University of San Carlos
Department of Chemical Engineering
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Experimental Plan Assessment

Laboratory Course	:	CHE 3110L
Experiment Title	:	White Cheese Making
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		Villanueva, Kristine Claire E.
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Scheduled Date	:	October 28, 2020
Date Submitted	:	October 27, 2020
Submission Number	:	1
Teacher's Name	:	Dr. Camilla Flor Y. Lobarbio
Term and Academic Year	:	1st Semester A.Y. 2020-2021

Criteria	Grade
Preparation & Planning for Experiment (x 0.50)	
Ability to Answer Questions (x 0.50)	
Grade	

Assessed and Graded By: Dr. Camila Flor Y. Lobarbio

(Signature over printed name)

Date and Time

University of San Carlos
Department of Chemical Engineering

CHE 3110L Laboratory Simulation of Industrial Product Manufacture

Experiment Plan

(Form CHE 3110L-2)

Prepared and submitted by:

Amaba, Adrian Seth S.

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Experiment: **White Cheese Making**

Objectives of the Experiment

1. Prepare a process flowsheet for the manufacture of white cheese, complete with details in process conditions and stream specification;
2. Monitor overall and component mass and energy flows during the lab-scale implementation of the product manufacture;
3. Calculate component yields in every process step and for the entire process; and
4. Identify critical steps in the process based on laboratory data and the entire experience of generating the product.

Methodological Framework

Objective 1:

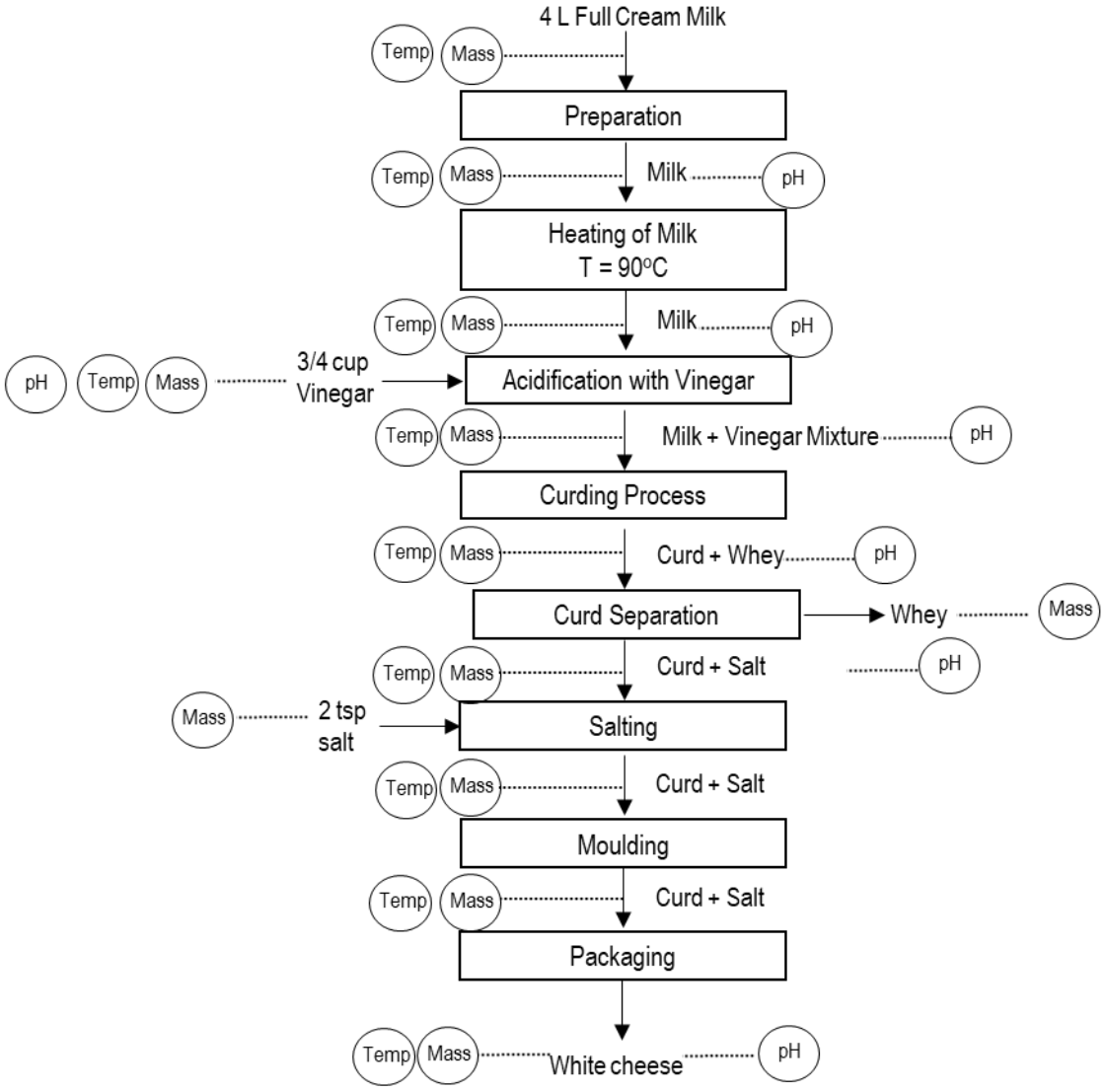
To prepare the process flowsheet of the production of white cheese, the following are to be done:

