

Manufacturing of Processed Cheese

(OFO-code: 681301)

EXTERNAL SUMMATIVE ASSESSMENT: THEORY

Learner name & surname: _____

Assessor name & surname: _____

Date: _____

DECLARATION OF COMPETENCE	
To be completed by the External Assessor (tick the applicable block)	
Learner competent (C)	
Learner not yet competent (NYC)	

Instructions to the Learner:

1. Answer all of the following questions without referring to any notes.
2. No group work is allowed, i.e. complete the questionnaire on your own individual effort.
3. After completion, hand the questionnaire to the External Assessor for evaluation.
4. You need to obtain a minimum of 70% for this assessment in order to be found competent in the theory component.

1. Complete the following sentence: (2)

Too much _____ cheese will cause little flavour, whereas too much _____ cheese will cause an unstable emulsion, resulting in a crumbly, less elastic texture.

2. Name any advantage of manufacturing processed cheese. (1)

3. Use the table below to list 7 raw materials that are commonly used to manufacture processed cheese. Also name the function of each. (7)

Raw material	Function

4. Fill in the values in the empty spaces in the table on the following page and make use of the information to calculate the following: (10)

- (a) % Fat in dry matter (FDM) in the Cheddar cheese
- (b) % Fat depression
- (c) % Dry matter in the blend
- (d) Calculated yield
- (e) Amount of water to add

The final dry matter content of the processed cheese should be 45%.

	RAW MATERIAL (kg)	DRY MATTER (kg)	FAT (kg)
Cheddar cheese	165	104,5	52,8
Emulsifying salt (3,2%)			
TOTAL MASS			

Space for rough work:

Space for rough work:

7. (a) Name the type of emulsifying salts that are most commonly used for processed cheese manufacturing. (1)

- (b) Why? (1)

- (c) Name 2 factors that will influence emulsifying properties of cheese (other than emulsifying salts). (2)

8. Complete the following sentence: (2)

During emulsifying, the critical point is the point where there is just enough

_____ present to _____ the fat without any fat separation.

9. Complete the following sentences: (4)

During creaming the long _____ structure is broken up into a shorter structure. These shorter protein molecules have better _____ properties and _____ more easily to have an enlarged surface area and good _____ .

10. How is creaming achieved in processed cheese? Give 2 processes. (2)

11. What is the effect of over-emulsifying in processed cheese? Give a reason for your answer. (2)

12. Describe 3 ways in which processed cheese made in a batch cooker can be cooled.(3)

13. Name 2 ways in which the pressure can be lowered in a batch cooker after the cheese has been processed. (2)

14. Both the continuous cooker and the batch cooker have advantages for manufacturing of processed cheese. Use the table below to list 2 advantages for each (4)

Continuous cooker	Batch cooker
1.	1.
2.	2.

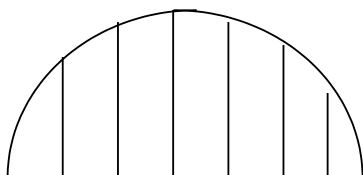
15. Why must the cheese intended for processed cheese manufacturing be cleaned prior to processing? (1)

16. Why is cheese cut into smaller portions prior to processed cheese manufacturing? (1)

17. The following sketches illustrates how round cheese can be cut into smaller pieces for processed cheese manufacturing. Draw another sketch to show an alternative method of cutting cheese into smaller pieces. (1)

A

B



18. Which of the above 2 sketches will provide pieces of the same general consistency?(1)

19. Cheese portions are minced or grinded prior to processing. Name 2 pieces of equipment that can be used to mince or grind cheese portions. (2)

20. Why are raw materials mixed prior to processing? (2)

21. (a) Name 2 ways in which pre-mixing of raw materials can be done. (2)

(b) For which cheeses are each of the methods that you have mentioned in question 21 (a) suitable? (2)

22. What is done to prevent burning on of the cheese in the batch cooker? (2)

23. Why is it advised to add all raw materials prior to heat treatment? (3)

24. What is the function of the heat during processing? (3)

25. What is the function of stirring during processing? (2)

26. What is the function of homogenisation of processed cheese or processed cheese mixture? (4)

TOTAL: (83)

Occupational Certificate: Processed Cheese Maker

EXTERNAL SUMMATIVE ASSESSMENT

LEARNER NAME & SURNAME _____

ASSESSOR NAME & SURNAME: _____

LEARNER ID NUMBER: _____

DATE: _____

DECLARATION OF COMPETENCE	
To be completed by external assessor (Tick applicable box)	
Learner Competent (C)	
Learner not yet Competent (NYC)	

Instructions to the Learner:

1. Answer all of the following questions without referring to any notes.
2. No group work is allowed, i.e. complete the questionnaire on your own individual effort.
3. After completion, hand the script to the invigilator
4. You need to obtain a minimum of 50% in both theory and application sections for this assessment in order to be found competent.

TOTAL MARKS	137
LEARNER MARK	

Duration: 4 ½ Hours

SECTION A (THEORY)

1. QUESTION 1:

1.1. Interpreting production instructions, obtaining cheese milk

1.1.1. Multiple Choice Questions (5)

- Which of the following is the MOST critical factor to monitor when receiving raw cheese for processed cheese production?
 - a) Packaging color.
 - b) Delivery truck temperature.
 - c) Temperature and microbial load.
 - d) Best-before date.

