Biyani's Think Tank

Concept based notes

Dairy & Food Technology

B.Sc. Biotechnology (Part-II)

Rajneesh Kumar Mishra
Deptt. of Science
Biyani Girls College, Jaipur

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Sector-3, Vidhyadhar Nagar,
Jaipur-302 023 (Rajasthan)
Ph : 0141-2338371, 2338591-95 • Fax : 0141-2338007
E-mail : acad@biyanicolleges.org
Website :www.gurukpo.com; www.biyanicolleges.org

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Preface

I am glad to present this book, especially designed to serve the needs of the students. The book has been written keeping in mind the general weakness in understanding the fundamental concepts of the topics. The book is self-explanatory and adopts the "Teach Yourself" style. It is based on question-answer pattern. The language of book is quite easy and understandable based on scientific approach.

Any further improvement in the contents of the book by making corrections, omission and inclusion is keen to be achieved based on suggestions from the readers for which the author shall be obliged.

I acknowledge special thanks to Mr. Rajeev Biyani, *Chairman* & Dr. Sanjay Biyani, *Director* (*Acad.*) Biyani Group of Colleges, who are the backbones and main concept provider and also have been constant source of motivation throughout this Endeavour. They played an active role in coordinating the various stages of this Endeavour and spearheaded the publishing work.

I look forward to receiving valuable suggestions from professors of various educational institutions, other faculty members and students for improvement of the quality of the book. The reader may feel free to send in their comments and suggestions to the under mentioned address.

Note: **A feedback form is enclosed along with think tank. Kindly fill the feedback form and submit it athe time of submitting to books of library, else NOC from Library will not be given.**

Rajneesh Kumar Mishra

Syllabus

DIARY AND FOOD TECHNOLOGY

BT - 402

Note : Question No. 1 shall consisit of wuestions requiring short answers and shall cover entire paper . The paper is divided into four sections. Student are required to attempt five questions in all, selecting not more than one question from each section. All question carry equal marks.

Section -A

1. Microbial role in food processes, operation and production new protein foods- mushroom, food yeasts, algal proteins
2. Fermentation as a method for preparing and perserving foods. food additives like coloring flavours and vitamins.
3. Organisms and their use for production of fermented foods and beverages: Picking, alcoholic beverages, cheese, sourkrat, idli, vinegar

Section -B

1. Deoxygenating and desugaring by glucose oxidase, beer mashing and chill proofing or cheese making by proteas in and various other enzyme catalytic action in food processing Classification of fruit juice.
2. Post harvest technology and process of food preservation.

Section -C

1. **Milk :** Defination, composition, chemical and functional properities of milk components : physicochemical properties of milk protein, aggregation of Casein,micelles, factors affecting milk compsition, milk secretion and lactation.

2. **Micro-organisms :** Importance in dairy science and technology . Microbial spoilage of milk, hydrolytic rancidity in milk and milk product, autooxidation of milk fats and effects on milk quality.

Section -D

3. **Milk processing operation :** Milk pasteurization, Homogenization & Sterilization. Effect of processing of milk component and their functional properties.

4. Skimming of milk, Cream & Cream charecteristics, manufacture of yoghurt and other fermented milk product Ice cream manufacture, Butter making technology, technology of cheese and processing of concentrated milks and dried milk powder. 5. Milk quality control, sanitation in the dairy plant, adulteration of milk, dairy equipment maintenance and waste disposal.

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DAIRY & FOOD TECHNOLOGY

MUSHROOM CULTIVATION

Q.1. Describe the condition required for efficient production of edible Mushroom.

Ans. - Mushroom Culture

- Nutrional Value

- Cultivation Methods

- Mushrooms are the members of higher fungi belonging to class Ascomycetes and Basidiomycetes.

- They are rich in protein and Constitute a valuable source of supplementary food.

- The Great value in promoting the cultivation of mushroom lies in their ability to grow on discardable agre-wastes and require less space.

- Mushroom Contain 85-90% water only 34-89% protein is digestible.

- Free and Combined fatty acids also occurs in mushrooms.

- They appear as a Good source of vitamins, minerals and essential amino acids.

- Mushroom production is principally a fermentation process.

- Agaricus use straw as substrate while Lenticula use wood.

- Cultivation Methods

(1) Garden and field – Cultivation in open area.

(2) Cave Cultivation – Cultivation in small tunnels in rocky area.

(3) House Cultivation – Houses of diff. sizes are Constructed for mushroom Cultivation.

(Operations involved in Mushroom Cultivation)

(1) Selection of mushroom spores or strains

(2) Maintenance of Mycelial Culture.

↓

(3) Development of spawn/inoculum.

(4) Preparation of Growing medium.

(5) Spawn inoculation and Colonisation of substrate.

(6) Crop management for Mushroom production.

Overview of General Techniques for the Cultivation of Mushrooms

Isolation of mushroom

Mycelium from Contaminants

Sterilization and Pouring of Agar medium

Propagation of Pure Culture

Sterilization of Grain

Inoculation of Grain

(i) Inoculation of Spawn – Plugging Logs – Stump Culture – Log Culture

(ii) Laying out of spawn on Tray – Tray Culture

(iii) Inoculation of Bulk Substrate – Wall Cultures – Column culture – Bag culture – Mound Culture

Q.2 . Explain Single Cell Protein in detail.

Ans. * Single Cell Protein (SCP)

- microbial cell grown and harvested for Animal or human food.

Definition – SCP literally means use of processed micro-organisms as food or feed supplement.

Coined at Massachausetts institute of Technology. (1966)

Basis – On the basis of single celled habitat of micro-organism.

SCP – The term is used today to include "a microbial biomass from unicellular as well as multicellular micro-organism which can be used as food or food additive.

The protein of these micro-organisms contain all essential amino-acids.

Genuine Dill Pickles

Unit operations

Brine

[7.5 to 8.5% salt]

Cucumber (add)

45-gal barrel

Dill & pickle spices also are Added.

Add vinegar

Temp 15-30

(lower temp. preferred)

(2) Prevention of Contamination of Medium and Plant.

By maintaining sterile or hygienic conditions.

The circulating air and Gaseous Components (NH_3, CO_2 etc) of medium are sterilized by passing through filters.

Other Components are sterilized by Steam fermentation equipments are also sterilized before and after use.

(3) Production of Desired Micro-Organisms

The Desired micro-organism is cultural on the medium under Clean Conditions.

This process is carried out in a fermenter.

Choice of fermentor depends on micro-organisms.

Aeration is an important operation in cultivation.

(+) SCP Production At a Glance

(1) Preparation of suitable medium.

(2) Prevention of Contamination of medium and Plant.

(3) Production of Desired Micro-organism.

(4) Separation of microbial biomass and its processing.

(1) Preparation of Suitable medium –

The medium of SCP production varies according to micro-organisms.

The medium must contain a Carbon source for cultivating the heterotrophic micro-organisms.

(Carbon Source)

(Fossil) (Renewable)

(4) Separation of microbial Biomass and its processing.

Single cell organisms like Yeast and bacteria are normally recovered by Centrifugation.

Filamentous organisms are recovered by filteration. It is important to recover as much water as possible. The whole process (operation) is to be done under clean and hygienic Conditions to keep the product acid broth free from bacterial Contamination.

Heat-treatments are used during final stages of harvesting. Cell walls must be broken to enhance nutrional value of SCP.

The final dried products are bacteriologically stable.

Heat is generated during Cultivation and it is to be removed by using a cooling device.

The production is usually Continued for indefinite period for maximum economy.

ICI Fermentor to produce SCP.

* Process of obtaining SCP From micro-organisms.

From Algae

- (Spirulina)

Two popular process undertaken for mass cultivation of spirulina.

Seminatural lake system.

Artifically built cultivation system.

- ❖ Clean water system.
- ❖ Waste water system.

Requirements

(a) Algae Tank

(b) Light

(c) pH

(d) Agitation

(e) Drying

(f) Avoid Contamination

Uses

(1) As protein supplemented food.

(2) As health food.

(3) In therapeutic and natural medicine.

(4) In Cosmetics.

Unit Operations

Distilliation of hydrocarbon

Dewaxed hydrocarbon

Feedstock Purification

Fermentation

Separating Concentration

Protein Production Plant

Drying

Product

Animal Feed

Human Food

Disadvantage

(a) Rich chlorophyll Content

(b) Low cell density

(c) Serious risk of Contamination

(d) Costly recovery methods

(2) Bacteria and Actinomycetes

Unit Operation –

Nutrient Substrate

Formulation of Suitable medium

Multiplication of micro-organism through fermentation

Separation of Cellular substrates

Further treatment to kill and dry bacterial biomass

Use –

Production of Bacterial Protein

Production of protein from methylophilus methylotropus.

1.72 CH_3OH + 0.23 NH_3 + 1.51O_2 1.0 $CH_{1.68}0_{0.36}$No.22 + 0.72 CO_2 + 2.94 H_2O

Disadvantage –

(a) Risk of Contamination

(b) High nucleic acid.

(c) Maintenance of sterility.

(d) Recovery of cell is problematic.

(3) Yeasts

(Unit Operation)

Cane Molasses - Beet Molasses

Additional Nutrients

Mixing and Cooling

Finished Mash Storage

Build-up of Large Volume inoculum (Yeast)

Large Scale fermentation

Removal of Yeast cell crop

Filter Press

Mixer and extruder

Conversion of cell Paste to yeast cake

Packaging

Refrigerated Storage

Use – Baker's Yeast

Disadvantage –

(1) Slower growth rates.

(2) High nucleic acid Content.

Q.3. Define Food Preservation

Ans. **Food Preservation** preventor delays spoilage and stops the growth of harmful organisms which would make the food unsafe.