- Research on the methods pertaining to white cheese making and taking note of inputs, transformation processes, and outputs.
- Determine the key process steps
- Determine the underlying reactions
- Identify process conditions such as temperature and pH levels
- Establish the flow of inputs and outputs of the different processes such as materials and products

- Present the overall process as a flow diagram specifying on the process and stream conditions

Objective 2:

To monitor the component mass and energy flows, recordings of the mass and temperatures from each process step when necessary throughout the manufacturing will be made. This is represented as a process flow diagram below:



Objective 3:

To calculate the component yield of each process step and for the entire process the following are to be done:

For each process step, identify the primary input material to be processed and desired output product. Measure their respective mass in grams and calculate the yield for each process step by:

$$Percent\ Yield,\ \% = \frac{Mass\ of\ Primary\ Input\ Material, g}{Mass\ of\ Desired\ Output\ Product, g} \times 100\%$$

- For the entire process yield, it is calculated by:

$$Percent\ Yield,\ \% = \frac{Mass\ of\ Final\ Product\ Ricotta\ Cheese, g}{Mass\ of\ Full\ Cream\ Milk\ Used, g} \times 100\%$$

Objective 4:

Critical Steps based on laboratory data and potential eventualities:

- Selection of Milk Product – Avoid the use of Ultra-High Temperature (UHT) pasteurized milk, otherwise curds will not form. High fat content is recommended.
- Sanitation of Apparatus and Equipment – To adversely avoid affecting milk quality and removes contaminants.
- Heating of Milk – Gradual heating and stirring of the milk to avoid boiling, burning, and sticking to the pot. Temperatures beyond the optimum range prevents the curds from forming.
- Acidification – Initiates the curding process. Imbalances will affect the quality of formed curds, and in turn, the final product.
- Curding - The crux of the entire process. Any slight change can affect final product quality.
- Salting – Helps add flavor to the cheese, it also controls the bacteria that grow inside the cheese, helps with texture development, regulates moisture, and helps preserve the cheese as it ages
- Curd Separation – Is essentially extraction of the final product's precursor.
- Molding - Consolidates cheese curds, allowing for the customization of shape and size.
- Packaging – Sanitize packaging, lest allow cheese to spoil faster

Materials, Measuring Apparatus & Equipment

Material		Quantity
Full Cream Milk		4 L
Table Salt		2 tsp
Tap Water		5 L
White Vinegar		¾ cup
Apparatus	**Size**	**Quantity**
PH strips	7x4.5 cm	10
Pot (with clear cover)	24" in diameter	1
Bowl	11" in diameter	1
Measuring cups	¾ cup and 1 L	1 each
Metal spoon	7" in length	1
Wooden Spatula	10 cm in length	1

