Technews
National Dairy Development Board
For Efficient Dairy Plant Operation

January-February 1998 No. 12

HACCP FOR PASTEURIZED MILK

This bulletin includes technical information, latest developments on products, systems, techniques etc. reported in journals, companies' leaflets, books and based on experience. The technical information would be on different areas of plant operation in different issues. It is hoped that the information contained herein, if employed in the factory, will help in making dairy plant operations more efficient.

Your contributions and suggestions will make the bulletin more useful, and are welcomed.

The theme of information in this issue is HACCP for Pasteurized Milk. It may be understood that the information given here is by no means complete.

In this issue

1. INTRODUCTION

The importance and the principles of Hazard Analysis and Critical Control Points (HACCP) system were briefly described in the 11th issue (Nov-Dec 1997) of the Technews. This issue presents the HACCP system for pasteurized milk.

The intention of HACCP is to focus on control over and pay special attention to the critical control points (CCPs).

The preventive measures include the automatic and the manual control measures directly controlling the process steps.

In case a HACCP results in too many CCPs or uncontrolled but essential process steps, a redesign of the process is indicated.

The HACCP chart should be reviewed and necessary changes be made when any modification is made of the product, process, or any step.

The HACCP system primarily focuses on food safety management, as done in the example of pasteurized packaged milk given here, but it can include other process steps as well, if required, such as in the ISO 9000 system.

2. HACCP WORKSHEET

The HACCP application should have the following four elements, as recommended by the Codex Committee on Food Hygiene (CCFH) of the Codex Alimentarius Commission of FAO/WHO:

i) Product description

ii) Process flow diagram

iii) A list of the results, with eight headings - step/ hazards/ preventive measures/ CCP/ critical limits/monitoring procedures/corrective action/ record - in preferably a chart or table form. Another heading that may be useful to add to the list is responsibility.

iv) Verification.

The detailed and elaborate process required to arrive at the results for the element iii) mentioned above is not presented here. Only the results are presented.

For effective HACCP application to the product, the hygienic design of the processing plant, good manufacturing practices, good quality raw materials and trained manpower are a pre-requisite for the control over hygiene.

Verification procedures indicate clearly that the total manufacturing system of the plant results in safe products. Part of the verification is the result of statistical analysis of the control charts system.

For the HACCP plan to be effective, it is important that the objective of the plan is clear and the plan is kept simple.

The HACCP plan for the packaged pasteurized milk is presented in items 3 to 7.

3. TERMS OF REFERENCE

The HACCP plan here of the manufacture of pasteurized packaged milk considers health hazards only throughout the entire process from milk reception from road tankers to distribution to retailers. Microbiological, chemical and physical hazards are identified.

The product should be safe to consume up till the 'use by' date, taking into account the storage temperature.

4. DESCRIPTION OF THE PRODUCT

Table 1 describes the product.

Table 1 Description of pasteurized packaged milk

Product Description : Pasteurized Packaged Milk

Facility

The dairy factory produces a variety of dairy products including pasteurized packaged milk for sale to the consumer. The factory is located on the state highway 10 km south of the town.

The product

The product is pasteurized, standardized milk in 500 ml polyethylene pouches stored under refrigeration. The keeping quality of the end product justifies a 'use by' term of 7 days. The temperature up till the distributor is kept below 6°C.

Manufacture

The milk is standardized on fat content of 4.6%, pasteurized at 76°C for 15 seconds in a plate pasteurizer and cooled to 4°C continuously and immediately. It is then filled in 500 ml polyethylene pouches in automatic pouch filling machines. Pouches are then put in crates which are stored in cold stores till despatch. The pouched milk is kept at 4°C. Refrigeration for raw and pasteurized milk is conditioned by official regulations and management additions to the official rules.

Intended use

The product is fit for consumption by people of all ages, except persons who are allergic to components of the milk.

5. FLOW DIAGRAM FOR THE MANUFACTURE OF PASTEURIZED MILK

Figure 1 presents the simplified flow diagram for the manufacture of pasteurized milk.

