A On Job Training

Report on Dairy Industry

Completed at

Bharat Dairy Foods LLP,

Sphurti Industries Gat no.

143/B, Sphurti compound,

A/p. Kogil Budruk, tal

karveer, dist. Kolhapur

416216

By

Sanika Sagar Chavan

Sanovar Salim Mulla

Rasika Sanjay Bhosale

Priti Anil Tangade

M. Sc. Microbiology

Part I Semester II

PG Department of Microbiology

Vivekanand College

(An Empowered Autonomous Institute)

Kolhapur, 416003

Maharashtra, India

2024-25

VIVEKANAND COLLEGE KOLHAPUR (Empowered Autonomous) ESTD JUNE 1964

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Dissemination of Education for Knowledge, Science and Culture"
- Shikshanmaharshi Dr. Bapuji Salunkhe

Shri Swami Vivekanand Shikshan Sanstha's

VIVEKANAND COLLEGE, KOLHAPUR

(AN EMPOWERED AUTONOMOUS INSTITUTE)

PG Department of Microbiology

(स्वायत्त) कोल्हापूर

CERTIFICATE

OF

"ON JOB TRAINING"

This is to certify that Sanika Sagar Chavan (Exam seat no. 1 1 1 9113) has satisfactorily carried out the required practical work prescribed by the BoS Department of Microbiology, Vivekanand College, Kolhapur (An Empowered Autonomous Institute) for M.Sc. - Part- I Semester II course in On Job Training (Sub code – OJT20MIC21) and this report represents his/her Bonafide work in the year 2024 - 2025

Place: Kolhapur

Date: 15/4/25

Examiner

OJT In charge

Head

HOD HEAD
DEPARTMENT OF MICROBIOLOGY
VIVEKANAND COLLEGE, KOLHAPUR
(EMPOWERED AUTONOMOUS)

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Dissemination of Education for Knowledge, Science and Culture"
- Shikshanmaharshi Dr. Bapuji Salunkhe

Shri Swami Vivekanand Shikshan Sanstha's

VIVEKANAND COLLEGE, KOLHAPUR

(AN EMPOWERED AUTONOMOUS INSTITUTE)

विवेकानंद कॉलेज

(स्वायत्त) कोल्हापूर

PG Department of Microbiology

CERTIFICATE

OF

"ON JOB TRAINING"

This is to certify that Sanovar Salim Mulla (Exam seat no. 1 1 1 9109) has satisfactorily carried out the required practical work prescribed by the BoS Department of Microbiology, Vivekanand College, Kolhapur (An Empowered Autonomous Institute) for M.Sc. - Part- I Semester II course in On Job Training (Sub code – OJT20MIC21) and this report represents his/her Bonafide work in the year 2024 - 2025

Place: Kolhapur

Date: 15/4/25

Kawade 15/4/25

Examiner

Jmali

OJT In charge

Head

HC HEAD
DEPARTMENT OF MICROBIOLOGY
VIVEKANAND COLLEGE, KOLHAPUR
(EMPOWERED AUTONOMOUS)

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Dissemination of Education for Knowledge, Science and Culture"
- Shikshanmaharshi Dr. Bapuji Salunkhe

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VIVEKANAND COLLEGE, KOLHAPUR
(AN EMPOWERED AUTONOMOUS INSTITUTE)

PG Department of Microbiology

(स्वायत्त) कोल्हापूर

CERTIFICATE
OF
"ON JOB TRAINING"

This is to certify that Rasika Sanjay Bhosale (Exam seat no. 1 1 1 9121) has satisfactorily carried out the required practical work prescribed by the BoS Department of Microbiology, Vivekanand College, Kolhapur (An Empowered Autonomous Institute) for M.Sc. - Part- I Semester II course in On Job Training (Sub code – OJT20MIC21) and this report represents his/her Bonafide work in the year 2024 - 2025

Place: Kolhapur
Date: 15/4/25

Examiner 5/5/25

OJT In charge

Head

I/C HEAD
DEPARTMENT OF MICROBIOLOGY
VIVEKANAND COLLEGE, KOLHAPUR
(EMPOWERED AUTONOMOUS)

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Dissemination of Education for Knowledge, Science and Culture"
- Shikshanmaharshi Dr. Bapuji Salunkhe

Shri Swami Vivekanand Shikshan Sanstha's

VIVEKANAND COLLEGE, KOLHAPUR
(AN EMPOWERED AUTONOMOUS INSTITUTE)

PG Department of Microbiology

(स्वायत्त) कोल्हापूर

CERTIFICATE
OF
"ON JOB TRAINING"

This is to certify that Priti Anil Tangade (Exam seat no. 1 1 1 9108) has satisfactorily carried out the required practical work prescribed by the BoS Department of Microbiology, Vivekanand College, Kolhapur (An Empowered Autonomous Institute) for M.Sc. - Part- I Semester II course in On Job Training (Sub code – OJT20MIC21) and this report represents his/her Bonafide work in the year 2024 - 2025

Place: Kolhapur

Date: 15/4/25

Examiner 05/05/25

OJT In charge

Head

I/C HEAD
DEPARTMENT OF MICROBIOLOGY
VIVEKANAND COLLEGE,KOLHAPUR
(EMPOWERED AUTONOMOUS)

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DECLARATION

I hereby declare that I have successfully completed the On Job Training program at Bharat Dairy, Sphurti Industries I acknowledge that skills acquired during this training program are valuable to me and will contribute to my professional development.

I express my gratitude to Mr. Chirag Mehta – Head of Sphurti Industries and the whole training team for their support and guidance throughout the training.

Date: 15/4/25

Place: Kolhapur.

Miss . Sanovar Salim Mulla

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DECLARATION

I hereby declare that I have successfully completed the On Job Training program at Bharat Dairy, Sphurti Industries I acknowledge that skills acquired during this training program are valuable to me and will contribute to my professional development.

I express my gratitude to Mr. Chirag Mehta – Head of Sphurti Industries and the whole training team for their support and guidance throughout the training.

Date: 15/4/25

Place: Kolhapur.

Miss. Sanika Sagar Chavan

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DECLARATION

I hereby declare that I have successfully completed the On Job Training program at Bharat Dairy, Sphurti Industries I acknowledge that skills acquired during this training program are valuable to me and will contribute to my professional development.

I express my gratitude to Mr. Chirag Mehta – Head of Sphurti Industries and the whole training team for their support and guidance throughout the training.

Date: 15/4/25

Place: Kolhapur. **Miss . Rasika Sanjay Bhosale**

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DECLARATION

I hereby declare that I have successfully completed the On Job Training program at Bharat Dairy, Sphurti Industries I acknowledge that skills acquired during this training program are valuable to me and will contribute to my professional development.

I express my gratitude to Mr. Chirag Mehta – Head of Sphurti Industries and the whole training team for their support and guidance throughout the training.

Date: 15/4/25

Place: Kolhapur.

Miss . Priti Anil Tangade

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ACKNOWLEDGEMENT

At this juncture where the herculean task is nearing its pinnacle, science deems it a pleasure to look back and acknowledge efforts and support of all kith and kin that helped with zeal to turn a distant dream of an industrial training into reality.

We are extremely thankful to Dr. S.D.Mali Mam Assistant Professor, PG Department of Microbiology, Vivekanand College, Kolhapur (An Empowered Autonomous Institute), project guide for her valuable guidance and mentorship throughout this project work given to us during the study.

We are indeed grateful to Head Dr. T. C. Gaupale, Coordinator Ms. V. V. Misal, PG Department of Microbiology, Vivekanand College, Kolhapur (An Empowered Autonomous Institute) for their kind co-operation and valuable support and we are also thankful to all the staff members of our department for their direct and indirect support.

We are thankful to Principal Dr. R. R. Kumbhar, for his kind co-operation and valuable support.

Also, we sincerely thank our parents for helping us in all aspects to complete the project work. Finally, we would like to appreciate our friends, colleagues for their direct and indirect contribution.

Date: 15/4/25

Place: Kolhapur

Miss. Sanovar Salim Mulla

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Date: 15/4/25

Place: Kolhapur

Miss. Sanika Sagar Chavan

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Date: 15/4/25

Place: Kolhapur

Miss. Rasika Sanjay Bhosale

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Also, we sincerely thank our parents for helping us in all aspects to complete the project work. Finally, we would like to appreciate our friends, colleagues for their direct and indirect contribution.