Some Food Preservation processes are traditional and have been around for 100 of years. (e.g. Pickling and Sun drying), While others are more modern (e.g. Pasteurization and irradiation.)

Food Preservation is the treatment of food to prevent spoilage and stop growth of harmful organism (e.g. bacteria and moulds).

Q.4. Explain Principles of Food Preservation.

Ans. **Principles of Food Preservation :** To survive and grow harmful microorganisms need the right conditions the right temperature, moisture content and food. Preservation techniques work by changing these conditions and therefore preventing the growth of such micro organisms.

The principles can be summarised as

(1) The use of Low temperature (e.g. Chilling or freezing) to retard growth of micro-organisms and inhibit enzyme activity, e.g. Frozen Pizza, Frozen meat and fish.

(2) The use of high temperature e.g. heating Food to destroy micro-organisms and prevent enzyme activity e.g. Pasteurized milk, canned foods.

(3) The use of substances to slow down growth of M'org. This may include placing the food in a sugary or salty solution to make water unavailable to m'org (e.g. Jam) or changing the acid/alkaline environment, e.g. pickled onions.

(4) Controlling the atmosphere and restricting access to oxygen for example keeping

food in airtight containers to remove/deprive microorganisms of oxygen and prevent further contamination, e.g. Canning modifying the atmosphere in the packaging of a food product e.g. Vaccum packing.

(5) The use of dehydrates to make water (which is essential for growth) unavailable to m'org. e.g. drying grapes to form raisins.

(6) The use of physical methods e.g. irradiation (only limited use currently permitted).

(7) The use of fermentation to produce food products with extended shelf life e.g. Using milk to produce cheese.

Q.5. Describe Food Preservation Methods.

Ans. Traditional Food Preservation Method : -

(1) Pickling : Pickling vegetables and fruits with vinegar prevents the growth of m'org. This is due to the food being placed in a low pH solution in which m'org cannot grow.

(2) Fermentation : Fermentation has been used for many centuries to make a perishable/fresh/consumable food into one that has a longer shelf life e.g. Fresh milk to Yoghurt or cheese.

During fermentation M'org (e.g. bacteria) convert glucose (Sugar) to alcohol (e.g. beer) or to lactic acid (e.g. Yoghurt)

Fermentation can act as a preservation method by producing an acid which lowers the pH of the product, as is the case with Yoghurt.

(3) Addition of Sugar or Salt : The addition of large Quantities of sugar inhibits the growth of M'org by making water less available Jams, marmalades and Jellies use this principle in their manufacture.

- Coating food in Salt or placing it in a salt solution (brine) reduces the moisture content of the food e.g. it reduces the availability of water to M'org with little moisture, M'org growth is retarded. However the taste of the food may will be changed considerably.

(4) Dehydration : Dehydration reduces the amount of water available therefore reducing M'org activity. Many products such as vegetables are diced before drying – to increase their surface area – making water loss more rapid. Blanching may be necessary to inactivate enzymes that cause browning.

Sun drying is one of the most traditional methods of drying it is slow and only practical

in hot, dry climates. The food may be vulnerable to contamination through pollution and vermin e.g. rodents and flies.

Other types of Food Preservation are more Modern

(5) Freezing : Freezing is based on two principles

(a) very low temperatures inhibit growth of Microorganisms and stop enzymatic and chemical activity.

(b) The formation of ice crystals draws away available water from food, therefore preventing the growth of Micro-organisms.

In a domestic situation, food is frozen by placing it in a freezer and allowing heat transfer to occur by conduction (e.g. The removal of heat from the food). This process can take several hours, depending on the nature of the food being frozen.

Other forms of freezing have been developed by the food industry to speed up the freezing time. This ensures that products are frozen in the shortest time possible reducing the risk of M'org growth examples include.

* **Blast Freezing :** This method is most common for freezing it involves batches of food being subjected to a constant, Steady stream of cold air (- 40^0C or Lower) in a tunnel cabinet.

*** Scraped heat exchange :** Products such as ice-cream are frozen using this method to reduce the formation of Large ice crystals. The product is scraped against a cooled surface and then immediately scraped away.

* **Cryogenic freezing :** Liquid nitrogen (or CO_2)is sprayed directly onto small food items such as soft fruits or prawns. Owing to the Liquids extremely low temp. (-196^0C and -78^0C respectively) freezing is almost instant.

(6) Canning : The process of canning aims to destroy M'org and their spores through the application of heat. This is achieved by sterilising food within air tight containers to prevent re-contamination.

The basic stages of canning are

(1) Washing the cans

(2) Filling the cans with product.

(3) Sealing the cans

(4) Sterilising the cans

(5) Cooling the cans

Food products that have been canned have very long shelf life and are stored at ambient (room) temperature e.g. Canned baked beans. Most canned products will carry a best before date mark on the label.

7. Sterilisation : Sterilisation (used in canning but also used in the past for milk) uses a combination of high temp and lime to destroy nearly all M'org present in food. This process is more severe than pasteurisation (below) and can affect the appearance, taste and nutritional content of the food it is very important that the correct temp. is becoz some M'org are capable of forming spores at high temp. to enable them to survive e.g. Clostridium butulinum spores can germinate a grow with possibility of subsequent food poisoning.

(8) Pasteurisation : Pasteurisation involves the use of relatively low temp. for a short time to extend shelf life by several days products that have been pasteurised (e.g. Fresh milk) Usually need to be stored in the refrigerator and have a 'Use by' date mark on the Label.

Pasteurisation involves the following steps :

(1) Raw milk is fed into a plate heat exchanger.

(2) It is heated to72^{o}C for 15 seconds.

(3) It is then passed through a regenerator which brings it into close contact with the cold raw milk pipe.

Ultra heat treatment (UHT) is a more recently developed method used for milk and other products. It results on a product with an extended shelf life without the change in taste and colour associated with sterilisation.

(9) Newer dehydration Processes : Using the same principles described above newer methods have been developed which are Quicker & normally more effective example spray drying. Suitable for dried milk and coffee powder. A Fine spray of liquid is injected into a blast of hot air in a chamber. Water evaporates in seconds, leaving the solid part of the product behind in a powdered form.

Tunnel drying : hot air is blown over a food in a tunnel e.g. Fruit.

(10) Irradiation : This is the process of exposing food to carefully controlled amount of ionising energy.

Irradiation can be used to

* inhabit sprouting of vegetables.

* Delay ripening of fruits.

Reduces number of M'org which cause food spoilage or poisoning e.g. *Salmonella* in poultry and E. Coli 0157:H7 in red meat.

(11) Modified Atmosphere Packaging : Modified Atmosphere packaging is the enclosure of food in a package in which the atmosphere has been changed by altering the proportions of CO_2, O_2, N_2, water vapours and trace gases. The process retards microbial and bio-chemical activity products such as bacon, red meat, poultry, vegetables and backery products use this method to increase shelf life by retarding m'org growth. Controlled atm. Packaging is also used for storage of fruits and vegetables.

Q.6. Explain Alcoholic Beverages.

(A) Alcoholic Beverages + Beer Defects

It is likely that soft drink Consumption, exceed in tap water is use Alcohol. Beverages are consumed because of their stimulating effect.

(1) Beer = (A) Brewing – General term for hot water exaction of plant materials. Thus extracting coffee, tea, from Plant also called Brewing. It is a critical step in making beer and in general term Making of Beer is Brewing. But this doesn't describe many step involved.

(B) Raw Material & Manufacture of beer – Principle raw material of beer manufacturing are water, hops (Colour of aroma), Malted Cereals, grains, Principle barley. In Many Cases rice, corn, other unmalted also added as source of addition carbohydrate (Adjunct).

For Fermentation by Saccharomyces, Yeast, hops are used to add Flavour. Addition Co_2 may be to naturally Produce in the Fermentation.

(B_1 Malt – Malt is the most important ingredient in beer making from the quality & Function Point of View is **Barley Malt**. Malt is barley, green, germinated to the Point where roots and Steups just began to appear. The green Malt (germinated Malt) is gently dried to stop growth. Yet leave the enzyme activity intact germination result in activation of enzyme you which Converts, Starches in the Malted barley and in other cereal grain into other. Cereal grains which can be fermented easily by yeast during fermentation step, so because of this Starch is converted into the ethanol via

sugar intermediate.

(B_2) Hops – Hops are plants, the flower of which contains resins and essential oils. That Contributed characteristic better flavour coconut. Havouring Cathja has been Hops also have Mild Preservative Property foam holding capacity but hops are add only aroma and flavour.

Production of Beer (Step) :-

(1) Mashing – The First Steps in Beer. Making is to combined the Malted barley and Cereals adjunct with water and Mildly Cook. The Mixture (Mash)

Mildly Cook (Cereals + Adjunct + Water) Mash – Low Molecular Weight Amino Acid – Used for Yeast grow – Dextrins and Maltose + gelatined Huch + Protein

This Cooking is for extraction of "Dextrin & Maltose from the Starch Present in Cereal & Adjunct. This Mildly Cooking also extracted gelatined starch and Soluble Material and Protein which undergoes enzymatic breakdown into compounds of Lower Molecular Weight.

Sugar ethanol + Co_2

Mashing May began 38^0C with the temperature gradually raised to about 77^0C. This heating is done for 30 Min. Between each temperature increment. The Step wise heating of fruits specific Amylase and Protinase to function before they are heat inactivated.

The Mash Vessels is designated as (tun) and it is designed in a way that of completion of Meshing. The liquid fraction which is high in Fermentable Sugar can be fermented to sent grains and starch is hydrolysing.