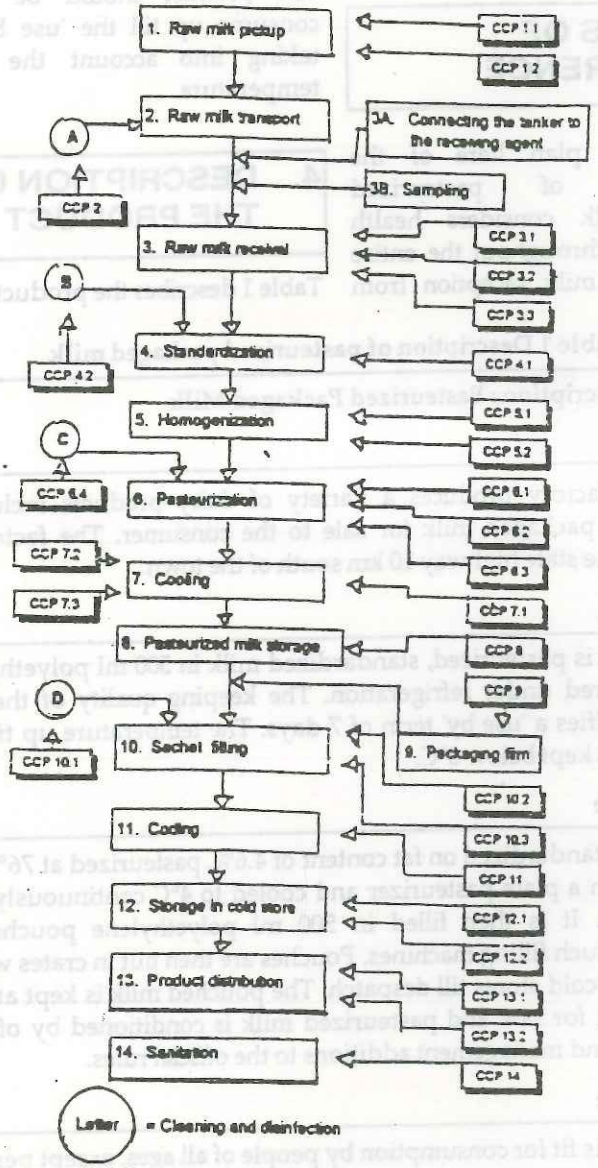

Fig.1 Flow diagram for production of pasteurized milk

The figure shows only the simplified process flow diagram. The diagram should normally detail all of the inputs to and outputs from the process as well as data concerning conditions, e.g. temperature, time, pressure, etc. The diagram should also be accompanied by explanatory notes for each process step. The explanatory notes are not presented here due to lack of space.

6. HACCP CHART FOR PASTEURIZED MILK

The HACCP chart for pasteurized packaged milk is given in Table 2.

7. VERIFICATION

Verification would include the following:

- Audits by the Dairy's quality assurance department of the processing plants, suppliers of packaging film and the chilling centre and transport (CC&T) sections.
- Reviewing and discussing the monitoring results of every processing plant, at intervals of 4-6 weeks. This would include such results as of the testing for recontamination, the testing at the 'use-by' date and other inspection or tests.

  The results may be processed and tested statistically by the computer.
- Review and analysis of complaints at half-year intervals.
- Results of public health (Prevention of Food Adulteration) inspection.
- Audits by external agencies of quality assurance system (ISO or otherwise).
- Results from market research.

Table 2 HACCP Chart for pasteurized packaged milk.