Date: 15/4/25

Place: Kolhapur

Miss. Priti Anil Tangade

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INTERNSHIP UNDERTAKING

1. Student Name	Sanovar Salim Mulla
2. Current Address	Khatkole mala ,Pattan kodoli 416202 Tal. Hatkangale ,kolhapur
3. Residence Address	Khatkole mala ,Pattan kodoli 416202 Tal. Hatkangale ,kolhapur
4. Email id	sanowarmulla028@gmail.com
5. Mobile Nos.	7058075971
9. Internship /Area (Company/Institute)	Bharat Dairy Foods LLP, Sphurti Industries . Gat No.143/B, Sphurti compounds ,A/P. Kogil budruk

I confirm that I agree with the terms, conditions, and requirements of the Internship Policy

Student Signature:

Date: 14|12|24

I confirm that the student has attended the internship orientation and has met all paperwork and process requirements to participate in the internship program, and has received approval from her mentor.

Sign of Head of the Department:

Date: 14|12|24

UG HEAD
DEPARTMENT OF MICROBIOLOGY
VIVEKANAND COLLEGE,KOLHAPUR
(EMPOWERED AUTONOMOUS)

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INTERNSHIP UNDERTAKING

1. Student Name	Sanika Sagar Chavan
2. Current Address	A ward plot no. 322 4th bus stop phulewadi, kolhapur
3. Residence Address	A ward plot no .322 4th bus stop phulewadi , kolhapur
4. Email id	csanika37@gmail.com
5. Mobile Nos.	8766428661
9. Internship /Area (Company/Institute)	Bharat Dairy Foods LLP, Sphurti Industries . Gat No.143/B, Sphurti compounds ,A/P. Kogil budruk

I confirm that I agree with the terms, conditions, and requirements of the Internship Policy

Student Signature:

Date: 14/12/25

I confirm that the student has attended the internship orientation and has met all paperwork and process requirements to participate in the internship program, and has received approval from her mentor.

Sign of Head of the Department:

Date: 14/12/25

HC HEAD
DEPARTMENT OF MICROBIOLOGY
VIVEKANAND COLLEGE,KOLHAPUR
(EMPOWERED AUTONOMOUS)

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INTERNSHIP UNDERTAKING

1. Student Name	Rasika Sanjay Bhosale
2. Current Address	Sainiki mulinche vastigruha ,near by circuit house road ,kolhapur
3. Residence Address	At post Belanki tal. Miraj district sangali
4. Email id	rasikab746@gmail.com
5. Mobile Nos.	9359960697
9. Internship /Area (Company/Institute)	Bharat Dairy Foods LLP, Sphurti Industries . Gat No.143/B, Sphurti compounds ,A/P. Kogil budruk

I confirm that I agree with the terms, conditions, and requirements of the Internship Policy

Student Signature: RSBhosale

Date: 14|12|25

I confirm that the student has attended the internship orientation and has met all paperwork and process requirements to participate in the internship program, and has received approval from her mentor.

Sign of Head of the Department: Gaupels

Date: 14|12|25

HC HEAD
DEPARTMENT OF MICROBIOLOGY
VIVEKANAND COLLEGE,KOLHAPUR
(EMPOWERED AUTONOMOUS)

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INTERNSHIP UNDERTAKING

1. Student Name	Priti Anil Tangade
2. Current Address	13 /740 Sant mala ,Ichalkaranji 416115 Tal. Hatkangale ,kolhapur
3. Residence Address	13 /740 Sant mala ,Ichalkaranji 416115 Tal. Hatkangale ,kolhapur
4. Email id	tangadepritianil@gmail.com
5. Mobile Nos.	9309338968
9. Internship /Area (Company/Institute)	Bharat Dairy Foods LLP, Sphurti Industries . Gat No.143/B, Sphurti compounds ,A/P. Kogil budruk

I confirm that I agree with the terms, conditions, and requirements of the Internship Policy

Student Signature: Ptangade

Date: 14/12/25

I confirm that the student has attended the internship orientation and has met all paperwork and process requirements to participate in the internship program, and has received approval from her mentor.

Sign of Head of the Department: Gaupale

Date: 14/12/25

I/C HEAD
DEPARTMENT OF MICROBIOLOGY
/IVEKANAND COLLEGE,KOLHAPUR
(EMPOWERED AUTONOMOUS)

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ATTENDANCE SHEET

BHARAT DAIRY FOODS LLP INDUSTRIES, Gat no.143/B sphurti compound , A/p. Kogil budruk , Tal kolhapur
Email.ID: sphurti@sphurti.com
Name of Supervisor: Mr. Rajendra Admuthe

Name of the Student	Sanovar Salim Mulla
Roll Number	5420
Name of Course	M.Sc- Part I Sem-2 Microbiology
Date of Commencement of Training	21st December 2024
Date of Completion of Training	4th January 2025

Month and Year:

Sr. No	Date	Day	Time	Work done	Sign
1.	21-12-2024	First	9.00am-5.00pm	Raw milk reciving dock	
2.	22-12-2024	Second	9.00am-5.00pm	Raw milk reciving dock	
3.	23-12-2025	Third	9.00am-5.00pm	Milk processing	
4.	24-12-2025	Forth	9.00am-5.00pm	Milk processing	
5.	25-12-2025	Fifth	9.00am-5.00pm	Dahi production	
6.	26-12-2025	Sixth	9.00am-5.00pm	Microbiology section	
7.	27-12-2025	Seventh	9.00am-5.00pm	Microbiology section	
8.	28-12-2025	Eighth	9.00am-5.00pm	Butter section	
9.	29-12-2025	Nineth	9.00am-5.00pm	Butter section	
10.	30-12-2025	Tenth	9.00am-5.00pm	By product testing	
11.	31-12-2025	Eleventh	9.00am-5.00pm	Mehta milk protein	
12.	1-1-2025	twelfth	9.00am-5.00pm	Tak and lassi production	
13.	2-1-2025	Thirteenth	9.00am-5.00pm	Other sections: refrigerator, boiler, maintenance	
14.	3-1-2025	Fourteenth	9.00am-5.00pm	Effluent treatment plant	
15.	4-1-2025	fifteenth	9.00am-5.00pm	Overall revision.	

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ATTENDANCE SHEET

BHARAT DAIRY FOODS LLP INDUSTRIES, Gat no.143/B sphurti compound , A/p. Kogil budruk , Tal kolhapur
Email.ID: sphurti@sphurti.com
Name of Supervisor: Mr. Rajendra Admuthe

Name of the Student	Sanika Sagar Chavan
Roll Number	5407
Name of Course	M.Sc- Part 1 Sem-2 Microbiology
Date of Commencement of Training	21st December 2024
Date of Completion of Training	4th January 2025

Month and Year:

Sr. No	Date	Day	Time	Work done	Sign
1.	21-12-2024	First	9.00am-5.00pm	Raw milk reciving dock	
2.	22-12-2024	Second	9.00am-5.00pm	Raw milk reciving dock	
3.	23-12-2025	Third	9.00am-5.00pm	Milk processing	
4.	24-12-2025	Forth	9.00am-5.00pm	Milk processing	
5.	25-12-2025	Fifth	9.00am-5.00pm	Dahi production	
6.	26-12-2025	Sixth	9.00am-5.00pm	Microbiology section	
7.	27-12-2025	Seventh	9.00am-5.00pm	Microbiology section	
8.	28-12-2025	Eighth	9.00am-5.00pm	Butter section	
9.	29-12-2025	Nineth	9.00am-5.00pm	Butter section	
10.	30-12-2025	Tenth	9.00am-5.00pm	By product testing	
11.	31-12-2025	Eleventh	9.00am-5.00pm	Mehta milk protein	
12.	1-1-2025	twelfth	9.00am-5.00pm	Tak and lassi production	
13.	2-1-2025	Thirteenth	9.00am-5.00pm	Other sections: refrigerator, boiler, maintenance	
14.	3-1-2025	Fourteenth	9.00am-5.00pm	Effluent treatment plant	
15.	4-1-2025	fifteenth	9.00am-5.00pm	Overall revision.	