Silicone Ladle	13.5” in length	1
Colander	10” in length	1
Plastic Container	9” x 12.5” x 3.5”	1
Cheese Cloth	1 ft x 1 ft	2
Plastic Plate	10” in diameter	1
Pitcher	I liter capacity	1

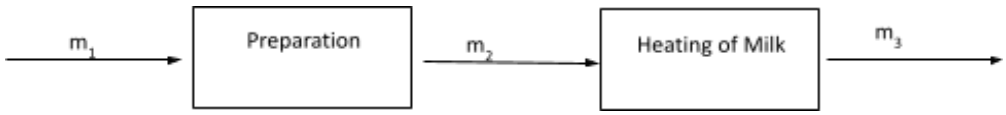
Equipment	Specifications
Gas stove	La Germania FS 530 00W; 1 large and 2 medium gas burners
Digital Weighing Scale	0.1-3000g weighing range
Digital Kitchen Thermometer	23.88 mm; battery-powered

Task Plan

Time	Task	Person Responsible
	Preparation	
Day 1 8:30AM to 8:40AM	Preparation of all materials and equipment	Talandron
	Sterilize the all the equipment	
	Pour the milk in the pot	
	Curding and Coagulation Process	
Day 1 8:40AM to 10:30AM	Measure the initial temperature of milk	Talandron
	Heat and constantly stir the milk until the temperature reaches 90 ^{o}C	
	Stir the milk constantly to avoid scorching on the bottom of the pot	
	Pour the white vinegar gradually and constantly stir the mixture	
	Cover the pot and let the mixture stand for 25 minutes to complete the separation process	
	Whey Separation	
Day 1 10:30AM to 1:00PM	Prepare clean and sterilized bowl, ladle, and colander	Talandron
	Line the colander with a double layer of cheesecloth	
	Transfer the mixture into the colander with cheesecloth	
	Rinse the curds with hot water	
	Tie the cheesecloth and slowly press to separate the whey	
	Discard the whey and transfer the cheesecloth with the cheese into a plastic container	
	Salting Process	
Day 1 1:00 PM to 1:15:PM	Prepare a sterilized spoon	Talandron
	Untie the cheesecloth and evenly distribute the cheese across the container	
	Pour the salt and constantly fold the cheese to evenly distribute the salt	
	Fold the cheesecloth to cover the cheese	
	Place the plastic plate on top of the cheese	
	Fill the pitcher with water and place it on the plate	

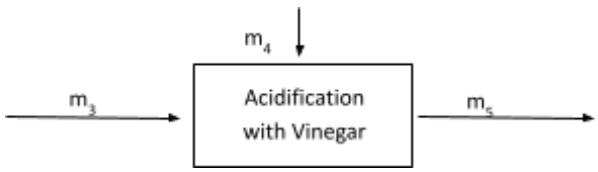
Storing and Packaging		
Day 1 1:15PM to 1:45PM	Remove the cheese from the cheesecloth and transfer it to a plastic container.	Talandron
	Since there are no microbiota added to extend the shelf life of the cheese, store the cheese inside a freezer.	
Post-Production Analytics		
Day 1 1:45PM to 5:00PM	Observe the final product. List down sensible characteristics such as color, scent, taste, and texture.	Amaba
	Characterize the stiffness of the cheese by attempting to spread the cheese over a piece of bread using a bread knife.	
	Compare the cheese with known brands and take note of their observable differences.	
Day 2	Data Processing and Analysis.	Amaba

Sample Calculation



$m_1 = m_2 = m_3$

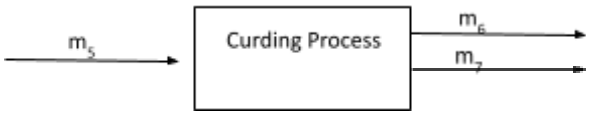
Full Cream Milk (m_1) = 4000mL x 1.026 g/mL = 4 104 g = $m_2 = m_3$



