sanitation program of the United States Public Health Service/Food and Drug Administration, divisions of the Department of Health and Human Services which have developed a statement of policy and regulations with regard to milk quality. This model regulation is known as the "Pasteurized Milk Ordinance of 1978" (PMO), which also contains the milk quality standards recommended to states, counties and municipalities. The main milk quality problems at herd level are : the increased number of clinical mastitis , high somatic cell counts , high bacteria counts and antibiotic residues in the bulk milk .

Current milk quality standards in Kentucky include the following requirements: 1) no visible adulteration or objectionable odor, 2) standard plate counts of <100,000 cfu and <300,000 cfu for Grade A and Grade B milk

respectively, 3) no drug residues, 4) SCC <690,000, 5) temperature < 7.20 and 10 degrees C for Grade A and Grade B milk respectively, and 6) no pesticide residues. While US standards for SPC are comparable to peer countries, the current US SCC limit is conspicuously higher than Canadian and European standards (500,000 cells/ml for Canada and 400,000 cells/ml for most of the E.U.).

The company applies Total Quality Management System whose slogan is " To deliver safe milk to consumers ". High quality milk should be white in appearance, have no objectionable odors and be free of abnormal substances such as pesticides, added water or antibiotic and antiseptic residues. The company pays a special attention to the quality of raw milk because this is conditioning the quality of its dairy products and profit level.

Table 1.

Raw Milk rejection Criteria at FLAV O'RICH DAIRY Inc, London , Kentucky

Specification	Rejection milk criteria
Antibiotics Test	any positive or indeterminable results
Temperature	greater than 42 degrees F
Bacteria	anything greater than 90,000/slide sample
Added Water	1% or greater than (Cryoscope reading lower than 0.530)
Organoleptic properties	any odor or appearance deemed unacceptable by Flav-O'Rich personnel
Acidity	greater than 0.14
Direct Microscopic Somatic Cell Count	greater than 690,000

Note : Not meeting any of the above criteria will not be considered a guarantee of acceptance.

For this reason, every tank truck of milk is carefully checked concerning the presence of antibiotics prior to the tank being unloaded. If the truck is confirmed positive for the presence of antibiotics, another test is run in order to identify which farm contaminated the milk. The entire tanker load of contaminated milk must be dumped and the offending farmer is fined. A farm that repeatedly violates antibiotic residue standards will be prohibited from selling milk. Antibiotic residues are undesirable for public health reasons and because of their potential impact on the manufacturing process .

If raw milk passes the antibiotics test , milk samples are collected from the bulk milk in order to determine temperature, bacteria content , acidity and somatic cell count .A high quality milk has to have less than 42 degrees F , less bacteria than 90,000/slide sample, no or less than 1 % added water and less than 0.14 acidity. Also the organoleptic properties are checked such as appearance and odor . Somatic cell count (DMSCC) must be less than 690,000 cells/ml.

In most developed dairy countries, milk quality is defined by the *somatic cell count (SCC)* in pre-pasteurized bulk tank milk. The SCC of milk are influenced by mastitis . The company prefers to purchase milk with low SCC ,

offering financial incentives to farmers for high quality milk. High SCC milk is not desirable because it reduces the shelf life of dairy products and diminishes the quality and quantity of milk protein; thereby reducing cheese yields. For instance , for a milk counting 240,000 somatic cells/ml an amount of 9.748 lbs cheese should be produced from 100 lbs milk, while in a milk counting 640,000 cells/ml just 9.430 lbs cheese is achieved .

Milk is an excellent growth media for bacteria , originating from either mastitis or from contamination of the milk with environmental pathogens during the milking or milk handling process. High quality milk originates from healthy cows that are free of mastitis . The company experts pay a special attention to the *standard plate count (SPC*), in pre-pasteurized bulk tank milk too . Less bacteria than 90,000/slide sample have to be found as milk bulk to be accepted for processing .

Because the bacterial quality and somatic cell content of raw milk are important to product shelf-life, flavor and yields (particularly cheese), the company strives to obtain the highest quality raw product possible from its suppliers . Grade A milk quality standards allow a maximum of 90,000 bacteria/ml. in raw bulk milk. The raw milk samples are then used for determining milk components : water, butterfat, total solids, protein, lactose, solids-non-fat, minerals, acids, enzymes , gases and vitamins as shown in Table 2.

Table 2 .

Analysis of Raw Milk Composition at FLAV-O-RICH, INC.London , Kentucky, USA

Farmer's name	% Water	% Butterfat	% Total Solids	% Protein	% Lactose	% Solids Non Fat	% Minerals	% Acids
John Smith	86.4	3.88	11.07	2.73	4.78	8.86	0.64	0.17
Admitted limits of variation	85.5 –88.7	2.2 – 5.5	10-12.63	3.25	4.60	7.9 – 10.0	0.65	0.18

Note: Date : 2/01/2009, FT-120 FOSS results

Butterfat percentage is determined by means of butterfat test both at farm place, in the truck milk and finally the receiving butterfat is established. The amount of milk in pound is weighted both at farm level and also at the Dairy Plant reception department . Then the amount of butterfat is calculated taking into account the butterfat percentage and the amount of milk delivered at the farm place and in the truck.