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BHARAT DAIRY FOODS LLP INDUSTRIES, Gat no.143/B sphurti compound , A/p. Kogil budruk , Tal kolhapur
Email.ID: sphurti@sphurti.com
Name of Supervisor: Mr. Rajendra Admuthe

Name of the Student	Rasika Sanjay Bhosale
Roll Number	5404
Name of Course	M.Sc- Part 1 Sem-2 Microbiology
Date of Commencement of Training	21st December 2024
Date of Completion of Training	4th January 2025

Month and Year:

Sr. No	Date	Day	Time	Work done	Sign
1.	21-12-2024	First	9.00am-5.00pm	Raw milk reciving dock	RBhosale
2.	22-12-2024	Second	9.00am-5.00pm	Raw milk reciving dock	RBhosale
3.	23-12-2025	Third	9.00am-5.00pm	Milk processing	RBhosale
4.	24-12-2025	Forth	9.00am-5.00pm	Milk processing	RBhosale
5.	25-12-2025	Fifth	9.00am-5.00pm	Dahi production	RBhosale
6.	26-12-2025	Sixth	9.00am-5.00pm	Microbiology section	RBhosale
7.	27-12-2025	Seventh	9.00am-5.00pm	Microbiology section	RBhosale
8.	28-12-2025	Eighth	9.00am-5.00pm	Butter section	RBhosale
9.	29-12-2025	Nineth	9.00am-5.00pm	Butter section	RBhosale
10.	30-12-2025	Tenth	9.00am-5.00pm	By product testing	RBhosale
11.	31-12-2025	Eleventh	9.00am-5.00pm	Mehta milk protein	RBhosale
12.	1-1-2025	twelfth	9.00am-5.00pm	Tak and lassi production	RBhosale
13.	2-1-2025	Thirteenth	9.00am-5.00pm	Other sections: refrigerator, boiler, maintenance	RBhosale
14.	3-1-2025	Fourteenth	9.00am-5.00pm	Effluent treatment plant	RBhosale
15.	4-1-2025	fifteenth	9.00am-5.00pm	Overall revision.	RBhosale

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BHARAT DAIRY FOODS LLP INDUSTRIES, Gat no.143/B sphurti compound , A/p. Kagil budruk , Tal kolhapur
EmailID: sphurti@sphurti.com
Name of Supervisor: Mr. Rajendra Admuthe

Name of the Student	Priti Anil Tangade
Roll Number	5432
Name of Course	M.Sc- Part 1 Sem-2 Microbiology
Date of Commencement of Training	21st December 2024
Date of Completion of Training	4th January 2025

Month and Year:

Sr. No.	Date	Day	Time	Work done	Sign
1.	21-12-2024	First	9.00am-5.00pm	Raw milk receiving dock	P.Tangade
2.	22-12-2024	Second	9.00am-5.00pm	Raw milk receiving dock	P.Tangade
3.	23-12-2025	Third	9.00am-5.00pm	Milk processing	P.Tangade
4.	24-12-2025	Forth	9.00am-5.00pm	Milk processing	P.Tangade
5.	25-12-2025	Fifth	9.00am-5.00pm	Dahi production	P.Tangade
6.	26-12-2025	Sixth	9.00am-5.00pm	Microbiology section	P.Tangade
7.	27-12-2025	Seventh	9.00am-5.00pm	Microbiology section	P.Tangade
8.	28-12-2025	Eighth	9.00am-5.00pm	Butter section	P.Tangade
9.	29-12-2025	Nineth	9.00am-5.00pm	Butter section	P.Tangade
10.	30-12-2025	Tenth	9.00am-5.00pm	By product testing	P.Tangade
11.	31-12-2025	Eleventh	9.00am-5.00pm	Mehta milk protein	P.Tangade
12.	1-1-2025	twelfth	9.00am-5.00pm	Tak and lassi production	P.Tangade
13.	2-1-2025	Thirteenth	9.00am-5.00pm	Other sections: refrigerator, boiler, maintenance	P.Tangade
14.	3-1-2025	Fourteenth	9.00am-5.00pm	Effluent treatment plant	P.Tangade
15.	4-1-2025	fifteenth	9.00am-5.00pm	Overall revision.	P.Tangade

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Sphurti

BHARAT DAIRY FOODS LLP

Manufacturers of Joy

Date: 13.01.2025

CERTIFICATE

This is to certify that Ms. Sanovar Salim Mulla, student of M.Sc.-I Microbiology, Vivekanand College, Kolhapur has undergone training in our organisation for a period of Fifteen days. She has collected all the information about milk procurement, manufacturing processes of products and both Chemical & Microbiological testing of all products manufactured here.

During this period of her training, we found her sincere and punctual.

We wish her success and luck in her career and life.

13/01/2025

Authorised Signature

BHARAT DAIRY FOODS LLP
LLPIN - ABB - 6299
KOLHAPUR

Stamp

Office: 1079 B, Mangalwar Peth, Tembe Road, Kolhapur-416012
Ph. +91 231 2645 604/703/804. E-mail: sphurti@sphurti.com
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GSTN-27AAZFB7610G1Z4

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Sphurti

BHARAT DAIRY FOODS LLP

Moments of Joy

Date: 13.01.2025

CERTIFICATE

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13/01/2025

Authorised Signature

BHARAT DAIRY FOODS LLP
LLPIN - ABB - 6299
KOLHAPUR

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Sphurti BHARAT DAIRY FOODS LLP

Manufacturers of Ghee

Date: 17.01.2025

CERTIFICATE

This is to certify that Ms. Rasika Sanjay Bhosale, student of M.Sc. -I Microbiology, Vivekanand College, Kolhapur has undergone training in our organisation for a period of Fifteen days. She has collected all the information about milk procurement, manufacturing processes of products and both Chemical & Microbiological testing of all products manufactured here.

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We wish her success and luck in her career and life.

17/01/2025

Authorised Signature

BHARAT DAIRY FOODS LLP LLPIN - ABB - 6299 KOLHAPUR

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Sphurti

Date: 13.01.2025

CERTIFICATE

This is to certify that Ms. Priti Anil Tangade, student of M.Sc. - II Microbiology, Vivekanand College, Kolhapur has undergone training in our organization for a period of Fifteen days. She has collected all the information about milk procurement, manufacturing processes of products and both Chemical & Microbiological testing of all products manufactured here.

During this period of her training, we found her sincere and punctual.

We wish her success and luck in her career and life.

13/01/2025

Authorised Signature

BHARAT DAIRY FOODS LLP
LLPIN - ABB - 6299
KOLHAPUR

Stamp

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Raw Milk Reception Dock

The raw milk reception dock is the primary intake point of liquid milk entry in the dairies. It is specifically meant for the reception of milk brought in trucks from village milk collection centers located over a wide area. The collection process starts from the villages, milk collection centers, groups of which are assigned to distinct milk truck routes. The trucks of individual villages milk collection centers from many such routes are unloaded at the RMRD, after which their milk is weighed and tested separately to issue a milk receipt statement according to the measured parameters during the daily shift.

TESTS FOR THE MILK

- **Alcohol Test**

  Alcohol test is performed to assess milk quality and freshness. The alcohol test helps to find any abnormalities and spoilage of milk.

  Take 2 ml of milk sample, add 2 ml of 68 % alcohol then mix the contents

  Inverting the test tube.

  Observe flakes of curd /clots on side of test tube. Presence of clots denotes positive test

- **Adulteration tests:**

Soda test:

The soda test for milk is conducted to detect the presence of added neutralizers such as soda which may have been illegally added to milk. these neutralizers are sometimes used to mask acidity caused by spoilage or bacterial activity. Take 2 ml of milk sample in a test tube, add absolute ethanol in it. Mix the content, Add 1-2 drop of Rosalie acid. pink color gives positive test.

Malta Dextrin test:

The Malta dextrin test for milk is conducted to detect the presence of maltose dextrin, which may be added as adulterant to increase the milks solid content artificially. malt dextrin is a carbohydrate powder that can mimic the natural solids in milk, giving the appearance higher quality.Take 25 ml of milk sample in a test tube, boil it by using water bath then add 1 ml of 5 % lactic acid, allow to coagulate the milk after coagulation filter it. Take 5 ml of filtrate cool it. add 1-2 drops of iodine. yellow color gives negative test.