- According to standard workplace instructions, how should aged cheese blocks be prepared before grinding for processed cheese?
 - a) Washed with warm water.
 - b) Left at room temperature for several hours.
 - c) Inspected for mold, foreign objects, and trimmed if required.
 - d) Sprayed with a sanitizing solution only.

- What is the PRIMARY purpose of controlling the moisture content of raw cheese used in processed cheese?
 - a) To improve the cheese's color.
 - b) To ensure consistent texture and meltability in the final product.
 - c) To reduce the cost of production.
 - d) To extend the shelf life of the raw cheese.

- Which ingredient requires the MOST stringent temperature control during storage to prevent quality degradation before it is used in processed cheese?
 - a) Emulsifying salts.
 - b) Spices.
 - c) Natural cheese.
 - d) Colouring agents.

- Standard workplace instructions typically dictate that raw cheese should be stored:
 - a) In a warm, humid environment.
 - b) At varying temperatures to enhance flavor.
 - c) In a cool, dry environment with controlled temperature and humidity.
 - d) Exposed to direct sunlight for natural preservation.

1.1.2.

- A. List the step-by-step procedure for preparing a batch of raw cheese for processing, including the critical checks and adjustments you would make to ensure the raw material meets the required specifications. (5)

- B. A batch of raw cheese has been delivered with a slightly higher moisture content than specified in the production instructions. List a minimum of 3 adjustments that can be made to the manufacturing process to compensate for this deviation, ensuring the final processed cheese product meets the desired quality standards. (6)

2. QUESTION 2:

2.1. Production

2.1.1. processing of a formulated cheese mixture into the final products.

A. List the key steps involved in transforming a formulated processed cheese mixture into the final packaged product. (5)

B. During a production run, you notice that the processed cheese is not achieving the desired meltability and texture. List the possible causes of this issue and describe the specific adjustments you would make to the processing parameters to rectify the problem. (5)

2.1.2. "A processed cheese manufacturing facility is experiencing inconsistent product quality, specifically variations in texture and meltability, despite following the established formulation. Upon investigation, it is suspected that the issue may stem from improper operation of the cooker-blender. List the key operational checks and adjustments you would perform on the cooker-blender to diagnose and rectify the potential issues. (7)

2.1.5. What is the effect of insufficient emulsifying in processed cheese? (2)

2.1.6. Why is it necessary to standardize the fat and dry matter content of processed cheese mixture? (3)

2.2. Operating applicable equipment

2.2.1. Describe 3 ways in which processed cheese made in a batch cooker can be cooled. (3)

2.2.2. Name 2 ways in which the pressure can be lowered in a batch cooker after the cheese has been processed. (2)

2.2.3. Both the continuous cooker and the batch cooker have advantages for manufacturing processed cheese. Use the table below to list 2 advantages for each (4)

2.3.

2.3.1. Why must the cheese intended for processed cheese manufacturing be cleaned prior to processing? (1)

2.3.2. Why is cheese cut into smaller portions prior to processed cheese manufacturing? (1)

2.3.3. What is done to prevent burning on of the cheese in the batch cooker? (2)

2.3.4. Why is it advised to add all raw materials prior to heat treatment? (3)

2.3.5. What is the function of the heat during processing? (3)

Fill in the missing words

2.3.6. During creaming the long _____ structure is broken up into a shorter structure. These shorter protein molecules have better _____ properties and _____ more easily to have an enlarged surface area and good _____ (4)

2.3.7. Too much _____ cheese will cause little flavour, whereas too much _____ cheese will cause an unstable emulsion, resulting in a crumbly, less elastic texture. (2)

2.4.

2.4.1. What is the function of stirring during processing? (2)

2.4.2 Why is the processed cheese or
cheese mixture homogenized? (4)

processed

- C. "The factory manager proposes introducing a new, high-shear mixer to expedite the blending of cheese curds during the cooking stage, aiming to improve throughput. However, you are concerned about potential impacts on product texture, emulsification, and compliance with the National Regulator for Compulsory Specifications (NRCS) standards. List 3 risk assessment measures, outlining the key decision-making factors you would consider before implementing this change." (6)

3.1.3:

A. "The Standard Operating Procedure (SOP) specifies a pasteurization time of 8 minutes for each cheese batch. Today, a batch was processed for 7 minutes and 30 seconds.(6)

- Mention two data points that must be recorded in the batch processing log.

- Explain the significance of accurately documenting the pasteurization time."

B. "The production recipe requires cheddar cheese curds, diced into 2cm cubes, to be cooked at 78°C for 9 minutes with the cooker-blender set to 55 RPM. A recent batch was processed at 80°C for 8 minutes at 60 RPM.(8)

- Identify three critical parameters that must be recorded for this batch.

- Mention how these deviations from the process parameters should be documented in the production report, including the method for calculating the variance in cooking time."

C. "The Quality Assurance Manager requests a concise summary report detailing process consistency for the day's production, focusing on cheese cube dimensions, cooking temperature, and mixing speed. Data from 10 batches is available.(6)

- Mention three statistical calculations that would provide relevant insights for the report.