Process Step	Potential Hazard	Preventive Measure	CCP No.	Critical Control Point	Critical Limits	Monitoring Procedure & Frequency	Responsibility	Corrective Action	Record
1	2	3	4	5	6	7	8	9	10
1. Raw milk pickup	a. Microbiological growth	Tanker cleaning according to conformed instructions at least once per 24 hr.	1.1	Temperature of milk	≤ 6 C	Check the temperature of each vat of milk before loading. Inspection of the records of tanker cleaning operation	Tanker pickup driver	Chilling Centre incharge to be informed of problem If milk >6°C and <8°C then milk to be cooled at factory and used within 12 hours If Milk> 8°C then milk to be rejected for market milk.	Milk docket
	b. Contamination with foreign substances, cleaning residues.	Automatic pump stop at loading above 6 C.	1.2	Organoleptic assessment of milk	Free from taints, odours and foreign matter/ colour	Check appearance and odour of each vat of milk before loading	Tanker pickup driver	Pick up driver to reject milk if suspected as containing foreign substances.	Milk docket
2. Raw Milk transport	a. Microbiological growth	Short transporation time, Insulated milk tanker	2	Cleaning and sanitation	Refer to cleaning and sanitation procedures	Ensure that the farm pickup tankers are cleaned and sanitized before use	Farm pickup driver	Recloan and sanitize as necessary	Cleaning and sanitation record
3. Raw milk receival	a. Contamination with inhibitory substances dust etc.	Hanging unloading hoses	3.1	Inhibitory substance test (eg. antibiotic)	ISB <0.003 micro g per ml	Check each load of milk for inhibitory substances	Milk receival operator	Manager to reject milk containing inhibitory substances	Milk receival record
	b. Contamination with water, dust and /or cleaning chemicals		3.2	Examination for acceptance; pH test	No deviation of flavour & test pH 6.5-6.7	Check each load of milk for freezing point and pH. Anlysis of examination results	Milk receival operator	If pH in correct range adjust freezing point by addition of milk solids, if necessary	Milk receival record

Process Step	Potential Hazard	Preventive Measure	CCP No.	Critical Control Point	Critical Limits	Monitoring Procedure & Frequency	Responsibility	Corrective Action	Record
1	2	3	4	5	6	7	8	9	10
	c. Microbiological growth	Control of the milk temperature assurance, sampling & examination	3.3	Milk storage temperature	≤5 C. Over 10°C refusal. Between 6 & 10° C warning to CC & T	Check temperature of each load of milk at receival	Milk receival operator	If temperature >9 C then milk to be recooled to <5° C or processed within 4 hours of receival. Otherwise, reject for use in pasteurized milk	Milk receival record
4. Standardization	a. Incorrect fat content	Operation of separator according to conformed procedures	4.1	Milk separation	Min. 4.5%	Test Fat content hourly during standardization and from standardized milk silo before packaging	Milk receival operator	Adjust separator as as required. Restandardize, if necessary	Milk receival record
	b. Microbiological contamination.	Cleaning and sanitation of separators and associated equipment according to conformed procedures	4.2	Cleaning and sanitation	Refer to cleaning and sanitation programme	Ensure separator and associated equipment are cleaned & sanitized before use	milk receival operator	Reclean & sanitize as necessary	Cleaning and sanitation record
5. Homogenization	a. Inefficient homogenization	Operation of homogenizer according to conformed procedures.	5.1	Preheat temperature	55-60°C	Monitor preheat temperature hourly	Pasteurizer operator	Adjust preheat temperature and rehomogenize milk as necessary to reject for use in pasteurized milk	Milk processing record.