Urea test:

The urea test for milk is conducted to detect presence of added urea, which an adulterant sometimes used to increase appear ant protein content of milk artificially.

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Take 2ml of milk in test tube and add 2ml of urea reagent mix it properly. Dark yellow color gives positive test.

Sugar test:

The sugar test for milk is conducted to detect the presence of added sugar (sucrose and glucose), which is may be used as an adulterant to improve test, increase sweetness, or mimic natural density of milk.

Take 0.1gm of resorcinol powder then add 1ml of concentrated HCL and add 10ml of milk mix it properly. Keep it in boiling water bath for 5 min. red color gives positive test.

Starch test:

The starch test in milk is conducted to detect the presence of added starch, which is used to increase the total solid content, creating a false impression of better quality. Take 2 ml of milk and warm it cools it and add 1-2 drops of 1%iodine blue color gives positive test.

- **Acidity**

  Take 10 ml of milk and add 10 ml distilled water with 2 -4 drops of phenolphthalein indicator and titrate with 0.1N NaOH till colorless to faint pink. Note burette reading

  Calculation- BR x 0.09

  Normal Acidity of Milk=0.126-0.135

- **FAT**

It is checked by FT-3 machine and Gerber method

Gerber method – Take 10 ml of sulphury acid in Butyrometer and add

10.75 ml of milk sample and 1ml of isoamyl alcohol mix it. Carry out

Centrifugation. Check the fat by observing the fat layer

- **CLR -**

Correct Lactometer Reading.

Used to detect density of milk. Take milk sample in lactometer jar and dip lactometer. Noted down the

reading.

Standard range of CLR for raw milk = 28-30

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Observation table:

Sr.no	Test	Positive Test	Negative Test
1.	Alcohol Test	Clots are observed on sides of Test tube	No clots observed
2.	Soda Test	Pink color	Orange color
3.	Malta-Dextrin Test	Orange color	Yellow color
4.	Urea Test	Dark yellow color	Faint yellow color
5.	Sugar Test	Red Color	Colorless

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Milk processing

Milk processing in the dairy industry involves several stages to ensure the milk is safe for consumption, has a longer shelf life, and meets consumer preferences.

Collection and transportation:

Raw milk is collected from dairy farms. The milk is transported in refrigerated tankers to processing facilities to prevent spoilage.

Pasteurization:

Pasteurization refers to the process of heating each and every particle of milk at temperature 82 -85 ° c for 15 seconds after this milk is cooled at 2 °f. The pasteurization does not kill all microorganisms in milk and therefore, it is not a method of milk sterilization but it is a process of partial killing of microorganisms.

There are 2 methods of pasteurization:

- High temperature low time
- Low temperature high time

Standardization:

Standardization of milk is adjustment of the milk fat and solid not fat content of milk to prepare different varieties of milk. If the fat is low then high fat cream is added in the milk and in case if it is high then skimmed milk is added.

Homogenizer:

Homogenizer is used to standardized the milk. homogenizer breaks fat globules and mixed it throughout the milk. homogenized milk is used in the production of dashi. It works at 2000 rpm.

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Fig 1 -HOMOGENIZER

Cream separator:

Cream separation is the phenomenon by which milk is separated into cream and skimmed milk by centrifugal force the cream being lighter floats over the heavier skimmed milk. This happens because when centrifuge machine is switched on milk rotate at very high speed in its container. due to this separation of cream takes place.

FIG 2 – CREAM SEPARATOR

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Testing of pasteurized milk

Fat test:

Take milk sample in bottle, heat it at 110 ^{0}F, cool at 80 ^{0}F. Take 10ml sulphury acid in milk butyrometer and add 10.75 ml of milk sample and 1ml isoamyl alcohol, then shake it well and place it in Gerber machine for 5 minutes. Check the fat by observing fat layer.

Protein test:

Take 10 ml of milk sample and 0.4 ml of potassium oxalate and hold it for 3 mins and add 2-4 drops of phenolphthalein indicator and titrate it against 0.1 N NaOH till light pink color appears then add 2 ml neutral formaldehyde and titrate it against 0.1 N NaOH till the same color appears. note burette reading.

Formula: B.R x 1.7

Acidity test:

Take 10 ml of milk sample and 10 ml of distilled water and add 2-4 drops of phenolphthalein indicator and titrate it against 0.1 N NaOH till pink color appears. And note down the burette reading.

Formula: B.R X 0.09

Correct lactometer reading:

Heat milk sample at 110 ^{0}F and cool it to 70 ^{0}F and transfer it to lactometer jar, dip the lactometer in the jar. Note the reading.

Phosphatase test:

The phosphatase test is used to check efficiency of pasteurization .Alkaline phosphatase is a naturally occurring enzyme in raw milk, which is denatured by pasteurization, so it is used to detect the efficiency of pasteurization.

Procedure:

1. 5ml of phosphatase solution is taken in test tube and add 1ml of milk sample. Place the test tube in water bath at 37 ^{O}cé for minimum 90 minutes.
2. The enzyme (if active) will hydrolyze the substrate, showing a color change.
3. Yellow color indicates phosphatase activity and no color change indicates proper pasteurization.

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Dahi production

First of all, the cleaning in place (CIP) is carried out of all production plant to avoid unwanted growth of microorganisms to maintain the quality, shelf life and spoilage of milk and milk products. Caustic lye, hot water, nitric acid are used for CIP. CIP is done before and after the production of dairy products.

Pasteurization of raw mike is done at temperature 79 – 82 ° c for 15 sec and cooled at 2-4 ° c. This pasteurized milk is stored in tank.

*** Standardization and Homogenization:**

Milk is standardized to achieve a specific fat content.

Then, it is homogenized to ensure a uniform distribution of fat globules.

*** Second pasteurization:**

Milk is heated to 90-92°C and hold for 10 minutes to increase shelf life.

*** Cooling:**

Milk is cooled to 43-45 ^{0} C

*** Addition of culture:**

Milk is transferred into fermented milk storage tank and add culture in milk having temperature 42 -44 ° c and carry out agitation for 15 minutes. Transfer it for packaging.

***Packaging:**

Dahi is packaged in pouches or other containers. And incubate it at temperature 45-46 ^{0}c for 4-5 hours.

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Sampling of dashi done for check acidity and oral test.

* Cooling and Storage:

Dahi is stored in cold room at temperature below 4 ^{0}c.

* Blast Freezing (Optional):

For long-term storage, Dahi can be blast frozen .Blast freezing is an optional step that can be used to extend the shelf life of Dahi.

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Production of lassi

Cleaning in place:

First of all, the cleaning in place (CIP) is carried out of all production plant to avoid unwanted growth of microorganisms to maintain the quality, shelf life and spoilage of milk and milk products. Caustic lye, hot water, nitric acid are used for CIP. CIP is done before and after the production of dairy products.

Lassi:

Process of production of lassi in industrial dairy involves several steps:

Pasteurization of raw mike is done at temperature 79 – 82 ° c for 15 sec and cooled at 2-4 ° c. This pasteurized milk is stored in tank.

Standardizing of milk: Milk is standardized to specific fat and solid not fat. Homogenization of milk is carried out and it is transferred in tank.

Addition of culture: Starter culture is then added to milk at temperature 43 ° c to 44 ° c. agitation is carried out for 15 minutes. Incubation is carried out at temperature 44 ° c to 45 ° c for 4 hours. Then take a dashi sample to check acidity, if acidity ranges from 0.70-0.75 % then that dashi is taken for the preparation of lassi Uniformly mix the curd and take it for preparation of lass .Add sugar, salt, stabilizer, and water solution according to formulation takes place in the dashi. Continuously mixing of all content is carried out. The mixture is flavored with essence. Now take the lassi for pasteurization at temperature 58°C to 62°C for 15-20 minutes and then cooled it at 4-5°C to increase shelf life of lassi. Transfer the lassi into storage tank. .Then take a sample of lassi to check acidity and oral testing. Acidity should be between 0.5-0.6%The lassi is packed and stored in cold room at below 4°C.Shelf life of lassi is around 15 days.