Manufacturing of Processed Cheese

(OFO-code: 681301)

MODEL ANSWERS FOR EXTERNAL SUMMATIVE THEORY ASSESSMENT

Instructions to the External Assessor:

1. Evaluate each learner's answers at the hand of the model answers provided below.
2. Learners must answer all questions, without referring to any notes. No group work is allowed, i.e. each learner's questionnaire must be completed on own individual effort.
3. The learner must achieve a minimum of 70% for this assessment in order to be found competent in the theory component.
4. After evaluation, complete the Declaration of Competence on the first page of the learner's knowledge questionnaire, as well as the Summative Declaration in **Section 8** of the Assessment Guide.

1. Too much young cheese will cause little flavour, whereas too much mature cheese will cause an unstable emulsion, resulting in a crumbly, less elastic texture. (2)
2. Any 1 of the following: (1)
 - It encourages cheese production since cheese is used as raw material.
 - Cheese having mechanical defects can be used for making processed cheese.
 - Ripening and storage costs can be saved because young cheese can be pre-cooked and stored for later use in processed cheese making.
 - It can be stored without refrigeration and without damaging its shelf life.
 - Processed cheese is available in various forms and flavours, as well as different physical properties such as soft, firm or spreadable.

3. Any 7 of the following: (7)

Raw material	Function
Cheese	This is the main constituent of processed cheese and provides flavour and body (structure) to the final product.
Emulsifiers	Bind calcium and thus remove it from the milk proteins.
Water	Emulsifying salts need water to dissolve and react with the casein. Water is also added to the mixture to produce the desired moisture content in the final product.
Skim milk powder or whey powder	It provides a cheap method for substituting a part of the cheese solids in processed cheese or cheese spreads.
Fat	To increase the fat content of the mixture
Pre-cooked cheese	To increase the stability of the processed cheese.
Flavouring and seasoning	Provides flavour or improves the flavour of cheese.
Binding agents or stabilisers	Absorption of water and stabilisation of cheese.
Preservatives	To prevent growth of anaerobic spore formers (<i>Clostridia</i>) that cause blowing of processed cheese.

- 4.

	RAW MATERIAL (kg)	DRY MATTER (kg)	FAT (kg)
Cheddar cheese	165	104,5	52,8
Emulsifying salt (3,2%)	5,28	5,28	-
TOTAL MASS	170,28	109,78	52,8

(3)

$$\begin{aligned}
 \text{(a) \% FDM (Cheddar cheese)} &= \frac{52,8}{104,5} \times 100 \\
 &= 50,5\% \quad (1)
 \end{aligned}$$

$$\begin{aligned}
 \text{(b) \% FDM with added emulsifying salt} &= \frac{52,8}{109,78} \times 100 \\
 &= 48,1\% \quad (1)
 \end{aligned}$$

The fat depression therefore amounts to: 50,5 – 48,1%

$$= 2,4\% \quad (1)$$

$$\begin{aligned}
 \text{(c) \% Dry matter in the blend} &= \frac{109,78}{170,28} \times 100 \\
 &= 64,5\% \qquad (1)
 \end{aligned}$$

(d) The raw blend weighing 170,28 kg contains 109,78 kg dry matter. The expected yield of processed cheese with 45% final dry matter can therefore be calculated as follows:

Yield = X

109,78 kg represents 45% and
X kg represents 100% (1)

Therefore

$$\begin{aligned}
 X &= \frac{100 \times 109,78}{45} \\
 &= 243,96 \text{ kg}
 \end{aligned}$$

The calculated yield of processed cheese is therefore 243,96 kg. (1)

(e) The yield of processed cheese = 243,96 kg
Raw material used = 170,28 kg

Amount of water to add = 243,96 – 170,28
= 73,7 kg (1)

5. All of the following:

- To continuously manufacture a product with a consistent composition.
- To manufacture a product that conforms to legal requirements.
- To ensure profitability of production.

(3)

6. (a) The main function of emulsifying salts is to **bind calcium and thus remove it from the milk proteins.** (1)

(b) Cheese consists of two phases namely:

- (i) An oil phase consisting of fats and oil-soluble components.
- (ii) A water phase consisting of a solution of proteins and minerals.

Due to the difference in nature of these two phases in cheese, surface tension exists between the phases. This problem can be overcome by adding a surface active agent (emulsifier) to the mixture. The emulsifier binds the two insoluble phases by making the difference in surface tension between them as small as possible. Emulsifying salts have the ability to bind calcium. The calcium that is bound to the casein protein fragments weakens the ability of the proteins to dissolve in water, therefore they cannot properly bind the fat and water phases. The emulsifying salt removes the calcium and substitutes sodium in its place or otherwise binds with the calcium that is still bound to the protein and thereby weakens its action. (4)

If the emulsifying is only sufficient to prevent separation of the two phases the one substance will be distributed as big drops in the other one. As emulsifying improves, these drops will become smaller and eventually they will be distributed completely homogeneously. (2)

In cheese emulsifying this has big textural implications:

Cheese that has been emulsified insufficiently will contain big fat droplets that are suspended in the water phase containing the proteins. These proteins are supported by the fat globules. If pressure is applied to such cheese, the fat is deformed, the proteins do likewise and the cheese is soft. (2)

In the case of a nearly perfect emulsion the fat globules are very small and almost disappear in the protein network. When pressure is exerted on the cheese the fat cannot deform to any extent because of the size of the globules. The texture of the cheese is determined by the firm protein network. (2)

7. (a) Those that bind weakly with calcium. (1)

(b) They form a weak emulsion that is required for soft cheese and cheese sauces. (1)