Owing : Liquid is how writed to the increasing kettle. The hops are advise the liquid and the mixture is brewed by boiling in kottle in about 25 hrs. After having hops residual are allow Settle and liquid rest drawn from the kettle thing the bed of hops. Which fertility into the rest the want them cooled to nor temperature more up to the 18^0C. In that the brewing serves vertical Purposes :

(1) Concentrate the wort

(2) Nearly Steralise it.

(3) Inactivate enzymes.

(4) Precipitation remaining Proteins Which can Cause turbidity.

(2) Fermentation : The Cooled wort is inoculated with Saccharomyces Yeast and Fermentation of Sugar. From Starch during, Yasting Proceed. Fermentation in tank under near Sterilize condition with respect to Contaminating Microorganism is carried out at temperature 3-14^{0}C depending on the strain of yeast and Brimury. Fermentation complete in about 9 days. It produces an alcohol containt in the wort (liquid) about 4.6% by volume. Fermentation also lowers the pH of the wort to about 4 and produces dissolved Co_2 in the wort. To the Content of about 0.3%.

(3) Storage : After Fermentation Beer is chalked to O^{0}C Passed thorough the Filters to remove most of the yeast and other suspended Materials and Pumped into Pressure Storage tank. The young or green beer is stored in this tank to several week to several Months. This Storage is know as "Lagering". During this period of storage at O^{0}C further sattleing or Finally Suspended proteins yeast. Generally Additional Co_2 is added in Storage to increase. The level developed and absorbed during Fermentation and Purge the beer or any oxygen may be present and would adversely affect Storage life. This May be done by Periodically.

(4) Finishing and Packaging : After Storage beer is given final Policing, filtration to remove trace of Suspended Material and give the beer Crystal Clear appearance. Addition Co_2 may be added and beer Packaged. Although clear beer is not Sterilized and few viable yeast cells and low level of Fermentable Sugar remains in the Product. These Yeast and other microbes Could continued to grow during Storage.

Water (liquor) Mashing Malt Strachy adjuncts

Boiling Hops Sugar Syrups

Cooling

Yeast handling Fermentation Yeast Propagation

Racking

Cask Conditioned ales – Conditioning

Filtration

Flash Pasteurisation

Filling

Bottles, Cans

Tunnel Pasteurisation

Brewing Process :-

Considerable : Pressure with in the bottle when stored at room time is therefore Pasterize at a temperature of 60°C for several minutes water Packaging in the case of beer which is packaged in keys call. Draft beer it held at refrigeration and does n't need. Pasteurization it is not Pasterised so draft beer has a better. Flavour than Pasteurization may be also be biologically stabilise by Filteration. Process using Fitter have Pure fine enough to remove residual yeast and bacteria. "Cold Pasteurization or filteration to achieve microbial Stability without the new or Convectional Pasteurization similar cold Pasteurization can be applied to other product such as fruit juices and wines.

Grain Barley wheat and rice – Malting – Mashing – Filtering

Water

Hops – Brewing- Hops removing

Yeast – 10% of inoculate – Stortu tank

Fermentation Tank – Yeast removal

Ageing

Filtration

Carbonation – Filling

Process of Beer :-

Light Beer – It contain about 1/3rd to ½ of calories than regular Beer & also less alcohol. It is prepared from Mash lower in Solid and that is used for regular beer. It is alcohol Content can be further Modify by changing the ratio of Fermentable to non-Fermentable Solid in Mash. Enzyme can be added to further breakdown any remaining starch that could not be fermentable and contribute to calorie content.

(3) Malt Beer – high Alcohol Content

(4) Bock Beer – Dark Beer

(5) Pilsener – Lager type Beer

The term **defects** will i.e. applied to under stable characteristics with causes that are not Microbial Such as (1) **turbidity** due to unprotein, Protein-tunnin Complexes such as starch and resin. (2) Off **Flavour** caused by Poor ingredients as controls

with Metals. (3) **Poor-Physical Char-yeasts** and bacteria Produce turbidity when they grow in beer. Beer yeasts carried over from the fermentation may be responsible for **cloudiness**. Likewise Wild Yeasts, e.g. **Saccharomyces Pastorionus** cause cloudiness in beer yeasts can be inhibited or excluded by keeping out air, fermenting most of the sugar in the wort to produce a dry beer. Yeasts also may be responsible for off-tastes and off-odors. Bitterness may be caused by *S. Pastorianus* and an ethanol like taste by HanSenula-anomala. The bacteria causing beer disease are mostly from the genera *Pedicoccus, Lactobacellus, Flavobacterium* and *Acetobacter.* "Sarcina Sickness" characterized by Sourness, tulb and ropiness of beer is caused by *Pedicoccus Cerevisiae,* b'coz the Cocci often aggregate in Fours or tetrads, they were First thought to be Sarcinae.

Some bacilli, being tolerant to acid and hop antiseptics can grow in beer. *Lactobacillus Pastorianus* & *Lactobacillus diastaticus* cause Sourness and a Silky turbidity. These bacteria Produce lactic, acetic and Fermic acids and alcohol and Co_2 From Sujal *Zymomonas anaerobium* When growing in beer causes a Silky turbidity & Produces an odor reminiscent of hydrog-sulfide and apples. *Obesumbacterium Proteus* is responsible for a Parniplike odour and taste in wort and in beer. Species of *Acetobactes* and *Gluconobacter* which are tolerant of acid and hop antiseptics can cause sourness of worts and beer under aerobic condition. Micrococcus, Streptococcus and Becillus Species also.

Q.7. Describe fermentation process for manufacture of Beer.

Ans. BEER

Yeast strains should be low temp toolsant.
Because Low temp. flavours the growth of yeast.
But not the bacteria.

Requirements –

In the production of Beer" Malt", hops, yeast, water, malt adjuncts are used.

- Malt is prepared from barley grains.
- Hops are the dried flowers of hop plant.
- Malt adjuncts : starch or sugar.

Brewing of Beer –

The manufacture of beer is an example of the brewing process following steps.

Unit Operations –

(1) (Malting)

[Barely, grains are soaked at 10 to 15.6^{o}C, germinated at 16 to 21C for 5 to 7 days and Kilri-dried]

Most of the sprouts and germs are removed.

[Malt remains]

(a source of amylases and Proteinases)

(2) [Mashing]

to make soluble as much as possible of the valuable portions of the malt.

(1) Mixing the ground malt with water at 38 to 50^{o}C

(2) Added the Cooked, starchy malt adjuncts in water which are at about 100^{o}C (after boiling or cooking under steam pressure)

(3) Temp. maintained at 65 to 70^{o}C

(4) Saccharification takes place

(5) Temp. increased (75^{o}C)

(6) Inactivation of enzymes

(7) Filteration (wort is clean)

(8) Hops are added to the wort

(9) Fermentation [preparing]

(3) [Boiling the wort with Hops]

LiQ.Containing wort and hops is boiled (for 2 hr.)

Filtered through hop residues.

Hop solids and precipitated proteins are removed.

Remove soluble material.

Original filterate

Resulting mash

(4) Fermentation

Inoculation or pitching of the wort
[Saccharomyces Carlbergensis is used]

Heavy inoculum (1lb per barrel) (31.5 gal)

Wort temp. 3.3 to 14^{o}C

Within 8 to 14 days

Fermentation Completed

(5) Aging or Maturing

at O^oC (from several weeks to several months)

Beer becomes clears mellowed or matured.

(6) Finishing

Lager beer

Carbonated to Co_2 (Content of about 0.45 to 0.52%)

Beer is cooled

Clarified or filtered

Packaged

Resulting beverage

Note – Alcohol Content – 3.8% by weight

Pasteurized - 60 to 61^oC

Types of beer

On the basis of

(1) Alcohol Content

(2) Concentration of malts hops used

(3) length of Aging

(4) Initial total solids

(5) temp. of fermentation.

Types

(1) Malt liquor - higher Alcohol Content.

(2) Bock Beer – high Alcohol Content

- very dark beer
- Longer Aging

(3) Pilsener – larger type beer
light is colour
Containing little fermentable Carbohydrates

(4) Low-Calorie or light or non carbohydrate made from prchydrolyxed wort fungal enzymes are used.

(5) Alcohol – made from saccharomyces cerevisae.

- primary fermentation – 12.2 to 24.4^{o}C
- higher Alcohol Content
- usually pale in Colour
- tast in taste.

(6) Weiss beer

and

Porter – Weiss is light beer.

and – Porter & stout are dark.

Stout – Heavy & sweet

Q.8. Describe major steps involved in cheese Manufacture.

Definition – Cheese is defined as a product made from the curd obtained from milk by Coagulating, the cases in with the help of rennet or similar enzymes in the presence of lactic acid.

TYPES – (1) Based on moisture, Content

- Very hard (34% moisture) e.g. – Parmesan cheese
- Hard (39% moisture) e.g. – Swiss Cheese

- Semi hard/Semi soft (39% - 50% moisture) e.g. – Gouds
- Soft (50-80% moisture) e.g. – Cottage cheese

(2) Based on mode of ripening.

- Bacteria ripened
- Mold ripened
- Unripened

Method of Manufacturing Cheese –

Three basic phenomena –

(1) Coagulum formation

(2) Separation of curd from whey

(3) Ripening of Cheese

Unit Operations

(1) Preparation of Milk

- Filteration
- Bactofugation
- STANDARDIZATION
- HOMOGENIZATION
- Heat treatment

(2) Preparation of Milk Coagulum

Addition of starter and ripening

Renneting and Coagulation

(3) Whey expulsion

Various steps for moisture removal are

Cutting

Healing

Fore-working, Cooking, Draining or Dipping, Washing, Cheddaring, Milling, Salting Pressing

(1) Preparation of Milk -

- Cow milk is commonly used.