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- **Standard values**

Fat: 2.5-2.9%

Acidity: 0.5-0.6%

Moisture: 65-68%

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Butter production

First of all, the cleaning in place (CIP) is carried out of all production plant to avoid unwanted growth of microorganisms to maintain the quality, shelf life and spoilage of milk and milk products. Caustic lye, hot water, nitric acid are used for CIP. CIP is done before and after the production of dairy products. Butter is a dairy product made from milk through a series of steps, including:

Separation of milk: Milk is passed through a separator to separate the cream, which has a higher milkfat content. Separated cream should have fat percentage between 38-40%.

Pasteurization of cream: Cream is pasteurized at a higher temperature at 82-85 ° C for 15 seconds and cooled at temperature 4-5°C.Transfer the cream to PCST (pasteurized cream storage tank.) carry the ageing of cream for overnight. Then the cream is transferred to continuous butter machine.

Churning of cream: The cream is churned in continuous butter machine at high speed to create butter grains and buttermilk.

Removing of buttermilk: The buttermilk is drained and the churning continuous until the butter grains are kneaded together.

Dispersing moisture: The butter is forced through perforated plates to remove remaining buttermilk and achieve the desired consistency.

packaging: The butter is packed for sale. And stored in deep freezer at temperature -24 to -26°C.

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we can calculate fat moisture and curd of butter by using following formulas:

curd = $(w4 - w_1) \div w \times 100$

moisture = $(w2 - w_3) \div w \times 100$

fat = $(w3 - w_4) \div w \times 100$

- ✓ W: weight of sample
- ✓ W1: weight of empty dish
- ✓ W2: addition of weight of dish and sample
- ✓ W3: weight of dish after ghee sample
- ✓ W4: weight of dish after petroleum ether wash

Standard value:

Curd :1.5-1.45%

Moisture :14-15%

Fat: 82.5- 83%

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Production of Buttermilk

First of all, the cleaning in place (CIP) is carried out of all production plant to avoid unwanted growth of microorganisms to maintain the quality, shelf life and spoilage of milk and milk products. Caustic lye, hot water, nitric acid are used for CIP. CIP is done before and after the production of dairy products.

Pasteurization of raw mike is done at temperature 79 – 82 ° c for 15 sec and cooled at 2-4 ° c. This pasteurized milk is stored in tank

Standardization and homogenization:

Milk is standardized to achieve a specific fat content. Then it is homogenized to ensure distribution of fat globules. Standardized and homogenized milk is then transfer into storage tank.

Addition of culture:

Starter culture is added to the milk having temperature 43-44° c. Then agitate it for 15 minutes to mix the culture. Incubate the mixture at temperature 44-45 ° c for 4 -5 hours. Once the incubation is done take the sample to check its acidity. Acidity should be ranges between 0.75-0.80 %.

In incubated dashi addition of salt, stabilizer, and water takes place.

1. The mixture is homogenized to improve its body and texture.
2. Now take the buttermilk for pasteurization at temperature 55-60°C for 15 -20 minutes and cooled it at 4-5°C.
3. Transfer the buttermilk to storage tank.
4. Sampling of final product is done to check acidity and oral testing.
5. The buttermilk is packed and stored in cold room at below 4°C.

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6. Shelf life of buttermilk is 10 days.

Standard values:

Fat: 1.0-1.5 %

Acidity: 0.35-0.40%

Moisture: 90-95 %

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By products

Moisture:

Along with several brand of milk, spurt also produces many byproducts such as paneer, Srichand, Barundi, buttermilk, butter, dashi, sweet lassi, mango lassi, fruit hand etc.

Testing of fat, acidity and protein for these products is carried out.

Fat test:

Take 10gm sample and 10 ml distilled water is taken to prepare dilution.

Take 10ml sulphury acid in milk butyrometer and add 10.75 ml sample and 1ml isoamyl alcohol, then shake it well and place it in Gerber machine for 5 minutes. Check the fat by observing fat layer.

Protein test:

Take 3gm of sample and add 10 ml distilled water. And add 1.2ml of saturated potassium oxalate and rest it for 3 mins then add 3-4 drops of phenolphthalein indicator and titrate it against 0.1 N NaOH till light pink color appears then add 2 ml neutral formaldehyde and titrate it against 0.1 N NaOH till the same light pink color appears. Note burette reading.

Formula: B.R X 1.7 X 10+ 0.5÷Weight of sample

Acidity test:

Take 1gm of sample and 10 ml of distilled water is taken then add 2-4 drops of phenolphthalein indicator and titrate it against 0.1 N NaOH till faint pink color appears. And note down the burette reading.

Formula: B.R X 0.9 ÷weight of sample

Moisture is checked by moisture analyzer machine by taking 1-1.5 gm of sample.

Total solids can be calculated using following formula:

T.S = 100- Moisture

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Observation table:

Name of product	Moisture (%)	Acidity (%)	Protein (%)	Total solids (%)
Dahi	82-85	0.77-0.82	3-4.50	15-17
Buttermilk	90-95	0.35-0.40	2.50-3.50	5-10
Lassi	75-77	0.58-0.62	3-4	22-25
Mango lassi	70-72	058-0.62	2-4	28-30

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Microbiology Section

Microbiology analysis methods detect, identify and quantify microorganisms in dairy products. This helps to prevent foodborne illness and maintain product quality.

- Microbial examination:

1.Total plate count: It is also known as total bacterial count, is a microbiological technique used to estimate the number of viable bacteria present in a sample. Plate count agar is used. Total plate agar contains nutrients such as peptone and glucose, which serves as energy source. Its balanced composition makes it suitable for enumerating viable microorganisms in a sample under standard incubation condition.

Composition of total plate agar:

1. **Yeast extract:** source of vitamins
2. **Glucose:** source of carbohydrates
3. **Agar:** solidifying agent

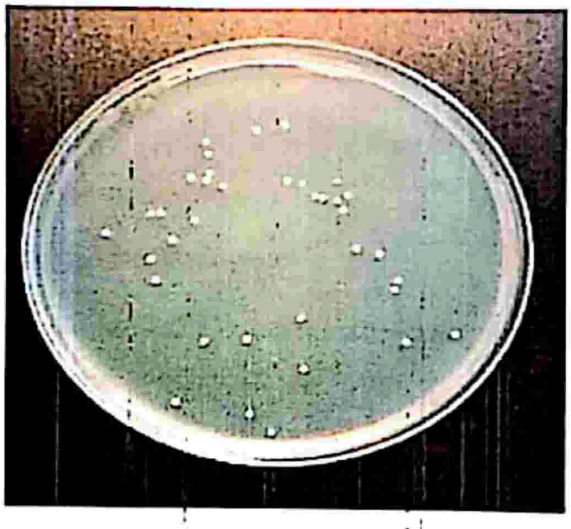

FIG 3 – TOTAL PLATE COUNT AGAR PLATE

2.Detection of coliform: violet red bile agar is a selective and differential medium used to isolate and enumerate gram negative bacteria particularly Enterobacteriaceae, from food, water and environmental sample.

Composition of violet red bile agar:

1. **Peptone:** provide nitrogen and other nutrients

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2. **Yeast extract:** supplies vitamins and growth factor
3. **Lactose:** serves as fermentable carbohydrate to differentiate lactose fermenting coliforms.
4. **Bile salt:** inhibits the growth of non-enteric and gram positive
5. **Sodium chloride:** maintains osmotic balance
6. **Neutral red:** A pH indicator that turns red under acidic condition
7. **Crystal violet:** suppresses the growth of gram-positive bacteria

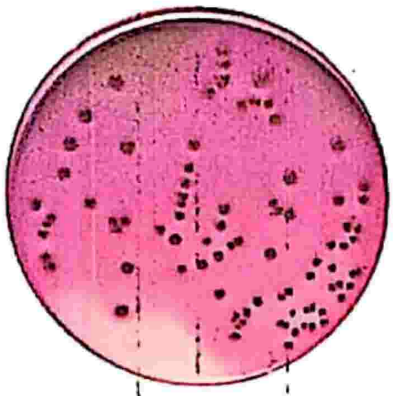

FIG 4 – VIOLET RED BILE AGAR PLATE

3. Detection of yeast and mold: Rose Bengal chloramphenicol agar is a selective and differential medium used to isolate and enumerate f

Composition of rose Bengal chloramphenicol:

1. **Peptone:** provides nitrogen, vitamins and other nutrients to support microbial growth.
2. **Dextrose (glucose):** serves as carbon source for energy.
3. **Monopotassium phosphate:** Act as a buffer to maintain the pH of the medium.
4. **Magnesium sulfate:** provides essential ions for microbial metabolism.
5. **Rose Bengal:** A dye that inhibits bacterial growth and restricts the colony size of molds to prevent overgrowth and making enumeration easier.
6. **Chloramphenicol:** An antibiotic that suppresses bacterial growth, ensuring the selective growth of fungi.
7. **Agar:** A solidifying agent to create a firm medium for microbial growth
8. **Distilled water:** To prepare medium.