(c) Any 2 of the following: (2)

- Presence of emulsifying salts
- pH of the cheese
- Age of the cheese
- Temperature to which the cheese is subjected during processing

8. During emulsifying, the critical point is the point where there is just enough protein present to emulsify the fat without any fat separation. (2)

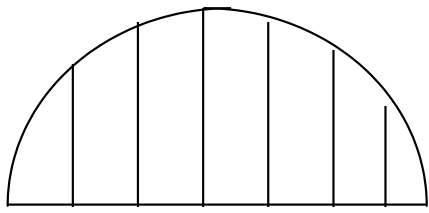
9. During creaming the long casein structure is broken up into a shorter structure. These shorter protein molecules have better hydration properties and swell up more easily to have an enlarged surface area and good malleability. (4)

10. **Addition of emulsifying salts (1) and heat processing in the cooker (1).** (2)
11. The **cheese will be hard** because **fat will separate** from the cheese. (2)
12. All of the following:
 • By filling the double jacket of the pan with cold water.
 • By introducing part of the cold water to be added to the mix.
 • By reducing the steam pressure inside the cooker. (3)
13. Both of the following:
 • By either opening the air vents while the mixture is being stirred slowly.
 • By draining the hot processed cheese from the pan through an outlet into a special container fitted with a stirrer. (2)
14. (4)

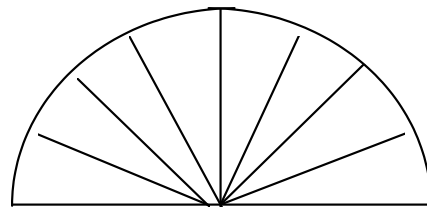
Continuous cooker	Batch cooker
1. The amount of labour required is considerably reduced.	1. Better control of the process can be exercised.
2. It is possible to sterilise the cheese while at the same time protecting the structure of the casein.	2. Changes can be effected during processing (a change in the formulation can even be introduced without the equipment having to be cleaned during the changeover).
3. The end product is uniform in quality.	
4. Processing and sterilisation is conducted in an enclosed system after which the product is delivered to the packaging machines. The chances of contamination are thus considerably reduced.	

15. To remove hard and contaminated parts. (1)
16. To make the fine mincing, that takes place at a following stage, more manageable. (1)

17. Another method for cutting is shown in B: (1)



A



B

18. Method B. (1)

19. A **meat grinder or a shredder** (1) after which it is further ground between a **set of refining rollers** (1). (2)

20. Both of the following:

- To obtain uniformity in a large amount of raw material.
- To promote degradation of the casein. The emulsifying salt that is added and mixed in with the cheese aids in this process.

(2)

21. (a) Both of the following:

- The minced lots of cheese can be mixed either alone or with milk products, e.g. butter or whey powder. All the components will at this stage still be in the dry state.
- The cheese is mixed with water and the emulsifying salt.

(2)

- (b) Suitable for the following cheeses:

- In the case of cheese that shows a strong tendency to swell up when absorbing water, e.g. Emmentaler, or when good manufacturing practice is based on obtaining a uniform mix, it is advisable to use the first method in question 25 (a).
- In the case of normal mixes, especially those in which the majority of the cheese is young, the second method in question 25 (a) is recommended.

(2)

22. The upper parts of the steam inlet nozzles, through which steam is introduced, are cooled (1). The jacket of the rotating driving shaft of the stirrer unit is also cooled (1). (2)

23. To reduce the risk of contamination that will increase the risk to the health of the consumer (1) and that will lower the shelf life of the final product (1). Also to enhance the sensory quality of the final product (heat treatment facilitates in creaming and emulsifying actions) (1). (3)
24. All of the following:
- A homogeneous mixture of the different raw materials is obtained during heating.
 - Heat processing facilitates in creaming and emulsifying actions.
 - Heat applied as pasteurisation or sterilisation during processed cheese manufacturing (85 - 145°C) improves the keeping quality of the product. (3)
25. Both of the following:
- Formation of a homogeneous mixture.
 - Creaming of the casein. (2)
26. All of the following:
- The cheese mass takes on a lighter colour, as well as a smooth, shiny appearance.
 - The cheese texture is more elastic.
 - No fat separation takes place.
 - The flavour intensity of the cheese is diminished. This is an advantage when the natural cheese has an undesirable flavour but is a disadvantage in cheese having a good, aromatic flavour. (4)

TOTAL: (83)

Occupational Certificate: Processed Cheese Maker

MODEL ANSWERS

FOR EXTERNAL SUMMATIVE THEORY ASSESSMENT

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- 3. The learner must achieve a minimum of 50% in both sections for this assessment in order to be found competent in the theory component.**
- 4. After evaluation, complete the Declaration of Competence on the first page of the learner's knowledge questionnaire.**

SECTION A (THEORY)

1. QUESTION 1:

1.1. Interpreting production instructions, obtain cheese milk

1.1.1. multiple-choice questions

Which of the following is the MOST critical factor to monitor when receiving raw cheese for processed cheese production?

c) Temperature and microbial load.

According to standard workplace instructions, how should aged cheese blocks be prepared before grinding for processed cheese?

c) Inspected for mold, foreign objects, and trimmed if required.

What is the PRIMARY purpose of controlling the moisture content of raw cheese used in processed cheese?

b) To ensure consistent texture and meltability in the final product.