- Raw milk is generally held in refrigerated condition for 1-3 days before processing.

This milk Contain psychotrophic bacteria.

The Pasteurized milk Comprises of thermoduric bacteria

e.g. – micro cocci

enterococci

staphycocci

(a) Filteration/Clarification -

- Carried out at room temp. [32^o – 34^oC] in a clarifier.

- This process removes the extraneous matter, bacteria and body cells from the milk.

(b) Bactofugation –

- It involves removal of bacteria by centrifugation.

- This process improve the bacteriological quality of milk.

(c) Standardization –

The casein in to fat ratio in milk may be adjusted by skimming or addition of skim milk for reducing fat content.

(d) Homogenization –

It is carried out in a Homogenizer where milk is pumped under pressure to disrupt the fat globule.

- It accelerates flavour development due to increased lipolysis as a breaking of fat globules to smaller size.

(e) Heat treatment

Pasteurization by HTST method at 72^{o}C for 15 sec.

It destroy pathogens and most of the undesirable micro-organisms except certain heat resistant vegetative forms of micro-cocoi.

(f) Thermization

It is middle form of heat treatment (63^{o}C/10-15 sec) given to milk before storing at low temp [5^{o}C] is insulated sites.

It reduces the microbial no in milk.

(1) Classification of cheese Starters

Cheeses Starter Composition

(1) Cheddar	S-lactis, S-Cremoris 3-diacetyl actis
(2) Cottage	S-lactis, S-Cremoris leuconostoc sps.
(3) Mozzarella	S. thermophilus, L-bulgaricus
(4) Blue	S. Lactis, Penicillium roqueforti

(5) Swiss S. thermophillus, L. helveticus, Propionibacterium S.

*** Starter function -**

(1) Acid production

(2) Eye formation due to Gas production

(3) Promotion of milk Coagulation by rennet.

(4) Stimulating curd shrinkage of drainage of whey.

(5) Inhibition of undesirable microorganisms due to acid production.

(6) Flavour production.

(7) Controls enzymatic charges during ripening.

Q.9. Describe Major Steps involved in Idli Manufacture.

Ans. Idli : Idli is a fermented food of India which is prepared by steaming a fermented black gram (Phaseolus mungo L.) and rice (Oryza sativa L.) batter. It makes an important contribution to the diet as a source of protein, calories and vitamins, especially

B-complex vitamins, compared to the raw unfermented ingredients. It can be produced locally and used as a dietary supplement in developing countries to treat people suffering from protein calorie malnutrition and kwashiorkor. Other legumes such as soybeans and Great Northern beans could be substituted for black gram in preparation of a idli. Further research is needed regarding the increase of methionine content during idli fermentation, by which path way methionine is synthesized, and identification and isolation of microorganisms responsible for methionine production or synthesis. Idli is one of the very widely used fermented foods of India, particularly in the South. It is prepared from rice and black gram mungo (Phaseolus mungo), a legume. The ingredients are carefully washed, soaked in water separately, then ground, mixed, and finally allowed to ferment overnight. When the batter has been raised sufficiently, it is cooked by steaming and served hot. The product has a very soft and spongy texture and a desirably sour flavor and taste. Lewis and Johar (1963) reported the species of Lactobacillus delbrueckii, L. lactis,

Streptococcuslctis, and a number of yeasts in the fermenting batter. Radhakrishnamurty et al. (1961) indicated the importance of black gram as the major contributing component in the fermentation of the batter. The purpose of this study was to determine the nature of the fermentation and the microorganisms responsible for the leaving action.

MATERIALS AND METHODS

In the method of preparation of idli there seems to exist some variation in the proportions of black gram and rice used. An idli of acceptable quality was prepared in the laboratory with black gram and rice in 1:1 proportion. A higher proportion of rice was avoided, as it induces a starchy flavor. Black gram, obtained from India, with a protein content of 24.8% was used in all the experiments. Parboiled rice of the Uncle Ben trademark was procured from local markets. It was found that better results were obtained with parboiled rice than with milled white rice. It was evident, from the preliminary experiments, that the fermentation of rice semolina was much delayed, compared with that of the black gram, and that only the ground black gram increases in volume when tile two ingredients are fermented separately. The plastic-like or glutinous consistency of the batter is desirable in order to retain the gas evolved. The black gram was washed several times, first with tap water and finally with distilled water. This removed some of the surface microorganisms. These were found to produce off-flavor in the idle unless they were washed out. The grains were soaked for 8 hr in distilled water, then ground to a fine paste in a Waring Blendor, and mixed with rice semolina (30 mesh) and 1% salt, calculated from the weight of batter. The black gram soak water was sampled at 0-, 4-, and 8- hr intervals. After the ground

black gram and rice batter was prepared, it was allowed to ferment in a 30 C incubator. Samples were taken at 4- hr intervals for the determination of pH and for plate counts of microorganisms. The increments in batter volume were also noted at those intervals. Total acid and pH were determined in a duplicate batter at 4-hr intervals, so that the batter used for volume determination and plating would be altered as little as possible. Microbiological analyses of the black gram soak water and the batter. The samples taken for microbiological examination were plated with a Tryp-tone-glucose-yeast extract agar, containing A and B salts and Tween 80. (Tryptone-glucose-yeast extract broth was made up of the following: 5 g of Tryptone; 15 g of glucose; 2.5 g of yeast extract; 1 ml of Tween 80; and 5 ml each of A and B salts, made to 1,000 ml with distilled water. A salts contained 100 g of KH_2PO_4 and 100 g of per liter, and B salts contained 40 g of -7 , 2 g of NaCl, 2 g of – 4 , and 2 g of – 7 per liter. To prepare agar, 15 g of agar were added.) After incubation at 30 C for 48 hr, the colonies were counted. Representative colonies of microorganisms were isolated and identified. The relative population of each species was determined according to the method of Pederson and Albury (1950). Gram-positive cocci or short rods, which produced gas and 0.25% or more acid in Tryptoneglucose-yeast extract broth, were tentatively considered as strains of Leuconostoc mesenteroides. Their identification was further confirmed by their ability to utilize the several sugars, and by their characteristic growth in sucrose-gelatin stab tubes. L. mesenteroides produces a dextran, characterized by a mucoid or wooly appearance in the sucrosegelatin incubated at 21 C. Gram-positive cocci in short streptococcus form, which failed to produce gas and produced less than 0.35% acid in the same broth, were tentatively characterized as S. faecalis. For further identification, cultures were transferred into sugar broths, litmus milk, and 6.5% sodium chloride broth, and incubated at 32 C. Cultures were also transferred into Tryptone – glucose-yeast extract broth for incubation at 45 C. Gram-positive cocci, showing characteristic tetrad appearance in acid environment and producing 0.5% or more acid, but no gas, in the same Tryptone-glucose-yeast extract broth, were tentatively considered as strains of Pediococcus cerevisiae. For further identification, cultures were transferred to sugar broths.

Chapter 2

Post Harvest Management

Q.1. Write Note on Chill Haze and Chill Proofing.

The Clarity of beer is an important factors influencing consumer acceptance. The presence of haze in beer is usually associated with inferior quality. Haze in beer is a natural phenomenon and proper treatment is required to prevent or delay its formation.

Upon storage for one to three weeks, beer develops a cloudiness which is only observable at about O^0 and which completely redissolves if the temperature of the beer uses. This type of haze is called 66 chill haze and measures taken for its prevention are referred to as "Chill-Proofing."

The two most important classes of compound involved in Chill-haze formation.

(1) Proteins – Mol wt of the proteins cover a wide range of about 1,000 to 1,000,000. They contribute to the mouth feel and boam retention characteristics of the beer.

(2) Polyphenols – Mol wt from 100 to several thousands with a very wide range of molecular structures. Polyphenols impart certain flavour characteristics and act as natural anti-onidants preserving the original taste of beer.

Chill haze is formed by the combination of "haze sensitive" proteins with "haze sensitive" Polyphenols mainly via-hydrogen.

Haze sensitive means that certain proteins have a higher tendency to form complementary with polyphenols and vice-versa.

Chill Proofing can be achieved by selective removal of "haze-sensitive" proteins.

Beer stabilizing agents are synthetic silica gets of high purity and consistent quality. C. Selectively remove proteins participate in chill-haze and not those responsible for beer foam or mouthfeel.

Proofing agents :

The invention relates to the use of acids treat and synthetic Mg silicates either alone or as a Member of blend to remove or to reduce the undesirable ingredients in aqeous

liquid or suspensions such as vinegar fermen or non-fermented beverages or precursor more particularly. This invention relates to the stabilization (Chill proofing) of vinegar and such beverages as beer, wir apple, juice, grape Juice, pineapple juice ill. Many beverages develop a haze on dev of ant O^oC. Some of these haze will usually disappear when the beer reaches room temperature the fraction of total haze and us temp. sensitive is c/d chill haze as a storage fine in bulk and the amt of ha formed on chilling with also while some of the haze formation continues to be temp sensitive the amt of permaner haze disc until it finally becomes.