Process Step	Potential Hazard	Preventive Measure	CCP No.	Critical Control Point	Critical Limits	Monitoring Procedure & Frequency	Responsibility	Corrective Action	Record
1	2	3	4	5	6	7	8	9	10
			5.2	Homogenzation pressure	200-250 Bar	Monitor homogenization pressure hourly	Pasteurizer operator	Adjust homogenization pressure and rehomogenize milk as necessary or reject for use in pasteurized milk.	Milk processing record
6. Pasteurization	a. Survival of pathogenic organisms	Operation according to conformed 'sterilizing', start, processing and stop procedure.	6.1	Pasteurization time and temperature	≥76°C for ≥ 15 secs	Check temperature setting and chart recorder at the start and end of each batch	Pasteurizer operator	Attend to pasteurizer and as required to fix any faults and reprocess milk as necessary. Manager to decide on further action as necessary.	Chart recorder
		Automatic safety system to prevent too low or too high temperature.	6.2	Diversion valve	Diversion at <76°C	Testing the diversion and stop system every two weeks. Check that diversion valve is working before start of batch.	Pasteurizer operator	Improve preventive maintenance .	Chart recorder
		Extra cleaning in case of more than 3 days between processing runs. Dismantling and inspection every 2 years. Flow control and assurance.	6.3	Temperature calibration	Temperature device to be within ±0.5°C	Calibrating the temp. & pressure instruments every 6 months	Maintenance operator	Thermometer to be repaired or replaced and recalibrated before use	Calibration record

Process Step	Potential Hazard	Preventive Measure	CCP No.	Critical Control Point	Critical Limits	Monitoring Procedure & Frequency	Responsibility	Corrective Action	Record
1	2	3	4	5	6	7	8	9	10
		Restricting running time to 6 h.							
	b. Microbiological contamination		6.4	Cleaning and sanitation	Refer to cleaning and sanitation procedures	Ensure that the pasteurizer and associated lines have been cleaned and sanitized before use. Testing for corrosion cracks by a lithium injection test twice a year. Testing & calibration of the pressure difference control.	Pasteurizer operator	Reclean and sanitize as necessary Analyse the origin of deviation & improve the preventive maintenance.	Cleaning and sanitation record. Deviation and corrective action record.
7. Cooling	a. Microbiological growth	A minimum pressure difference between pasteurized milk side and raw milk or coolant side of 0.5 bar controlled by an automatic system.	7.1	Cooling temperature	≤4°C. 5°C results in an alarm, at 6°C the process is stopped.	Check temperature setting and chart recorder at the start and end of each batch.	Pasteurizer operator	Adjust temperature as necessary and recool milk, if required.	Chart recorder.
	b. Coolant contamination	Sufficient coolant capacity to assure a correct temp. control	7.2	Temperature calibration	Temperature device to be within ±0.5°C	Check temp. and pressure instruments calibration every 6 months.	Maintenance operator.	Thermometer to be repaired or replaced and recalibrated before use	Calibration record

Process Step	Potential Hazard	Preventive Measure	CCP No.	Critical Control Point	Critical Limits	Monitoring Procedure & Frequency	Responsibility	Corrective Action	Record
1	2	3	4	5	6	7	8	9	10
		A well balanced and reliable temperature control system	7.3	Pressure difference control	A min. pressure difference of 0.5 bar, alarm at below this. Starting a stop procedure when the difference drops below 0.1 bar.	Periodical testing of temperature and pressure control system.	Maintenance operator.	Analyse the origin of deviation and improving the preventive maintenance.	Records of pressure and temperature, testing and calibration records.
8. Storage of pasteurized milk	a. Microbiological contamination b. Cleaning residues.	Cleaning and disinfection according to conformed procedures. Minimum storage time and temperature.	8	Cleaning and sanitation	Refer to cleaning and sanitation procedures	Ensure that the storage tank/silo has been cleaned and sanitized before use.	Pasteurizer operator	Reclean and sanitize as necessary.	Cleaning and sanitation record.
9. Packging materials	a. Deterioration of packaging material	Storage and handling of film according to conformed procedures.	9	Storage and handling	Area to be clean and tidy. Each batch inspected for damage etc. as they are used.	Ensure that materials are stored in a clean environment and that any dirty or damaged materials are rejected for use. Audit the quality assurance of the supplier.	Packaging operator	Reject suspected packaging as necessary	Packaging record