Which ingredient requires the MOST stringent temperature control during storage to prevent quality degradation before it is used in processed cheese?

c) Natural cheese.

Standard workplace instructions typically dictate that raw cheese should be stored:

c) In a cool, dry environment with controlled temperature and humidity.

1.1.2.

- A. Describe the step-by-step procedure for preparing a batch of raw cheese for processing, including the critical checks and adjustments you would make to ensure the raw material meets the required specifications. (5 marks)

Upon receiving the raw cheese, first verify the delivery temperature and compare it to the specified range in the production instructions.

Next, visually inspect each block of cheese for any signs of mold, foreign materials, or damage. Any affected portions would be trimmed away.

Conduct a moisture content test using a calibrated moisture analyzer. If the moisture content is within the specified range, proceed. If it's outside the range, document the deviation and notify the supervisor.

If the cheese is aged, ensure it is at the correct temperature for grinding, as specified in the production documentation.

The cheese is then ground to the specified particle size using a sanitized grinder.

Before the ground cheese is added to the blending vat, re-check the temperature and moisture levels.

All checks and actions would be recorded in the batch record.

- B. A batch of raw cheese has been delivered with a slightly higher moisture content than specified in the production instructions. Explain in detail how you would adjust the manufacturing process to compensate for this deviation, ensuring the final processed cheese product meets the desired quality standards. Include specific examples of adjustments to processing parameters and explain the rationale behind each adjustment. (5 marks)

First, document the deviation in moisture content and inform the supervisor.

To compensate for the higher moisture, adjust the blending time and temperature during the cooking phase. Increasing the cooking time slightly will allow more moisture to evaporate.

Increase the cooking temperature by a small margin, within the safe parameters, to accelerate moisture removal. This must be closely monitored to prevent burning.

Closely monitor the viscosity of the cheese blend. If it is too low due to excess moisture, consider adding a small amount of dry ingredients, such as milk powder, to absorb the extra moisture. This must be done carefully to avoid altering the final product flavor.

Ensure that the emulsifying salts are added at the correct point in the process to ensure proper binding of the moisture.

After cooking, check the final moisture content of the processed cheese using the moisture analyzer.

If the moisture is still too high, extend the cooling time to allow further moisture loss.

Throughout the process, maintain detailed records of all adjustments made and the corresponding results, ensuring traceability and quality control.

Finally, conduct a sensory evaluation of the final product to ensure that the texture, flavor, and meltability meet the desired standards.

2. QUESTION 2:

2.1. Production

2.1.1

- A. Describe the key steps involved in transforming a formulated processed cheese mixture into the final packaged product. Include details on the cooking, emulsification, shaping, and cooling processes, and explain the importance of each step in achieving the desired product characteristics. (5)

Cooking: The formulated cheese mixture, including raw cheese, emulsifying salts, and other ingredients, is heated in a cooker. This step is crucial for melting the cheese, activating the emulsifying salts, and ensuring a homogenous blend. The temperature and cooking time must be precisely controlled to achieve the desired texture and prevent burning.

Emulsification: During cooking, the emulsifying salts work to bind the fat and moisture, creating a stable emulsion. This step is essential for preventing fat separation and achieving a smooth, consistent texture. Proper agitation and mixing are vital for effective emulsification.

Shaping: Once the cheese mixture has reached the desired consistency, it is formed into the desired shape. This can involve

molding, extruding, or slicing, depending on the product type. Accurate shaping ensures consistent portion sizes and product appearance.

Cooling: After shaping, the cheese is rapidly cooled to solidify the product and prevent bacterial growth. Rapid cooling is essential for maintaining product quality and extending shelf life.

Packaging: Once sufficiently cooled, the product is packaged using appropriate materials and machinery. This stage protects the product from contamination and preserves its quality during storage and distribution.

- B. During a production run, you notice that the processed cheese is not achieving the desired meltability and texture. Explain the possible causes of this issue and describe the specific adjustments you would make to the processing parameters to rectify the problem, ensuring the final product meets the required specifications. Provide a detailed explanation of the rationale behind each adjustment. (5)

*** Possible Causes:**

Inadequate emulsification due to insufficient emulsifying salts or improper mixing.

Incorrect cooking temperature or time, leading to incomplete melting or overcooking.

Variations in the moisture content or composition of the raw materials.

incorrect ph.

Incorrect cooling.

*** Adjustments:**

Emulsification: If emulsification is suspected, I would check the quantity and quality of the emulsifying salts and ensure that the mixing equipment is functioning correctly. I would increase the mixing time or speed to enhance emulsification.

Cooking: If the cooking temperature or time is incorrect, I would adjust the parameters according to the product specifications. I would carefully monitor the temperature and viscosity of the cheese mixture during cooking.

Raw Materials: If variations in raw materials are suspected, I would conduct additional quality control checks on the raw cheese

and other ingredients. I would adjust the formulation as needed to compensate for any deviations.

pH: The pH of the mixture can greatly effect the final product. I would check the ph and adjust with food safe acids or bases as needed.

Cooling: I would ensure the cooling process is being done quickly enough. I would check the cooling equipment is working correctly.

2.1.2.