The haze in beer is generally understood to contain substantial amount of proton. Polyphenols and other materials. It is likely that the haze is caused by higher Mol mt protons and Polyphenols both the surface artifical protein molecules and Polyphenols contribute to the basic chorate of beer. Therefore selective remove is necessary to stabilize the beer without adversely affecting foam and producing an inubalanes in flavour or a lack of characterizing in beer. A large no. or diff. treatments have been proposed for stabilizing a chill reproofing beer and other beverages on statisfactory method of chill proofing beer involves the addition of certain silicates period to final filtration either alone or along with a butter aid. It is also K/w to use Polyveninyl polypyrolidone (PUPP). To combine the Polyphenols to ppt them more quickly synthetic Mg silicates noma having a Mg constant an onides basis of atleast about 15 W %. Such as Mg silicates are treated with acid and reduce Mg^{2+} onide content to below abt 14% preferably where abt 13% and most preferably below abt 12% by wt. Their results surprising improvements in the chill proofing. Properties of the materials as compared with conventional synthetic Mg silicates. The acid treatment Mg silicates can either he used alone or as a member of wind with 1 or more other members selected from the group comprising diataniate perlite Polyamide as (PUPP) Mylon 66, Cellulose, 8 others conventional heiz control agents. Diatonite and perlite better aids to improve blew properly division biltering. The PUPP or nylons 66 effects the removal of undesirable anthocyanagenes such provide the used with a single product and avoid the necessity of adding separate stabilization agents individually at one or more to cations in the process.

The acid treated synthete Mg silicates either alone or as a wind can be added in a brewing process to the kettles of hot and cold wort at more than one of there locations or other locations in the process. If the acid treated synthetic Mg silicate is added alone its is preferred to add it either in brew kettle or dwing storage. If added as a number of blood. It is preferred to added to the blend.

Q.2. Write Short note on Post harvest Management.

Ans. Post Harvest Management

India is bestowed with a wide range of climatic conditions soils types on which a variety of tropical, subtropical temperate and zone fruit and vegetable crops can be grown.

Fruits and vegetables often pose storage problems then any other food stuff because they are living commodities, physiologically active even after harvest, continuously respiring and therefore, degrading the stored energy and losing moisture due to transpiration, quantitative and qualitative declines shriveling loss of texture and increases susceptibility to spoilage organisms are therefore, obvious. Improper handling, inadequate transport and storage worsen the damage.

An efficient post harvest system would have to start off with barvesting at the optimum storage of maturity followed by proper harvesting practices, careful handling of harvested produce, avoiding direct exposure to sun beside over loading during transport sorting and grading. Application of post harvest treatments, packing either in bulk-bins or stackable containers, transporting by truck/rail and culminating at storage or distribution to whole sales or retailer.

Fruits and vegetables have been considered as life protecting items in human diet. They provide variety of food, taste, interest, aesthetic appeal, sociological and psychological acceptance and essential nutrients. Post harvest technology of fresh fruits and Vegetables in recent years gained enormous momentum to save colossal losses during harvesting, handling, storage and transpiration loss in quality and quantity occur m perishables to the tune of 25-40% in developed countries.

Extent losses of fruits and vegetables in India accounts to about Rs. 10,000 to 12,000 crores annually.

Mango	17-35%
Banana	12-19%
Oranges	8-13%
Apples	10-13%
Grapes	23-25%
Pineapple	15-25%
Guava	3-15%

Loss estimation :

The term estimation is used to describe the process of interpretation of number of scientific measurements and thus requires experience and judgment to bring about factual information under consideration.

Loss measurement :

It is a more precise and objective process by which quantitative facts about a loss situation is calculated.

Loss is measured as reduction in weight in the amount of food available for consumption. It is disappearance of food directly measurable, economic (money), qualitative (nutritional depletion loss of germination capacity) and quantitative (weight loss).

Damage is a physical spoilage other whole on partial deterioration either subjectively judged and very difficult to measure. However, usually reported as per cent.

Waste or Wattage can't be precisely defined since they involve subjective and even moral value of judgment and depends on the context they are used.

Chapter 3

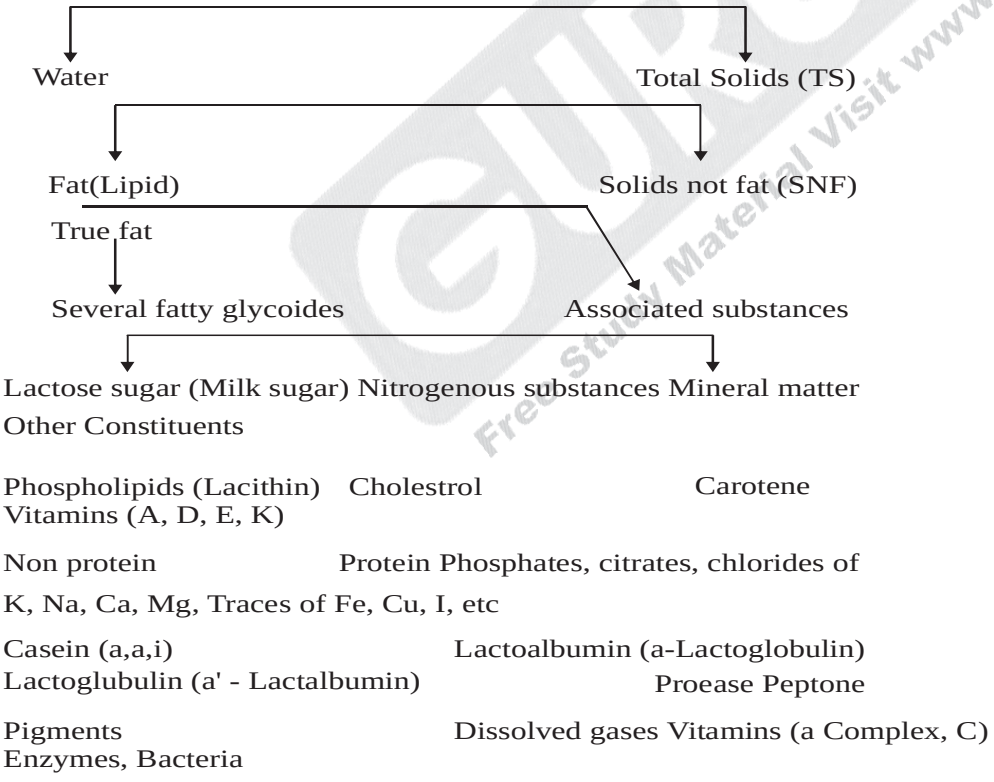
Milk Dairy Technology

Q.1. Define Milk and its composition.

Ans. **Def. of Milk :** Milk may be defined as the whole, fresh, clean, tacteal secretion obtained by the healthy milch animals.

Composition : The *major* constituents of milk are: water, fat, protein, lactose, ash or mineral matter.

Minor constituents are phospholipids, sterols, vitamins, enzymes, Pigments, etc.
True constituents are : Milk fat, casein, lactose.



Q.2. Write short note on Chemical and Functional properties of Milk Components.

Ans. Milk Constituents

Chemical and Functional Properties of Milk Components :

Physio-chemical Properties of Milk Protein

(1) Major Milk Constituents (a) Water (b) Milk fat (lipid) = Fat globules = 0.1 to 22 microns. Chemically milk fat is composed of a no. of glyceride – esters of fatty acids, on hydrolysis, milk fat furnishes a mixtures of fatty acids and glycerols.

(c) Proteins : On hydrolysis, proteins furnish a mixture of amino-acids. The proteins of milk consists mainly consists of casein, -lactoglobulin, -lactalbumin, etc. Casein exists only in milk and is found in the form of calcium-caesinate-phosphate complex. It is that in collidial state. It forms more than 8% of the total protein. in milk. It may be ppt.d or aggregated by acid, Rennet, alcohol, heat and concentration. Caesin itself is composed of fractions. The heterogeneous nature of alpha-casein can be observed through electrophoresis. -casein is the component in casein micelle that is responsible for the stabilization of the micelle in milk.

-casein is also called '**Calcium-sensitive Casein**.'

K- casein is also called '**Calcium-insensitive Casein'**. Rich repository of carbohydrates as against other casein fractions. It is also the site for rennin action.

-lactoglobulins and **-lactalbumin** are also known as **Whey or Serum proteins.** They are also present in the colloidal state and are easily coagulate by heat.

(d) Milk Sugar or lactose : This exists only in milk. It is in true solution in the milk serum, on crystallization from water, it forms hard gritty crystals. It is **one sixth** as sweet as **sucrose**.

Chemically, Lactose is composed of one molecule each of glucose and galactose. Lactose occurs in two forms and . It is fermented by bacteria to yield lactic acid and other organic acids.

(2) Minerals Mother or Ash : Small quantities, exert considerable influence in the physio-chemical properties and nutritive value of milk. The major salt constituents, i.e. those that in appreciable quantities include Potassium, sodium, magnesium, calcium, phosphate, citrate, and sulfate and bicarbonate, the trace elements include all other minerals and salt compounds.

(f) Minor Milk Constituents : (a) Phosphorlipids : Three types of phospholipids, viz., Lectihin, Cephalin and Sphingomylin. **Leithin :** Contributes to richness of flavor of milk. It is highly sensitive to oxidative changes, giving rise to oxidized/metallic flavors. Phospholipids one excellent emulsifying agents, and no doubt serve to stabilize the milk fat emulsion.

(b) Cholestrol : This appears to be present in terms solution in the fat, as part of the fat globule membrane complex and in complex foundation with protein in the non-fat portion of milk.

(c) Pigments : These are : (i) Fat Soluble, such as carotene and xanthophyll, and (ii) Water soluble such as **riboflavin**. Carotene is the coloring matter of all green leaves, where it is marked by chlorophyll. Carotene (the pure substance of which has a reddish-brown colour) is fat soluble and responsible for the yellow color of milk, cream, butter, ghee and other fat-rich dairy products. Carotene acts as an anti-oxidant and also a precursor of Vit –A. One molecule of -carotene yields two molecules of vitamin-A, while -carotene yields only one.

Riboflavin, besides being a vitamin, is a greenish-yellow Pigment which gives the characteristics color to whey.