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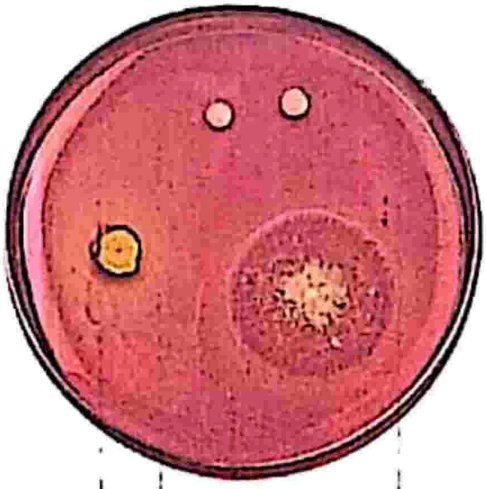

FIG 5 – ROSE BENGAL CHOLRAMPHENICOL AGAR PLATE

4.Detection of *E. coli*: Eosin methylene blue agar is a selective and differential medium used to isolate and identify gram negative bacteria, particularly Enterobacteriaceae.

Composition of Eosin methylene blue agar:

1. **Peptone:** provides nitrogen, vitamins, and essential nutrients for bacterial growth
2. **Lactose:** A fermentable carbohydrate that serves as an energy source for coliforms. lactose fermentation results in acid production, which helps in differentiating organisms.
3. **Dipotassium phosphate:** acts as buffering agent to stabilize the mediums pH
4. **Eosin:** A dye that combines with methylene blue to inhibit the growth of gram-positive bacteria and reacts with acid produced by lactose fermenting colonies.
5. **Methylene blue:** functions as a selective agent by suppressing gram positive bacteria and contributes to the color change seen in the lactose fermenting colonies.
6. **Agar:** solidifying agent
7. **Distilled water:** To prepare medium

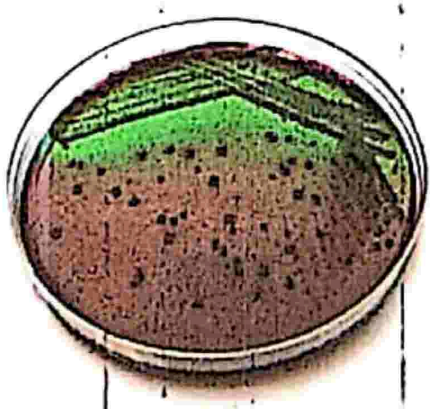

FIG 6 – EOSIN METHYLENE BLUE AGAR PLATE

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5.Detection of coliform in water sample: Most probable number is a technique used to detect presence of coliform in water sample. MPN is statistical method used to estimate the number of viable microorganisms particularly in water sample. Single and Double strength MacConkey's broth are used.

Composition of MacConkey's broth:

1. **Peptone**: provides nitrogen and essential growth factors for bacterial metabolism
2. **Lactose**: A fermentable carbohydrate to differentiate lactose fermenting coliforms from non-fermenters.
3. **Bile salts**: Inhibits the growth of gram-positive bacteria, ensuring selectivity for gram negative coliforms.
4. **Neutral red**: A pH indicator that turns pink or red in the presence of acid produced during lactose fermentation.

Procedure:

1. First of all, prepare 100 ml of single stranded MacConkey's broth and 50 ml of double stranded MacConkey's broth
2. In each and every tube (10 tubes) pour 10 ml of single stranded MacConkey's broth and also prepare 5 tubes containing 10 ml of double stranded MacConkey's broth.
3. Now, inoculate 10 ml of water sample in each tube (5 tubes) of double stranded MacConkey's broth
4. Then, inoculate 1ml of water sample in 5 tubes out of 10 of single stranded MacConkey's broth and then inoculate 0.1 ml of water sample in remaining 5 tubes of single stranded MacConkey's broth.
5. Incubate all tubes at 37 ^{0} C for 24 hours.
6. Detect acid production by observing color change and gas production by observing trapped bubble in Durham's tube.
7. Enumerate positive tubes and calculate by using following formula.

6.Methylene Blue Reduction Time Test:

MBRT test is used to assess the quality of milk and microbial load present in milk. It measures the time required for methylene blue dye to lose its blue color due to microbial activity, which reduces the dye in absence of oxygen.

Procedure:

1] A 10ml sample of the milk is added to a tube containing a 1ml of methylene blue solution.

2] The tube is placed in a water bath at temperature at 37 ° c and wait for the color change.

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Interpretation: If it takes time between 30-60Minutes to show color change to blue to colorless it means that the milk sample contains maximum microbial load in it and we consider it as a poor quality of milk, and if color change takes place within 7 -8 hours, then we consider that milk as an excellent quality of milk.

Sr. No.	Discoloration Time	Quality
1.	1-2 hours	Poor
2.	3-4 hours	Fair
3.	5-6 hours	Good
4.	7-8 hours	Excellent

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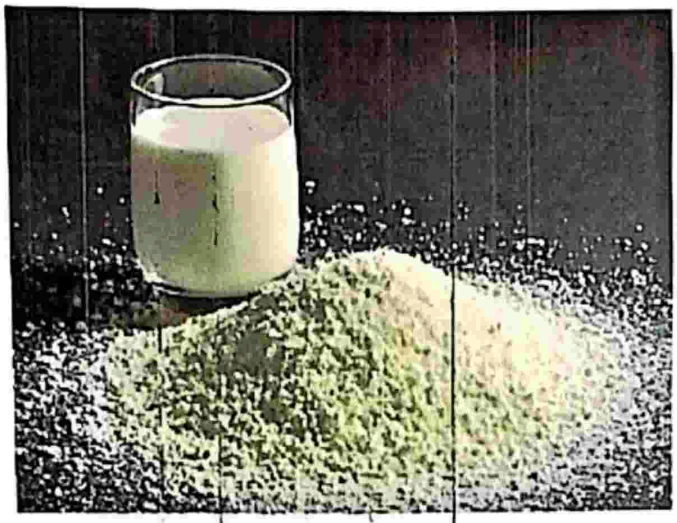
Mehta Milk Protein



Production of milk powder involves two basic principles:

1. Evaporation 2. Drying

1. Preconditioning:

* Balanced Tank: Milk is initially stored in a balanced tank to ensure a consistent flow rate and composition before further processing.

* Precondemns: The milk is then passed through a recondense where it is cooled down to a temperature suitable for the next stage, which is typically around 27-28°C.

2. Thermophilic Stage:

* Thermophilic Vessels: The preconditioned milk is then heated to 55°C in thermophilic vessels. This step is crucial as it activates the growth of thermophilic lactic acid bacteria, which play a role in improving the flavor and texture of the final product.

3. Flash Vessel and DSI:

* Flash Vessel: The milk is then transferred to a flash vessel, where it is held for a short period to ensure uniform temperature distribution.

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* Direct Steam Injector (DSI): The milk is further heated to 70°C using a DSI. This rapid heating helps inactivate heat-sensitive microorganisms while preserving the milk's nutritional value.

4. Holding Section:

* Holding Tubes: The heated milk is then passed through holding tubes, where it is maintained at 70°C for a specific duration (usually 30 seconds) to ensure complete inactivation of pathogenic bacteria.