To diagnose and rectify potential issues stemming from the cooker-blender, perform the following operational checks and adjustments, guided by standard operating procedures:

A. Temperature Calibration:

Verify the accuracy of the cooker-blender's temperature sensors using a calibrated external thermometer. Inaccurate temperature readings can lead to under- or over-cooking, impacting texture and meltability.

If calibration is required, follow the manufacturer's instructions to adjust the temperature settings, ensuring the cooker-blender maintains the specified cooking temperatures.

This is important because the cooking temperature directly effects the activation of the emulsifying salts, and the melting of the cheese.

B. Agitation/Mixing Mechanism:

Inspection of the the agitator blades or paddles for damage, wear, or misalignment. Improper agitation can result in uneven heating and incomplete emulsification, leading to variations in texture and meltability. Verify the agitator's speed and direction, comparing them to the settings specified in the standard operating procedures. Adjustments would be made as needed to ensure consistent mixing.

Proper agitation is vital to the even distribution of heat, and the even distribution of the emulsifying salts.

C. Heating Element Functionality:

Check the heating elements for proper functionality, ensuring they are heating evenly and consistently. Uneven heating can lead to localized overcooking or undercooking, affecting product quality.

Inspect the heating element for any signs of damage or corrosion. Consistent heating is required to ensure consistent melting, and emulsification.

D. Valve Operation and Seal Integrity:

Inspect the valves for proper opening and closing, ensuring accurate control of ingredient flow and preventing leaks. Leaks can lead to variations in product composition and moisture content.

Check the seals for wear and tear, replacing them as needed to prevent leaks.

E. Control Panel and Automation:

Verify the control panel settings, ensuring they align with the product specifications. Automated control systems should be checked for proper functioning and calibration.

Review the programmed cooking times, and mixing speeds.

2.1.3.

- A. Describe the key food safety practices that must be implemented in a processed cheese manufacturing environment, specifically referencing relevant South African legislation (e.g., R.638, Foodstuffs, Cosmetics and Disinfectants Act). Explain how these practices contribute to preventing foodborne illnesses and ensuring product safety. (7)

Clean Hands: Wash hands often with soap and water to stop germs from getting into the cheese.

Clean Equipment: Clean all machines and surfaces with sanitizer to kill bacteria.

Correct Temperatures: Keep cheese and ingredients cold or hot enough to stop bacteria from growing.

No Cross-Contamination: Keep raw and cooked cheese separate to stop germs spreading.

Check Dates: Use cheese and ingredients before their "use by" date.

Keep Records: Write down temperatures and cleaning times to show we are doing it right.

R.638: This law tells us to keep food safe and clean.

- B. The audit also highlighted concerns regarding the handling of cleaning chemicals and the use of personal protective equipment (PPE) in the facility. Discuss the specific occupational health and safety measures that should be in place to address these concerns, referencing relevant South African legislation (e.g., Occupational Health and Safety Act, Act 85 of 1993). Explain how these measures contribute to creating a safe working environment and preventing workplace injuries. (7)

Use Gloves and Goggles: Wear gloves and goggles when using cleaning chemicals to protect skin and eyes.

Read Labels: Read the chemical labels to know how to use them safely.

Store Chemicals Safely: Keep chemicals in labeled containers away from food.

Wear Safety Shoes: Wear safety shoes to protect feet from spills and falling objects.

Use Ear Plugs: Wear ear plugs if the machines

are loud.

Training: Get training on how to use chemicals and safety equipment.

Act 85: This law says we must have a safe workplace.

2.1.4. What is the effect of insufficient emulsifying in processed cheese?
(2)

Fat will separate from the cheese and the cheese will be soft

2.1.1. Why is it necessary to standardize the fat and dry matter content of processed cheese mixtures? (3)

All of the following:

To continuously manufacture a product with a consistent composition.

To manufacture a product that conforms to legal requirements.

To ensure profitability of production. (3)

2.2. Operating applicable equipment

2.2.1. Describe 3 ways in which processed cheese made in a batch cooker can be cooled. (3)

All of the following:

By filling the double jacket of the pan with cold water.

By introducing part of the cold water to be added to the mix.

By reducing the steam pressure inside the cooker. (3)

2.2.2. Name 2 ways in which the pressure can be lowered in a batch cooker after the cheese has been processed. (2)

Both of the following:

By either opening the air vents while the mixture is being stirred slowly.

By draining the hot processed cheese from the pan through an outlet into a special container fitted with a stirrer.

- 2.2.3. Both the continuous cooker and the batch cooker have advantages for manufacturing processed cheese. Use the table below to list 2 advantages for each (4)

Continuous cooker

1. The amount of labour required is considerably _____ reduced.

2. It is possible to sterilise the cheese while at the same time protecting the structure of the casein.

3. The end product is uniform in quality.

4. Processing and sterilisation is conducted in an enclosed system after which the product is delivered to the packaging machines. The chances of contamination are thus considerably reduced.

Batch cooker

1. Better control of the process can be exercised.

2. Changes can be effected during processing (a change in the formulation can even be introduced without the equipment having to be cleaned during the changeover).

2.3.

- 2.3.1. Why must the cheese intended for processed cheese manufacturing be cleaned prior to processing? (1)

To remove hard and contaminated parts

- 2.3.2. Why is cheese cut into smaller portions prior to processed cheese manufacturing? (1)

To make the fine mincing, that takes place at a following stage, more manageable

2.3.3. What is done to prevent burning on of the cheese in the batch cooker? (2)

To reduce the risk of contamination that will increase the risk to the health of the consumer and that will lower the shelf life of the final product (1).