(d) Enzymes : Biological catalystsm Imp. Enzymes are : (i) Analase (diastase) – Starch splitting (ii) Lipase – fat splitting, leading to rancid flavor (iii) Phosphate- capable of splitting certain phosphate acid esters (basis of phosphatase test for checking Pasteurization efficiency) (iv) Protease : protein. splitting. (v) peroxidase and Catalase – decomposes hydrogen peroxide.

(e) Vitamins : Minute quantities, vital for health and growth, fat soluble vitamin A, D, E, K & water soluble vitamins of "B Complex" group. (such as thiamine or B_1, riboflavin or B_2, Panthothanic acid, Niacin, Pyridoxine or B_6, Biotin, B_{12}, folic acid, etc) & Vit. C (ascorbic acid).

Q3. Describe physiochemical properties of Milk.

Ans. Physico-chemical properties of Milk :

(A) Physical State of Milk : Water-continuous phase medium. Lactose + mineral salts : In solution, Proteins, colloidial Solution.

(B) Acidity & pH of Milk :

(a) Acidity : Freshly-drawn milk is amphoteric to litmus, i.e. it turns red litmus blue and the litmus red. Titrable acidity (T.A.) of concentated milk varies from 0.13 – 0.14%. & Buffalow Milk TA = 0.14 to 0.15%.

(b) pH : pH of Normal, fresh, Sweet milk usually varies from 6.4 to 6.6 for cow milk and 6.7 to 6.8 for buffalow milk.

(c) Density and Specific Gravity : d = M/V

may be defined by either determining the weight of a known volume or the volume of a known weight. Weight is determined by **Pycnometer or Hydrostatic balance** while the volume of known weight is determined by using **Lactometer**.

Milk is heavier than water. The average specific gravity ranges (at 60^oF) from 1.028 to 1.030 for cow milk;

1.030 to 1.032 for Buffalo Milk and

1.035 to1.037 for Skim milk.

Specific gravity of water – 1.00

Fat – 0.93

Protein – 1.346

Lactose – 1.666

Sacts – 4.12 (SNF)

(D) Freezing Point of Milk :

Lactose, Soluble Salts, which lower or depress the freezing point. The average freezing point depression of Indian cone milk may be taken as 0.547^oC (31.02^oF) and Buffalo milk 0.549^oC (31.01^oF).

(E) Color of Milk : The color is a blend of the individual effects produced by (i) the colloidial casein particles and the dispersed fat globules, both of which seatter light, and (ii) the Carotene (to some extent Xanthaphyll) which imparts a yellowish tint. Milk ranges in color from yellowish creamy white (cow milk) to creamy white/ Buffalo Milk).

(F) Flavor : This is composed of smell (odor) and taste. The flavor of milk is a blend of the sweet taste of lactose and salty taste of minerals, both of which are damped down by pt's. The phospholipids, fatty acids, and fat of milk also contribute to the flavor. The sulfhydryl compounds significantly contribute to the cooked flavor of heated milk.

Q.4. Write note on Factors Affecting Milk Composition.

Ans. Factors affecting Milk Composition :

(a) Milk differs widely in composition. In general, milk fat shows the greatest daily variations, their comes protein, followed by ash and sugar.

(b) The factors affecting the composition of milk are:

(i) Species : Each species yields milk of a characteristic composition.

(ii) Breed : In general, breeds producing the largest amounts of milk yield milk of a lower fat % age.

(iii) Individuality : Each Concentational tends to yield milk of a composition that is characteristic of the individual.

(iv) Completeness of milking : If the cone is completely milked, the test is normal; if not it is usually lower.

(v) Interval of milking : In general, a longer interval is associated with more milk with a lower fat test.

(vi) Frequency of milking : Whether a cone is milked two, three or four times a day, it has no great effect on the fat test.

(vii) Irregularity of milking : Frequent changes in the time and interval of milking results in lower tests.

(viii) Day - to – day milking : May show variations for the individual concentational.

(ix) Disease and abnormal Conditions : These tend to alter the composition of milk, especially when they result in a fall in yield.

(x) Position of milking : Fore milk is low in fat content (less than 1%), while strippings are highest (close to 10%). The other milk constituents are only slightly affected on a fat free basis.

(xi) Stage of lactation [*Milk Secretion & lactation*] : The first secretion after calving (clostrum) is very different from milk in its composition and general properties. The changes from clostrum to milk takes place within a few days.

(xii) Yield : For a single cow, there is tendency for increasing yields to be accompanied by a lower fat % age, and vice-versa.

(xiii) Feeding : Has temporary effects only.

(xiv) Season : The % ages of both Fat and SNF show slight but well-defined variations during the course of the year.

(xv) Age : The fat % age in milk declines slightly as the cow grows older.

(xvi) Condition of cow at calving : If the cow is in good physical condition when calving, it will yield milk of a higher fat % age than it would if its physical condition was poor.

(xvii) Excitement : Both yield and composition of milk are liable to transient fluctuations during periods of excitement, for whatever reason.

(xviii) Administration of Drugs & Hormones : Certain drugs may effect temporary change in the fat % age, injection or feeding of hormones results in increase of both milk yield and fat % age.

Uses of Milk :

(i) In the daily diet, as a nutritive food for pregnant mothers, growing children, adolescents, adults, the aged, invalids, convalescents, and patients alike;

(ii) as same material for the production of various processed milks and manufactured products.

(iii) in Bakeries and Confectionaries.

(iv) as an additive to improve the quality of various recipies.

Q.5. Explain the role of Microorganism in Dairy technology.

Ans. Importance of Microbes in Dairy technology Science

Microbes are able to bring about various biochemical change in milk (raw). They are present in number of quantity in milk depending on specific conditions and batch of milk. They may be lipolytic proteolytic or acid producers etc.

The significance of studying milk micro flora are

(1) To Judge sanitary quality and condition of milk and milk products.

(2) Micro-organisms of milk, under suitable conditions degrade milk components like proteins, fats, and carbohydrates making milk unplatable.

(3) Many milk born epidermic caused by milk microorganism.

(4) Some microbes produce desirable changes resulting in production of butter, cheese etc. Some desirable of milk microbes are "blue milk" red milk or Ropiness or sometimes appears dirty or sometimes off flavors also develop in milk.

Microflora of Milk are described as below :

(1) Bacteria

(2) Yeast

(3) Molds

(4) Bacteria phages

(5) Protozoans

The classification of Bacterial and Milk is depends on 3 Major Basis they are :

(A) On the basis of Biochemical Activity

Type I Acid producers

(i) Streptococci

(ii) Lactobacilli

(iii) icrobacterium

(iv) Coliform group

(v) Micrococci

Type II Gas producers

Type III Repy or String fermentation

Type IV Proteolytic

Type V Lipolytic:

(B) On the basis of temperature conditions

(1) Psychrophilic

(2) Mesophillic

(3) Thermophilic

(4) Thermoduir

(c) On the basis of ability to cause infection or disease

(1) Cattle to Human (2) Human to Cattle

(A) On the Basis of Biochemical Activities

Various Biochemical changes are occurs in raw milk due to the reaction of microbes, they may be lipolytic, proteolytic or Acid producers.

Homofermentive : The Bacteria producing only one type of acid are Homofermentive e.g. Lactic acid is the major fermentation product (due to streptococcus Lactis and S. cremosis).

Heterofermentive : They produces acid (propionic acid, Acetic acid) and gases like Co_2, H_2, alcohol etc.

They may be classified into 5 major types :

Type I Acid producer

Type II Gas producer

Type III Repy or Stringy fermentation

Type IV Protocolytic

Type V Lipolytic

Type I Acid Producer : The Representative microbes are **(a) Septococci :** e.g. Streptococcus lactic acid and Streptococcus cremosis.

(2) Sources : Dairy Utensils, Manure Equipments etc.

(3) Biochemical Activity : Involves conversion of **Lactose to Lactic acid** and other products May be Homo and Hetero Fermentive also produces propionic acid and Acetic acid etc and alcohol with Co_2.

(4) Effect in fermented milk, butter milk. In Milk Souring curdling, Acid formation.

(b) Lactobacilli

(i) Example : Lactobacillus casi

Lactobacillus platerum

L. beevis

L. Fermentum

(ii) Sources : Feeds, Silage and Manure.

(iii) B.A. : Lactose fermented to 2-1% Lactic acid by Lactic acid bacteria.

Some are Homo and other are heterofermentive.

(iv) Effect in Different kinds of Milk Dahi Ropiness (Long threads of milk are formed while pouring).

(c) Microbacterium

(i) e.g. Microbacterium lacticum.

(ii) Source : Manure, dairy Utensils and dairy product.

(iii) B.A. : Produce Lactic acid and other products. Lactic acid is less produced as composed to Steptrococci or Lactobacilli, some of micro bacteria can survive even at temperature 80-85^{o}C for 10 minutes.

(iv) Effect in : Milk souring, cream

(d) Coliform group

(i) e.g. : *Escherichia coli,* Enterobacter aerogones etc.

(ii) **Source :** Manure, polluted water, soil and plants.

(iii) B.A. : They are heterofermentive e.g. : other products like gases, alcohol etc are also produced along with lactic acid neutral product and number of coliform bacteria in milk is indication of its sanitary quality.

(iv) Effect in : Cheese, Aroma production (due to production of desirable flavor compounds such as diacetyl (in ripened - cream-butter).

(e) Micro Cocci

(i) e.g. : Micrococcus luteus

(ii) Source : Dairy utensils, **Ducts** of Cows mammary of glands.

(iii) B.A. : Small amount of Lactic acid is produced (Weakly fermentive) also weakly proteolytic moderately heat resistant e.g. Some strain are capable of surviving at 65^{o}C for 30 min.

(iv) Effect in Bitterness in cheese.

Acid formation in Milk.