According to the Milk Quality System (ISO), milk is checked every moment along the whole chain of its processing in the Dairy Plant into various products such as Skim milk, 1 % milk , 2 % milk and whole milk . This dairy products have to meet the requirements concerning the product specification as

shown in Table 4. The company pays a special attention to Total Quality, as a component of its culture, attitude and organization . Customers' needs must be satisfied. Quality is approached in all aspects of the company's operations, with processes being done right the first time and defects and waste eradicated from operations. The whole company is focused to Total Quality Management, involving the integration of all the organizational functions such as marketing, finance, design, engineering and production, customer service, etc.). A convincing example is the shelf life for Half and Whole Gallons of White Milk in the Summer months of the year 2008. In the month of May the shelf life was 93.4, in July 80.6 , in August 85.5 and in September 86.1 , which are considered acceptable values . Also in the same months of the year 2008 , from the total number of milk tanks received only a very few have been rejected as shown in Table 5.

Table 3.

Butterfat producers comparison for Easter Fluid Group at January 2nd ,2009

Variant	Producer's name	Farm weight Lbs milk	Receiving weight Lbs milk	Farm test butterfat %	Truck milk butterfat %	Receiving test butterfat %	Farm butterfat Lbs	Truck of milk butterfat Lbs	Receiving butterfat Lbs
F1	John Smith	20,002	20,000	3.86	3.83	3.88	772.07	766	776
F2	Greg Mc Queen	19,508	19,501	3.99	3.94	3.95	778.37	768.33	770.29
F3	Mike Tompson	7,906	7,902	3.71	3.66	3.73	293.31	289.21	294.74
F4	Pete Mc George	43,059	43,051	3.79	3.80	3.76	1,631.94	1,635.93	1,691.71
F5	Tim Hoskin	54,000	54,008	3.86	3.82	3.82	2,084.40	2,063.10	2,063.10
F6	Ken House	51,490	51,496	3.72	3.73	3.69	1,915.42	1,920.80	1,900.20
F7	Pat Graham	59,999	59,992	3.99	4.00	3.93	2,393.96	2,399.68	2,357.68

Table 4 .

Specifications concerning Butterfat ,Total Solids and Acids for various dairy products

Product	% Butterfat	% Total solids	Acidity
Skim milk	0.01-0.20	9.00-10.00	0.12-0.13
1% Milk	0.80-1.20	11.00-12.50	0.12-0.13
2% Milk	1.60-2.40	11.50-12.50	0.12-0.13
Whole Milk	3.25-3.35	12.00-13.00	0.12-0.13

Table 5.

Tankers of Milk received at FLAV O'RICH DAIRY in Summer 2008

Specification	May	July	August	September
Milk Tankers , of which	511	569	629	608
Rejected tankers	3	3	2	1
Share of rejected tankers	0.19	0.52	0.31	0.16

The data show that the company had no incidents with bacteria (Coli), it registered zero incidents of positive tests from May to September. The Dairy Plant is facing very rarely with its customers complaints. For instance, in the analyzed months, the number of complaints was few as shown in Table 6. An important part of TQM is HACCP along the milk chain processing . It is a systematic preventive approach to milk and milk products safety that addresses physical, chemical and biological hazards as a means of prevention rather than finished product inspection. HACCP is used by the company to identify potential milk safety hazards, so that

key actions, known as CCP's can be taken to reduce or eliminate the risk of the hazards being realized. The system is used at all stages of milk processing (raw milk quality, pasteurization , packaging, distribution etc).

Table 6.

The number of complaints and customers' reasons

Customer reason	May	July	August	September
Number of complaints	3	5	4	6
- Missing seal	1	0	0	0
-Bunt material	1	0	0	0
-Spoilage	1	3	3	5
-Mold	0	2	0	0
-Fly in milk	0	0	1	0
-Brown substance	0	0	0	1

Conclusions

Milk processing is destined to provide the consumer with a wholesome, nutritious and safe product. The production of quality milk and milk products begins on the farm and continues through further handling, processing and distribution. Milk processing assures the destruction of human pathogens , the maintenance of product quality without significant loss of flavor, appearance, physical and nutritive properties and the selection of organisms which may produce unsatisfactory products .Total Quality Management is successfully applied as a combination of quality and management tools destined to increase the company business and reduce losses .The company has no problems with bacteria and incidents with positive tests. It is facing customers complaints very rarely , meaning that milk quality is assured along the milk chain from farm gate to final dairy products.Production of quality milk is the concern of dairy farmers , veterinarians, state regulatory departments, milk and milk product processors, retail distributors (super markets) and consumers of dairy products.

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