Also to enhance the sensory quality of the final product (heat treatment facilitates in creaming and emulsifying actions)

2.3.4. Why is it advised to add all raw materials prior to heat treatment? (3)

All of the following:

A homogeneous mixture of the different raw materials is obtained during heating.

Heat processing facilitates in creaming and emulsifying actions.

Heat applied as pasteurisation or sterilisation during processed cheese manufacturing (85 - 145C) improves the keeping quality of the product

2.3.5. What is the function of the heat during processing? (3)

The upper parts of the steam inlet nozzles, through which steam is introduced, are cooled (1).

The jacket of the rotating driving shaft of the stirrer unit is also cooled

Fill in the missing words

2.3.6. During creaming the long **casein structure** is broken up into a shorter structure. These shorter protein molecules have better **hydration** properties and **swell up** more easily to have an enlarged surface area and good **malleability** (4)

2.4.

2.4.1. What is the function of stirring during processing? (2)

Formation of a homogeneous mixture.

Creaming of the casein.

2.4.2 Why is the processed cheese or processed cheese mixture homogenized? (4)

All of the following:

The cheese mass takes on a lighter colour, as well as a smooth, shiny appearance.

The cheese texture is more elastic.

No fat separation takes place.

The flavour intensity of the cheese is diminished. This is an advantage when the natural cheese has an undesirable flavour but is a disadvantage in cheese having a good, aromatic flavour.

3. QUESTION 3:

3.1.1.

Your processed cheese production line is tasked with creating a new specialty cheese product with a specific, complex texture: a smooth, spreadable base with distinct, evenly distributed pockets of a firmer, meltable cheese component.

- Mention the specific adjustments and control measures you would implement at each stage of the processed cheese manufacturing process (from raw material preparation to final packaging) to achieve this unique texture, and explain how these parameters influence the final product characteristics.(8)

Adjustments and Control Measures (8 Marks)

- Raw Material Preparation: Select raw cheese with varying melting points: a softer, high-moisture cheese for the spreadable base and a firmer, lower-moisture cheese for the pockets.
- Control moisture content: Conduct precise moisture analysis of both cheese types. Adjust moisture levels if needed, possibly through drying or adding moisture-binding ingredients.
- Control Particle Size: Grind the firmer cheese into consistent, larger particles to ensure distinct pockets. The softer cheese should be finely ground for a smooth base.
- Temperature Control: Maintain separate, precise temperature control for each cheese type during storage and preparation to prevent premature melting or hardening.
- Cooking and Emulsification: Two-Stage Cooking: Cook the softer cheese base first, achieving a smooth, homogenous blend with emulsifying salts.
- Controlled Addition: Add the firmer cheese particles at a specific, later stage of cooking, with minimal agitation to preserve their shape and distribution.
- Temperature Gradient: Maintain a lower cooking temperature during the addition of the firmer cheese to minimize melting.
- Emulsification Control: Carefully control the emulsifying salt concentration and mixing time to ensure the base is stable, without overly affecting the firmer cheese pockets.
- Viscosity Control: Monitor and control viscosity of the base mixture. Too thin and the firm particles will sink, too thick and even distribution will be difficult.
- Shaping and Cooling:
- Gentle Shaping: Use a gentle molding or extruding process to avoid crushing or distorting the firmer cheese pockets.
- Rapid Cooling: Implement rapid cooling to solidify the product quickly, setting the texture and preventing further melting or diffusion of the firmer cheese.
- Even Cooling: Ensure even cooling throughout the product to prevent uneven texture formation.
- Portion Control: Ensure accurate portioning to maintain consistency in the distribution of the firmer cheese.

Packaging:

- Protective Packaging: Use packaging that prevents physical damage to the product, maintaining the integrity of the cheese pockets.
 - Temperature Controlled Storage: Store the final product at a consistent, refrigerated temperature to preserve the texture and prevent changes during shelf life.
-
- During the initial production runs of this new specialty cheese, you observe that the firmer cheese pockets are either unevenly distributed or dissolving into the spreadable base. List 3 possible causes of these issues and describe the specific corrective actions you would take to address them(7)

Answer:

Addressing Issues and Corrective Actions

Uneven Distribution of Firmer Cheese Pockets:

- Possible Cause: Inconsistent particle size of the firmer cheese, or improper mixing during the addition stage.
- Corrective Action: Re-evaluate the grinding process, ensuring consistent particle size. Adjust the mixing time and speed during the addition stage to achieve even distribution.

Dissolving Firmer Cheese Pockets:

- Possible Cause: Excessive cooking temperature or time after adding the firmer cheese, or insufficient moisture difference between the two cheese types.
- Corrective Action: Reduce the cooking temperature and time after adding the firmer cheese. Increase the moisture difference between the cheese types, possibly by selecting or processing cheeses with more distinct moisture levels.

Ensuring Consistency:

- Regular Sensory Evaluation: Conduct regular sensory evaluations of the intermediate and final products to assess texture, meltability, and distribution of the firmer cheese.

Statistical Process Control (SPC):

- Implement SPC to monitor critical parameters (temperature, moisture, viscosity) and identify deviations from target values.
- Batch Records: Maintain detailed batch records, documenting all processing parameters and corrective actions, to ensure traceability and facilitate continuous improvement.
- Calibrated equipment. Ensure all equipment is calibrated regularly.