5. Hydro Cyclone:

* Hydro Cyclone: The milk is then passed through a hydro cyclone, which is a centrifugal separator that removes any remaining debris or particulates.

6. Evaporation:

* Calandria: The milk is passes to calandria 1st which is a heat exchanger. The milk is heated to 66-68°C in the first stage and then cooled to 58-59°C in the second stage and 47-48°C in third stage calandria. This process helps to remove about approximately 50% of moisture from milk.

Evaporation: The initial step is to concentrate the milk by removing water. This is often done using a vacuum evaporator, which lowers the boiling point of water, allowing it to evaporate at lower temperatures. This helps preserve the milk's flavor and nutrients.

2. Spray Drying:

Atomization: The concentrated milk is then sprayed into a drying chamber using a nozzle. This creates a fine mist of tiny droplets.

Hot Air: The chamber is filled with hot air, typically around 150-200°C. This hot air rapidly evaporates the remaining water from the milk droplets, forming a powder. The dried milk powder is collected at the bottom of the chamber.

3. Cooling and Packaging:

Cooling: The dried milk powder is cooled at 40°C to prevent it from becoming sticky.

Packaging: The cooled powder is then packaged in airtight containers to maintain its quality and prevent moisture absorption.

Key Points:

* **Spray drying is a rapid process:** It allows for quick drying and prevents the milk from being exposed to high temperatures for extended periods, which can degrade its nutritional value.

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* **Particle size and shape:** The size and shape of the milk powder particles can be controlled by adjusting the spray nozzle and drying conditions. This is important for factors like solubility.

* **Milk type:** The type of milk (cow, buffalo, etc.) can affect the drying process and the properties of the final powder.

• Quality Control Test:

1.Moisture: Moisture is checked by moisture analyzer.

Standard value: 3.30-3.50%

2. Bulk Density: It is mass of powder or granular material per unit volume, including the space between particle. Procedure: Take 20 gm of sample in measuring cylinder. And tap 20 times and adjust the measuring cylinder.

Formula: Weight of sample÷ volume of sample

3.Protein test: Take 1 gm of sample and mix with 10 ml distilled water. Add 5 drops Phenolphthalein indicator and add 0.4 ml saturated potassium oxalate and keep the mixture for 4 minutes. Then titrate with 0.1 N NaOH till faint pink color appears. then add 2 ml of neutral formaldehyde and again titrate with 0.1N NaOH till same faint pink color appears. Note down the burette reading.

Formula: B.R X 1.7 X 100÷ Total solids X 10

- Standard Value: Minimum 34%.

4.Acidity:

Preparation of sample: Take 10 gm milk powder and mix it with 90 ml of distilled water.

Procedure: Take 10 ml of prepared sample and add 10 ml of distilled water and titrate against 0.1N NaOH using phenolphthalein indicator and note down the burette reading.

Formula: B.R x 0.09

Standard Value: 0.126-0.132 %

5.Alcohol test: Take clean Petridis and add 5ml of sample then 5ml of 70% alcohol is added. Observe the dish. Observation of clots gives positive test and if no clots is observed it indicates negative test.If first performed test is negative then only double alcohol test will be performed further confirmation.

6.ASH test: Take 3gm of powder sample in crucible and place it on Hot plate till caramelized then place this crucible in Muffle Furnace at 550^0c for 3 hours. Then cool this crucible.

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Calculation:

W1= weight of crucible

W2= weight of sample

W3= weight after cooling or drying

Formula: %of ASH= W3-W1÷W2

.FAT test:

Preparation of sample: Take 1.69gm of powder sample and add 10 ml distilled water and mix it.

Gerber method: In butyrometer take 10 ml of sulphuric acid and 10 ml prepared sample then add 1 ml of isoamyl alcohol and centrifuge in Gerber machine for 5 minutes.

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Refrigerator

Refrigeration is essential in the dairy industry for ensuring the quality, safety, and shelf life of dairy products its mani application include milk preservation, processing operations, cold storage, transportation.

Mechanism of Refrigeration in Dairy Industry

Refrigeration works by reducing the temperature of the environment to inhibit the growth of microorganisms and slow down chemical reactions. The refrigeration mechanism can be broken down into the following steps:

1. Cooling of the Product:

- Milk and other dairy products are cooled quickly using refrigeration units, which circulate cold air or use direct contact with cooling surfaces (e.g., cooling plates or coils) to draw heat from the product.
- In bulk milk cooling, tanks are often equipped with plate heat exchangers that rapidly cool milk to the desired storage temperature. This can be done in two ways: indirect cooling, where a refrigerant circulates through a heat exchanger to cool the milk, or direct cooling, where cold water or refrigerant is directly in contact with the milk.

2. Temperature Control:

- Dairy products must be kept at consistent temperatures to maintain quality. For example, raw milk should be cooled to around 4°C (39°F), while finished dairy products may have specific temperature ranges based on their type.
- Temperature-controlled storage rooms or refrigerated trucks use thermostats and refrigeration cycles to maintain a set temperature. Some systems may include sensors that monitor temperature fluctuations and activate cooling units to correct any deviations.

3. Compressor-Cooled Systems:

- Most commercial refrigeration systems in the dairy industry use vapor-compression refrigeration. This involves compressing a refrigerant gas (often ammonia, Freon, or a similar compound), which is then condensed into a liquid state by a condenser. The liquid refrigerant evaporates in the evaporator coil, absorbing heat from the surrounding environment (milk or dairy product).
- As the refrigerant absorbs heat, it cools the air or liquid (milk or dairy products) inside the refrigerated storage area, effectively lowering the temperature.

4. Insulation:

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- Refrigerated storage units, whether large cold rooms, tanks, or trucks, are typically insulated to maintain low temperatures with minimal energy consumption. Insulation reduces the transfer of heat from the external environment into the cooling system, thereby making refrigeration more efficient.

5. **Cold Chain Management:**

- The concept of the "cold chain" refers to the temperature-controlled supply chain for dairy products, ensuring that the temperature is consistently maintained from the point of production to consumption.
- Monitoring systems are often used to ensure that dairy products remain within the appropriate temperature range during storage and transport. Data loggers and remote temperature sensors can track temperatures, sending alerts if conditions deviate from the desired range.

6. **Evaporative Cooling and Cryogenic Cooling:**

- In some specialized dairy applications, evaporative cooling (using the evaporation of water to lower temperatures) or cryogenic cooling (using gases like liquid nitrogen) can be employed. These techniques may be used in processes like freezing dairy products or rapidly chilling large quantities of milk.

Importance of Refrigeration in Dairy Industry:

- **Microbial Control:** Refrigeration helps prevent the growth of spoilage organisms like *Lactobacillus*, *Staphylococcus aureus*, and *E. coli*, which can cause illness if ingested. By maintaining low temperatures, the growth of these microorganisms is slowed.
- **Retention of Quality:** Cooling helps maintain the fresh taste, texture, and appearance of dairy products. Dairy fats can separate or become rancid if not properly cooled and stored.
- **Compliance with Food Safety Standards:** Regulatory authorities like the Food and Drug Administration (FDA) and the European Food Safety Authority (EFSA) set specific temperature guidelines for the storage and transport of dairy products. Adherence to these standards ensures food safety and reduces the risk of contamination.

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Boiler

Boilers are essential in the dairy industry for providing steam and hot water used in various processes, such as pasteurization, sterilization, cleaning, and drying. These processes are crucial for ensuring dairy products are safe, hygienic, and of high quality.

Mechanism of Boilers

A boiler works by converting energy (typically in the form of fuel or electricity) into heat, which is then used to generate steam or hot water for industrial processes. Here's a breakdown of how this works:

1. Fuel Combustion:

- In a **fire-tube** or **water-tube** boiler, fuel (such as natural gas, oil, or coal) is burned in a combustion chamber to generate heat. The heat from combustion is transferred to water or another medium through heat exchangers (typically tubes or a heating surface inside the boiler).
- The combustion process may occur in a furnace or chamber, and the hot gases from this process then flow through tubes that are in contact with the water or steam system, transferring heat to convert water into steam.