$m_3 + m_4 = m_5$

Vinegar (m_4) = ¾ cups x 240 mL/cup x 1.05g/mL = 189 g

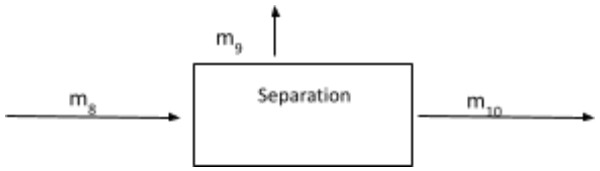
Vinegar + Milk Mixture (m_5) = $m_3 + m_4$ = 4293 g



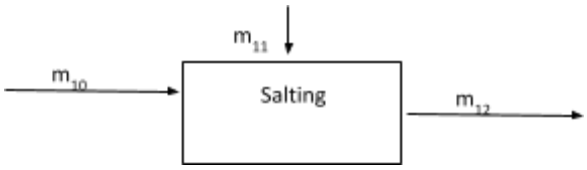
$m_5 = m_6 + m_7$

Curd (m_6) = 0.025 m_5 = 107.325 g

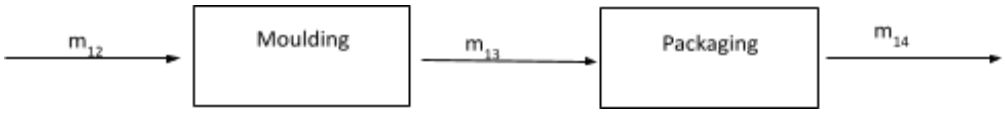
Whey Mixture (m_7) = 0.0975 (m_5) = 4 185.675 g



$m_6+m_7 = m_8 = m_9 + m_{10}$
Whey Mixture (m_9) = m_7 = 4 185.675 g
Curd (m_{10}) = 107.325 g



$m_{10} + m_{11} = m_{12}$
Salt (m_{11}) = 2 tsp x 6 g / tsp = 12 g
Salt + Curds (m_{10}) = 119.325 g



$m_{12} = m_{13} = m_{14}$ = 119.325 g
White Cheese (m_{14}) = 119.325 g

% Yield =

Raw Data Sheets

Table 1. Raw data from *Preparation Process*

	Quantity	Unit
Volume of Full Cream Milk Used		L
Density of Milk		g/mL
Temperature of Milk		^{O}C
Mass of Milk Used		g
pH level of Milk		

Table 2. Raw data from *Heating Process*

	Quantity	Unit
Volume of Full Cream Milk Used		L
Density of Milk		g/mL
Mass of pot with Milk		g
Mass of cleaned and dried pot		g
Temperature of milk before heating		^{O}C
pH level of milk before heating		
Temperature of milk after heating		^{O}C
pH level of milk after heating		
Mass of pot + Milk after heating		g

Table 3. Raw data from *Acidification with Vinegar*

	Quantity	Unit
Volume of Vinegar Used		L
Density of Vinegar		g/mL
Mass of Vinegar Used		g
Temperature of Vinegar before adding		^{O}C
Mass of pot with Vinegar and Milk		g
Temperature of Vinegar + Milk Mixture before adding		^{O}C
pH level of milk and vinegar mixture		

Table 4. Raw data from *Curding and Salting Process*

	Quantity	Unit
Mass of pot with Vinegar and Milk		g
Temperature of Vinegar + Milk Mixture		^{O}C
pH level of milk and vinegar mixture		
Mass of salt used		g
Temperature of salt + vinegar + milk mixture		^{O}C
Time taken before the curd formation		min
Temperature after curd formation		^{O}C

Table 5. Raw data from *Separation Process*

	Quantity	Unit
Mass of cleaned and dried colander		g
Mass of cleaned and dried cheese cloth		g
Mass of Curds		g

Temperature of Curds		^{O}C
pH level of curds		
Mass of Whey Mixture		g
Temperature of Whey Mixture		^{O}C
pH level of whey mixture		

Table 6. Raw data from *Moulding and Packaging Process*

	Quantity	Unit
Mass of cleaned and dried container		g
Mass of curds (cheese)		g

Table 7. Raw data from *Post-Production Analytics Process*

Characteristics	Observations	
	Cheese Product	Brand X
Color		
Scent		
Texture		
Taste		
Stiffness		