3.1.2.

- During the cooking phase, you notice the digital temperature readout on the cooker-blender suddenly drops below the setpoint for pasteurisation. What is the immediate action you must take, and why is this critical in a food processing context?"(5)

Answers

Immediate Action: Halt the cooking process and inform the production supervisor or quality control personnel.

Why is it Critical: Under-pasteurised cheese poses a significant risk of foodborne illness, violating R638 regulations, and could lead to product recalls and legal consequences.

B. "Post-production testing of a batch of flavoured processed cheese slices reveals an elevated Total Viable Count (TVC) exceeding the regulatory limits set by the Department of

Health. Identify two potential Critical Control Points (CCPs) within the production process where this microbial contamination could have occurred. For each CCP, outline a specific corrective action that aligns with HACCP principles and South African food safety regulations to prevent recurrence."(8)

Answer:

- CCP: Cheese Curd Cutting and Handling:

Corrective Action: Implement a standardized procedure for cutting cheese curds into consistent sizes, ensuring proper hygiene during handling. This includes regular sanitization of cutting equipment and adherence to strict personal hygiene practices by staff, as per GMP guidelines.

- CCP: Cooking and Emulsification:

Corrective Action: Verify the calibration of the cooker-blender's temperature sensors and ensure accurate control of cooking time and mixing parameters. Implement a robust monitoring system for these CCPs, logging data every 15 minutes, to confirm pasteurisation parameters are consistently met. Verify mixing blade integrity, and mixing speed. Ensure the emulsifying salts are stored correctly, and accurately measured.

"The factory manager proposes introducing a new, high-shear mixer to expedite the blending of cheese curds during the cooking stage, aiming to improve throughput. However, you are concerned about potential impacts on product texture, emulsification, and compliance with the National Regulator for Compulsory Specifications (NRCS) standards. List 3 risk assessment measures, outlining the key decision-making factors you would consider before implementing this change." (6)

* Risk Assessment measures:

NRCS Compliance:

- Does the new mixer meet the required safety and performance standards set by the NRCS?
- Will it affect the product's compliance with compositional standards and labelling requirements?

Food Safety:

- Will the increased shear affect the temperature uniformity during cooking, potentially compromising pasteurisation?
- Can the mixer be effectively cleaned and sanitised to prevent microbial contamination?

Product Quality:

- Will the high-shear mixing impact the texture, meltability, or emulsification of the cheese?
- Will it lead to excessive air incorporation, affecting product appearance and shelf life?

Operational Feasibility:

- What are the capital and operational costs associated with the new mixer?
- Will it require significant changes to existing production processes or staff training?
- Will the mixer require increased maintenance, or increase energy consumption?

Key Decision-Making Factors:

- laboratory testing to assess the impact of the new mixer on product safety and quality.
- A pilot-scale trial to evaluate the mixer's performance under realistic production conditions.

3.1.3:

"The Standard Operating Procedure (SOP) specifies a pasteurization time of 8 minutes for each cheese batch. Today, a batch was processed for 7 minutes and 30 seconds.(6)

Explain the significance of accurately documenting the pasteurization time."

"The production recipe requires cheddar cheese curds, diced into 2cm cubes, to be cooked at 78°C for 9 minutes with the cooker-blender set to 55 RPM. A recent batch was processed at 80°C for 8 minutes at 60 RPM.(8)

Identify three critical parameters that must be recorded for this batch.

- **The temperature of the cheese mix.**
- **The speed of the machine (RPM).**
- **The time the cheese is cooked**

Mention how these deviations from the process parameters should be documented in the production report, including the method for calculating the variance in cooking time."

Answer:

*** Record Actual Values:**

*** Create a table or section in the report with separate columns for "SOP Value" and "Actual Value."**

*** Clearly record the actual cooking temperature (80°C), actual cooking time (8 minutes), and actual cooker-blender RPM (60 RPM).**

*** Alongside these, record the corresponding SOP values: 78°C, 9 minutes, and 55 RPM.**

*** Note Deviations:**

*** In a separate column or notes section, state the deviations:**

*** "Cooking temperature was 2°C higher than the SOP."**

*** "Cooking time was 1 minute shorter than the SOP."**

*** "Cooker-blender RPM was 5 RPM higher than the SOP."**

*** Cooking Time Variance Calculation:**

*** Document the variance as "-1 minute" or "1 minute shorter than the SOP."**

*** If there is a known reason for the deviation (e.g., equipment malfunction, operator error), include a brief explanation in the report.**

*** Signature and Date:**

*** Ensure the report is signed and dated by the person responsible for recording the data.**

"The Quality Assurance Manager requests a concise summary report detailing process consistency for the day's production, focusing on cheese cube dimensions, cooking temperature, and mixing speed. Data from 10 batches is available.

Mention three statistical calculations that would provide relevant insights for the report. (6)

Answer:

*** Average: Find the average size of the cubes, the average cooking temperature, and the average mixing speed. This tells you the typical values.**

*** Biggest and Smallest (mean): Find the biggest and smallest cube sizes, the highest and lowest temperatures, and the fastest and slowest mixing speeds. This shows how much things changed.**

*** How Much They Change: Calculate how much the sizes, temperatures, and speeds usually change from the average. This helps you see if the process is consistent.**