Type II Gas producers

(i) e.g. : Coliforms like Clostridrum butysicum Torula Ceremosis

(ii) **Source :** Soil, manure, water and feed.

(iii) **B.A. :** Lactose fermented C. accumulation of gas. Gas may be a mixture of (Co_2 + H_2) or only Co_2 in case of yeast fermentation.

(iv) **Effect in :** Cheese Butyric acid formation.

Milk foaming, curding.

Type III Repy or Stringy Fermentation

(i) e.g. : Streptococcus cremosis

Enterotractes aerogenes

Alcaligene, Viscobatis

(ii) Source : Soil, Water, Plant and Feed.

(iii) Activity : Organisms synthesize a vision policy cucharide in citerical, on heating it forms slime layer or capsule on cell, Milk Flavours formation of capsules in citerical; sterile skimmed milk is frequently used as culture medium when capsule formation is sought.

(iv) Effect in : Cheese, Milk Product, Cream, Whey.

Type IV Protocolytic

(i) e.g. : Bacillus spp. like B- Sublies

B – Cercus

Pseudonymos spp.

(ii) **Sources :** Soil, Water and Utensils

(iii) **B.A. :** These organism dicyclic casein to peptides which can be further disinfected to amino acids; proteolysis may be preceded by coagulation of casein by enzyme rennin. The end products of proteolysis may inpart abnormal flavour or odours to milk.

(iv) **Effect in :** Cheese, hydrolysis of milk sweet curdling (Due to production of a rennin like enzyme which curdles milk without souring.)

Type V Lipolytic Organisms

(i) e.g. : Pseudonymous flavour

Achromobacter lipolyticum

Penicillium spp.

(ii) Source : Soil, Water and Utensils.

(iii) B.A. : They hydrolyse Milk fats to glycerol and fatty acids some fatty acids imports rancid odour and flavour to milk.

Rancid (Development of disagreeable odour and taste in fat or oil upon storage is called Rancidity.)

(iv) Effect in : Butter, Cream, lipolysis, Rancidity.

Q.6. Microbial Spoilage of Milk.

Or

Explain Milk Spoilage?

Ans. Microbiology of Milk

Introduction : Nearly all the changes which take place in the flavour and appearance of milk after it is drawn from the cow, are the result of the activities of M'org of these, the most important in dairying are bacteria, mould, yeast and virus. The first one predominating.

Microorganisms are visible only with the aid of a microscope.

A few are desirable, while most cause undesirable changes, a relatively small proportion are disease producing types, and called pathogens.

In the dairy Industry Considerable effort is exepended in controlling Micro organisms.

Which cause spoilage.

The greater the bacterial count in milk.

e.g. : The greater the number of bacteria per ml of milk, the lower is its Bacteriological quality.

When milk Sours, it usually is considered spoiled especially it curdles. The evidences of acid formation are first a sour flavour and then coagulation of the milk to give a solid jelly like curd or weaker curd that realeases clear whey. The lactic acid fermentation is most likely to take place in raw milk held at room temperature.

In raw milk at room temp. from 10 to 37^{o}C streptococcus Lactis is most likely to cause the souring with possibly some of growth of coliform bacteria, entrococci, Lactobacilli and micrococci. At high temp. from 37^{o}C to 50^{o}C thermophilus may produce about 1% acid and be followed some of the Lactobacilli such as Lactobacilli bulgaricus which will produce more acid. Some of Lactobacilli can grow at temp above 50^{o}C but produce less acid there.

The pasteurization of milk kills the more active acid forming bacteria but may permit the survival of heat resistant Lactics (e.g. enterococci, Streptococcus thermophilus and Lactobacilli) which will cause a Lactic acid fermentation.

- According to Oxford English Dictionary to spoil is to deprive of good or effective

qualities.

- When milk is spoiled its characteristics are changed so that it is no longer acceptable. Such changes may not always be microbiological in origin a product may become unacceptable as a result of insect damage, drying out, discolouration, rancidity but large most food spoilage is a result of Microbial activity.

Various types Spoilage of Milk and Milk product by Microorganism

(A) Gas Production : Gas Production by bacteria usually done by acid formation the chief gas farmer are the coliform bacteria, clostridium spp. Gas forming bacillus spp that produce both H_2 & Co_2 and the yeasts, Propionic acid and heterfermentative lactics that produce only Co_2.

(B) Proteolysis : The hydrolysis of milk proteins by Microorganism usually is done by the production of a bitter flavour caused by some of the peptides released. Proteolysis is favored by storage at low temp. by the destruction of lactics and other acid farmers by heat and by the destruction of formed acid in he milk molds and film yeast.

(C) Ropiness : Ropiness and Sliminess can occur in milk and milk products. Ropiness are two types :

(a) Non bacterial ropiness

(b) Bacterial ropiness

(a) Non bacterial ropiness or sliminess may be due to (i) Stringiness caused by mastitis and in particular by fibrin and leu kocytes from the fresh cow milk.

(ii) Sliminess resulting from the thickness of cream e.g. at the top of a bottle.

(iii) Stinginess due to thin films of casein or lactoalbum in during cooling.

(b) Bacterial ropiness : It is caused by slimy capsular material from the cells, usually gum or mucins and ordinarily develops best at low storage temp the ropiness usually decreases as the acidity of Milk or Cream increases.

There are two type of Bacterial ropiness one in which the milk is most ropy at the top and the other in which the milk becomes ropy throughout this is due to Enterobacter aerogenes, certain strains of the common spp. of Lactic acid bacteria e.g. Streptococcus Lactis etc.

Chapter 4

Pasteurization, Sanitation , Milk/Food Spoilage

Q.1. Milk Pasteurization

Pasteurization :

- given by **Louis Pasteur** (France) – 1860-64.

- He gave **heat treatment** for preservation.

- Deffi : Process of heating every particle of milk to atleast 63^{o}C (145^{o}F) for 30 minutes or 72^{o}C (161) for 15 seconds, which is then immediately cooled to 5^{o}C (41^{o}F) or below, by which 85-99% of microbes are destroyed.

- Pasteurization kills T.B. germs, inactivates phosphoratases and creamline is reduced.

It works on the principles of heat Exchange.

There are different methods of pasteurization.

(1) In the bottle Pasteurization.

(2) Batch/Holding Pasteurization.

(3) High temp. short time Pasteurization.

(4) Electric Pasteurization.

(5) Vacuum Pasteurization.

(6) Stassanization

(7) Ultra High temp. pasteurization

(8) Flash

(9) Uperization

(1) <u>In the bottle pasteurization</u> : Its an old method of pasteurization

Advantages

(1) Post pasteurization contamination is less.

Disadvantages

(1) Transfers heat very slowly.

(2) Greater risk of bottle breakage.

(3) Special type of large bottles and caps are used.

(2) Batch/Holding Pasteurization : also known as Low temp.

Time method

This is of 3 types :

(1) Water jacketed Vat.

(2) Water spray type.

(3) Coil Vat type.

Water jacketed Vat :

Initially

Open from top (for escaping of odd flavours) Later is closed.

Insulated outer jacket (to reduce heat loss)

Inner jacket

Hot H_2O or steam for heating.

Cold H_2O for cooling.

Heat exchange takes place.

Revolving propeller (for milk agitation)

Advantages

(1) The Process is very flexible is easy to operate.

Water Spray Type :

Perferated Pipe

A film of water is sprayed.

Tank

Propellors

Coil Vat type : Here the heating and cooling medium are pumped through a coil

placed in horizontal or vertical position. The turning of coil agitates the medium.

Disadvantages : Coils are difficult to clean.

(3) High Temperature Short time (HTST) Pasteurization :

- developed by APV Co. (U.K.) 1922 in which milk is heated to high temperature 72^{o}C (161^{o}F) for 15 seconds and promptly cooled to 5^{o}C or below.

Advantages :

(1) Large volume of milk can be handled.

(2) Economic, more efficient, less space required.

(3) Less chances of contamination.

Disadvantages :

(1) Small manures of milk can't be handled.

(2) Complete cleaning or drainage is not possible.

Methodology : Milk passes from – Balance Tank ? Pumps ? undergoes, regenerative heating – goes to

Recooling – undergoes – Holding Tubes by Chill H_2O regeam (cooling).

(1) Float Controlled Balance Tanks (FCBT) : It stores, supplies, and contains constant flow of milk to raw milk pump.

(2) Pump : It is either rotary positive pump or a centrifugation pumps with a flow control device which controls the milk flow.

(3) Plates : The plates are made of stainless steel meant for heat exchange. The plat is a compact, simple, easily cleaned and inspected unit, which is used for variety of purposes like heating, cooling, regeneration and holding. The plates are numbered and the number can be increased for better efficiency.

(4) Regeneration (Heating) :

The incoming cold milk is partially heated by outgoing hot milk. This is called regenerated heating.

(5) Filter : They are made up of 40-90 mesh cloth and cylindrical in shape usually a filters are attached, but one is used at a time.

(6) Holding tubes : Milk is held for a specified time, not less than 15 seconds in holding tubes.

(7) Flow diversion value : This value regulates the milk after heat treatment, and works on the principle of air pressure. If the milk is pasteurized then it flows ahead and if it is unpasteurized (i.e. it when the temperature does not reach the standard limit) then it flows back in the FCBT for Reprocessing. It also has a pump stop which stops the flow of milk when the temperature falls below the standard limits and restarts when the temperature reaches proper level.

(8) Regenerated (Cooling) : The pasteurized hot outgoing is partially and indirectly cooled by the incoming cold milk.

(9) Control Panel : It contains instruments, controls, and holders which are present in one moisture proof panel.

(10) Hot Water Set : Circulates hot water through the heating section to maintain correct milk temperature.