2. Water and Steam Formation:

- In the boiler, water is heated to form steam, a process that occurs once the water reaches the boiling point (100°C at sea level). The steam is then collected in a steam drum or storage tank.
- **Superheaters** (in some types of boilers) increase the temperature of the steam above its saturation point (beyond 100°C), making it superheated steam, which is ideal for processes that require higher temperatures.
- The steam produced is then directed through pipes to the relevant parts of the dairy plant for use in heating, pasteurization, sterilization, etc.

3. Heat Transfer:

- The mechanism of heat transfer in a boiler includes **conduction** (direct heat transfer from the hot gases to the water), **convection** (movement of hot gases that helps transfer heat to the water), and sometimes **radiation** (in the case of high-efficiency or advanced boilers).
- The heat is transferred efficiently to the water or steam by means of heat exchangers, tubes, and coils inside the boiler, ensuring that the energy generated by the combustion is effectively used to heat the water.

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4. Steam Distribution:

- After being generated, the steam is routed to the different parts of the dairy plant via steam lines. The pressure of the steam is typically controlled by **pressure regulators**, ensuring that it is maintained at the correct level for the desired application.
- **Pressure relief valves** are also installed in the system to prevent the boiler from exceeding safe pressure limits, which could result in a dangerous situation.

5. Condensation and Recirculation:

- Once steam has been used for heating or other processes, it condenses back into water. In some systems, the water is sent back to the boiler to be reheated (this process is called a **closed-loop system**).
- The condensation can also be part of a **heat recovery system**, where the waste heat is captured and used to preheat incoming water or air, improving energy efficiency.

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Maintenance

Maintenance in the dairy industry is critical to ensuring smooth operations, equipment longevity, product quality, and overall efficiency. Given the nature of the industry, which involves perishable goods and strict hygiene standards, regular maintenance is essential. Here are key aspects of maintenance in the dairy industry:

1. Equipment Maintenance

- **Milk Processing Equipment:** Machines like pasteurizers, homogenizers, and separators need frequent checks for wear and tear, calibration, and performance.
- **Cleaning and Sanitization Equipment**: Regular maintenance of CIP (Clean-in-Place) systems is critical for ensuring the hygiene of all surfaces, pipes, tanks, and valves.
- **Packaging Machines:** These need to be inspected for mechanical issues, alignment, and smooth functioning to prevent downtime.
- **Cold Storage and Refrigeration**: The cooling systems must be well-maintained to ensure that milk and dairy products are stored at the correct temperatures.

2. Preventive Maintenance

- Regularly scheduled inspections, lubrication, and replacements of components before breakdowns occur.
- Monitoring of the condition of high-risk components (motors, seals, and bearings) helps prevent unplanned downtime.
- Software tools or IoT-based monitoring can help track the condition of equipment and predict potential issues.

3. Pumps and Valves

- Pumps for milk transfer and processing need to be checked for leaks, blockages, and proper operation.
- Valves should be regularly checked to ensure they operate smoothly and prevent contamination.

4. Electrical and Automation Systems

- Dairy plants often use automation systems for efficient operations, so regular checks and calibrations are needed.

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- Regular inspections of electrical wiring, switches, and controls are important to prevent malfunctions that could halt production.

5. Hygiene Maintenance

- Hygiene is paramount in dairy production. Maintaining the cleanliness of production facilities, machinery, and workspaces is necessary to avoid contamination.
- Ensure that cleaning and sanitation protocols are followed to meet regulatory standards.

6. Preventing Downtime

- Maintaining a spare parts inventory can reduce downtime when parts fail.
- Scheduling maintenance during off-peak hours to minimize disruptions in production.

7. Training and Personnel

- Ensuring that staff are trained to identify potential issues before they escalate and that they can perform basic maintenance tasks.
- Technical staff should be up-to-date with modern dairy processing equipment, automation systems, and hygiene protocols.

8. Regulatory Compliance

- The dairy industry is subject to stringent hygiene and safety regulations. Maintenance practices should be aligned with these regulations to prevent legal issues or product recalls.

9. Quality Control and Inspection

- Regular testing of equipment performance, such as measuring pasteurization temperature or checking for microbiological contamination, ensures that product quality remains high.

10. Environmental Control Systems

- Ventilation, air quality control, and water treatment systems should be maintained to ensure the overall environmental conditions in the facility meet regulatory standards.

By maintaining a rigorous maintenance schedule, dairy plants can increase operational efficiency, extend the lifespan of equipment, and ensure the safe and high-quality production of dairy products.

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Effluent Treatment Plant

1. Bar Screen and Chamber (Fat Removal):

* Bar Screen: This is the first step, where large objects like debris and rags are removed from the wastewater using a grid or screen.

* Chamber (Fat Removal): In this stage, the wastewater is allowed to settle, allowing fats, oils, and grease (FOG) to float to the surface and be skimmed off.

2. Storage Tank (Equalization Tank):

* This tank stores the wastewater, allowing for fluctuations in flow rate and pollutant concentration to be smoothed out. This ensures a more consistent flow and composition for the subsequent treatment steps.

3. UASB (Up flow Anaerobic Sludge Blanket Reactor):

* This is a crucial anaerobic process where organic matter is broken down by bacteria in the absence of oxygen. The sludge blanket at the bottom of the reactor provides a high concentration of bacteria for efficient treatment.

4. Tube Settler (Sedimentation):

* This unit separates the treated effluent from the remaining sludge. The sludge is recycled back to the UASB reactor, while the clarified effluent moves on.

5. Aeration Tank (Aerobic Bacteria Growth):

* In this tank, oxygen is introduced to promote the growth of aerobic bacteria. These bacteria further break down organic matter and improve the water quality.

6. Secondary Clarifier (Sedimentation):

* Similar to the Tube Settler, this unit separates the treated effluent from any remaining suspended solids. The sludge is sent to a sludge treatment facility.

7. Treated Water Tank and Filtration:

* The treated water is collected in a storage tank before undergoing final polishing through filtration. Sand filters and carbon filters are commonly used to remove any remaining impurities.

Overall, this process aims to:

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* Remove pollutants and impurities from wastewater.

* Reduce the organic load and improve water quality.

* Produce a treated effluent that can be safely discharged or reused.

Additional Considerations:

pH Adjustment: The pH of the wastewater may need to be adjusted at various stages to optimize the treatment process.

Sludge Treatment: The sludge generated during the process requires proper treatment and disposal to prevent environmental contamination.

Dissolved oxygen (DO):

What is Dissolved Oxygen?

* Dissolved oxygen (DO) refers to the amount of free, gaseous oxygen that is dissolved in water.

* It's a crucial parameter for aquatic life as most organisms require oxygen for respiration.

* DO levels fluctuate based on various factors like temperature, pressure, salinity, and biological activity.

Why is Measuring DO Important?

* Water Quality Assessment: DO levels are a key indicator of water quality. Low DO can signal pollution or eutrophication (excessive nutrient enrichment).

* Fish Health: Adequate DO is essential for fish and other aquatic organisms to survive and thrive. Low DO can lead to fish kills and stress on aquatic ecosystems.

* Wastewater Treatment: Monitoring DO is important in wastewater treatment plants to ensure proper biological breakdown of organic matter.

Environmental Monitoring: DO measurements are used in environmental monitoring programs to assess the health of aquatic ecosystems.

Theory Behind the Pro

The procedure shown below:

* Fixing the Sample:

* The first step is to "fix" the sample, which involves adding chemicals to stabilize the dissolved oxygen and prevent it from changing before the titration.

* This usually involves adding a solution of manganese sulfate and potassium iodide-alkali solution.

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• These reagents react with the dissolved oxygen to form a white precipitate of manganous hydroxide.

Acidification and Titration:

• The fixed sample is then acidified with sulfuric acid, which releases iodine from the precipitate in proportion to the amount of dissolved oxygen.

• The released iodine is then titrated with a standardized solution of sodium thiosulfate using a starch indicator.

• The endpoint of the titration is reached when the blue color of the starch-iodine complex disappears.

Calculation of DO:

The volume of sodium thiosulfate used in the titration is directly proportional to the amount of dissolved oxygen in the sample.

Formula: DO = 0.5 X Number of drops sodium thiosulphate

Monitoring and Control:

Regular monitoring of various parameters (e.g., pH, dissolved oxygen, pollutant levels) is essential to ensure the effectiveness of the treatment process.

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