Process Step	Potential Hazard	Preventive Measure	CCP No.	Critical Control Point	Critical Limits	Monitoring Procedure & Frequency	Responsibility	Corrective Action	Record
1	2	3	4	5	6	7	8	9	10
10. Sachet filling	a. Microbiological contamination b. Pathogenic contamination c. B.cereus d. Cleaning residues e. Foreign matter	Cleaning and disinfection according to conformed procedures. Maximum Temperature 6°C Disinfection of specific machine parts by alcohol spraying. Instruction regarding start, stop & interruptions. Insturctions to keep hygienic conditions during filling. All U.V. tubes working. Removal of the first 20 packs. Machine cleaning & cleaning of the building. Correct 'use-by' date.	10.1	Cleaning and sanitation	Refer to cleaning and sanitation procedures.	Analysis of complaints. Analysis of the results of the recontamination tests. Analysis of plate count at 'use by' date results. Dismantling and visual inspection of the filling equipment.	Packaging operator	Reclean and sanitize as necessary	Cleaning and sanitation record
	f. Incorrect volume	Weight/volume check every half hour and at start	10.2	Weight/volume checks	Minimum volume as per net content.	Weight/volume to be checked at start, hourly and at end of each batch	Packaging operator	Adjust filling machine to correct weight/volume and reprocess underweight packs.	Packaging record.

Process Step	Potential Hazard	Preventive Measure	CCP No.	Critical Control Point	Critical Limits	Monitoring Procedure & Frequency	Responsibility	Corrective Action	Record
1	2	3	4	5	6	7	8	9	10
			10.3	Scale calibration	Scale to read within ± 1 g	Calibrate scale every 6 months	Maintenance operator	Scales to be repaired or replaced and recalibrated before use.	Calibration record.
11. Coding	a. Incorrect or illegible code	Ensure correct 'use by' date and legibility.	11	Code checks	correct use by date and clearly legible	Visual inspection at start, hourly and at end of each batch	Packaging operator	Codes to be adjusted and product to be recoded as necessary	Packaging record.
12. Storage in cold store	a. Microbiological growth	Control of the air temperature	12.1	Storage temperature	≤ 4°C	Check coolroom temperature at 12 positions. Measure temperature of product to be loaded. Periodical calibration of measuring instruments.	Coolroom operator	Adjust temperature as necessary and check milk temperature. Analyse origin of deviation & improve preventive maintainence	Coolroom temperature record Temperature Calibration record. Corrective action record.
13. Finished product distribution	a. Distribution of non-conforming product	Ensure finished product has been cleared	13.1	Product clearance programme	Refer to finished product specifications.	Ensure each batch of finished product has been cleared for distribution	Coolroom operator	Inform distributors to hold product. Retrive product as necessary. Manager to decide on further action as necessary.	Finished product clearance record
	b. Product deterioration	Control of cold store temperature	13.2	Storage and handling	No damage to pouches or leakers ≤ 4°C and deliver promptly	Check stock for damage during distribution. Temperature and time during transit	Coolroom operator	Remove any damaged stock for disposal Analyse the origin of deviation and improve preventive maintenance.	Damaged stock record Tansport log

Process Step	Potential Hazard	Preventive Measure	CCP No.	Critical Control Point	Critical Limits	Monitoring Procedure & Frequency	Responsibility	Corrective Action	Record
1	2	3	4	5	6	7	8	9	10
14. Clean- & dis-infection	a. Microbial contamination b. Bacterial growth c. Residues of cleaning chemicals/ disinfectants	Hygienic quality of the design optimized and programmed cleaning and disinfection programmes.	14. (2, 4.2, 6.2, 10.1)	Duration, temperature and concentration of the subsequent rinses	20 min. circulation of the cleaning solution at correct concentration at ≥85°C for the pasteurizer, 10 min. and >76°C for the other equipment. Disinfectant circulation at a correct concentration, if appropriate.	Deviation of temperature etc. are recorded. Daily determination of the concentration of the cleaning and disinfection solutions. Calibration of the measuring instruments every year.	Pasteurizer operator	Analyse the origin of deviations and improving the preventive measures.	Records of concentration and deviations. Records of corrective actions.