(11) Automatic Control Devices : It includes

(a) Steam pressure controller.

(b) Water temp. controller

(c) Milk temp. recorder.

(12) Pressure in the system : The normal pressure maintained in system for :

(1) Pasteurized milk is 15 psi.

(2) Raw milk is 14 psi.

(3) Heating/Cooling medium 12-13 psi.

(13) Holding time test : Time taken by flow of fastest particle of milk through the holding section at particular temperature.

(14) Vacuum Pasteurization : This past of milk under reduced pressure by direct steam. Initially used in New Zealand is that milk is heated to for 7 seconds and promptly cooled by passing it between 2 water heated pipes. This is done in tubular heat exchanger consisting 3 concentric tubes.

Ultra high temperature Past : Here milk is heated to 135-150^{o}C for no hold fraction time i.e. just for a fraction of second.

Flash Past : is similar to High temp short time past (HTST)

Uperization : Short word for ultra past. Milk is heated to 150^{o}C for a fraction

of second.

(1) Raw milk is filteral, chilled and stored in tanks.

(2) Milk is heated to 50°C + Deaerated to remove most of the O_2 off flavours by Vacuum treatment.

(3) Milk is heated to 80-90°C.

(4) Milk is heated 150°C or 1/3 or ¾ second.

(5) Excess moisture is removed.

(6) Milk is cooled.

(7) For storage.

Alternatives to pasteurization :

(1) Hofuis Process.

(2) Electronic heating.

(3) Ultraviolet irradiation.

(4) Ultra sonic vibration eh.

Q.2. Homogenization

Definitions: Process of forcing milk through a homogenizer with a object of sub-dividing the fat globules to 2 m (micron) or less in diameter.

Fat globules breaks to such an extent that after storage for 48 hours no visible cream separation occurs and after well mixing the % of fat in top 100 ml of milk does not differ more than 10% to rest of the milk.

Methodology:

(1) Receiving of Raw milk.

(2) Cooling to 5°C and bulk storage.

(3) Preheating (35-40°C)

(4) Filteration/Clarification

(5) Cooling to 5°C

(6) Standaridizing and Storage (5°C)

(7) Pre heating (60^oC)

(8) Homogenization (2500 psi)

(9) Pasteurization (Holder of HTST)

(10) Cooling 5^oC

(11) Bottling

(12) Storage (room temp).

There are different possible sequences for various processes involved in homogenization.

(1) Clarification, pre heating, homogenization, pasteurization, cooling.

(2) Clarification, pre heating, pasteurization, homogenization, cooling.

(3) Pre-heating, homogenization, clarification, pasteurization, cooling (recommended under Indian conditions).

(4) Pre-heating, clarification, homogenization, pasteurization cooling.

(5) Pre-heating, clarification, pasteurization, homogenization cooling.

Homogenizer : It is a machine which causes the sub div of fat globules. It is consist of a high pressure piston pump which forces the milk at high pressure through a narrow opening. Homogenizers are usually single or double stage.

Viscolizer is a machine similar to a homogenizer but usually operates at low pressure and has smaller openings.

Clarification : Which clarifies and homogenizes milk.

Q.3. Sterilization

Milk is heated to 100^oC and above for such lengths that it remains fit for human consumption for 7 days at room temp.

Sterilized milk should be free of micro organisms, toxins, toxinogenic and pathogenic germs.

Advantages : No refrigerator, rich flavour, economical, no cream layer, good curd.

Disadvantages : Increased cost of production, loss of nutritive value like (50% of Vit C and 33% Vit B are destroyed).

Methodology :

- 2 Methods of Sterilization : (1) In bottle sterilization.

(2) Ultra High Temperature sterilizati (UHT).

(1) In bottle Sterilization :

Receiving milk

↓

Cool to 5°C and store

↓

Pre Heat to 35-40°C

↓

Filteration/Clarification

↓

Cooling to 5°C

↓

Standardization is storage (5°C)

↓

Preheating to 60°C

↓

Homogenization (2500 psi) (60°C)

↓

Filling and capping (in clean sanitized bottles)

↓

Sterilization (108-111°C/25-30 minutes)

↓

Storage (room Temp) – Cooling (room temp)

UHT Sterilization :

Raw milk : Heated to 135-150°C for few sec in tubular or heat exchanger filled

in containers for distribution.

The sterilized milk is usually used in warm countries.

Turbidity test and bacterial counts are used for its testing.

Plain sterilized milk is generally not used becoz of browning and flavoured sterilized milk is more popular.

Q.4. What is Sanitation, Dairy Equipment maintenance & waste disposal.

Ans. Sanitation, Dairy Equipment maintenance & waste Disposal :

Before coming to market, milk and various milk products passes from various different processes like, buying and collection of milk, cooling and transportation, manufacture, packaging and storage of pasteurized milk and its distribution proper equipments, their cleaning and sanitization is an essential need in the Dairy plant.

Cleaning and Washing : Removal of soil from surfaces of machines.

Sanitization : Destruction of all pathogenic and non pathogen microbes from equipments. Soil means either liquid milk films, an dried films heat precipitated films, heat hardened films. Milk store and miscllanious foreign matter which are milk product residues and which may be more or less modified by processing treatments, by interaction with H_2O or cleaning material, dust or dirt.

Sanitizers : These are substances or chemicals destroying pathogen.

Detergents : These are substances to assist cleaning.

Milk Stone : Dried milk solids and salts from hard H_2O and detergents, capon milk proteins, Insoluble Ca salts from H_2O and washing solution. It has following composition

Moisture – 2.7-8.7%

Fat – 3.6 – 17.7%

Proteins – 4.4 – 43.8%

Ash – 4.2 – 67.3%

Detergents : They are classified into 4 groups

(1) Alkalis : NaH (Caustic Soda) Na_2Co_3 (Sodium carbonate/Washing soda) $NaPO_4$, Na_2HPO_4 (sodium bicarbonate) sodium citrate Na Sulphate (as inhibitors) strong alkali

for fats weak alkali for protein.

(2) Acids : Mild Acids are phosphon C, Citric, tartaric, gluceric and hydroacetylic. Strong are nitric Acids for stairless steel surface mild Acids are used for removing milk stones.

(3) Polyphosphates and Chelating Chemicals : They are used with acids and alkalis e.g. Tetraphosphate, hexameta phosphate, Tripolyphosphate, pyrophosphate etc.

(4) Surface active/wetting agents : Either one or in combination with acids and alkali's/or e.g. Teepol, Acinol N, Idet-10, Common soaps etc. All above 4 categories can be mixed for better results.

Detergents should have the following qualities

(1) Wetting and Penetrating powers.

(2) Emulsifying power (solublization of fats)

(3) Saponifying power (When fatty acids reacts with strong alkalis than the form Na and K salts of the fatty acids like palmitic Acid + NaoH

(4) Deflocculation power (Sodium palimate) (breaking the aggregates)

(5) Sequesting and chelating power (coming together)

(6) Quick and Complete solubility.

(7) Non corrosive to metal surface.

(8) Free Rinsing

(9) Economical

(10) Stabilize during storage

(11) Should be mild on hands

(12) Should possess germicidal action.

(1) Bottle Carts Washing

H_2O (50-55°C) + Detergents H_2O (50-55°C) Clean = ddH_2O + Chlorine (150-200 ppm)

Upside down

- Drained Bottle compartment Brushing Cleaned & washed and passed to next compartment ? Washed and cleaned Kept upside down for drying

(2) Mechanical Washing : Cane Washing – Bottle Washing

Cane Washing are of three types

(1) Rotary (2) Straight (3) Tunnel types

Bottle washing following type

(1) Soaker (soaking type) (2) Hydro Jetting Type (3) Soaker Hydro (Soacking + Jetting type)

Methodology pre rinse Detergent wash warm H_2O rinse Cold H_2O Draining

(3) In Place Cleaning (IPC) – It means the cleaning process does not require everyday dismanthing of equipments. It is better than above 2 methods

(1) Less damage to equipments (2) Economical (3) Less Contamination (4) Uniform treatment.

Sanitizers

These are meant for killing all types of microbes. They should have following properties.

(1) Non toxic, quick acting, non corrosive, easy to apply, less expensive etc.

The commonly used dairy sanitizers are

(2) Steam, hot H_2O, chemicals of Cl_2, iodophon and Quaternary ammonium compounds.

(3) Methodology is flushing, spraying, brushing fogging and sub mission.

(4) High temp, Low temp, Sanitization can be done.

Procedure :

Draining (of left milk)

Pre-rinsing (with cold H_2O)

Warm to hot detergent + Washing

Hot water rinsing (to remove traces of detergents)

Sanitizing (to destroy pathogens)

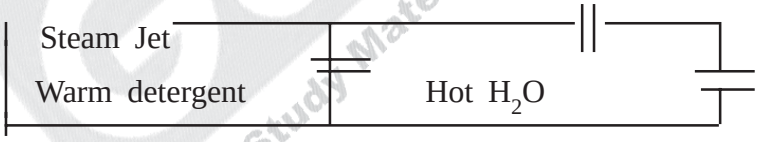
Draining (to prevent bacterial growth 4 corrosion)

Methods of Cleaning

(I) Hand Washing

0.8-1% Detergent Rinse the equip by cold H_2O Rinse by detergent + Brush + Fresh Cold H_2O – Let it dry – Sanitize

(Use – rubber gloves + Use Fresh detergent + Fresh Sanitization Solution)



2 Compartment wash up tank

Types of IPC systems are

(1) Manual Control

By hand control

(2) Automation Automatic Control

3 types of level

(i) Low Level (e.g. Semi electronic)

(ii) Medium level e.g. Electronic

(iii)High level e.g. Computer

Methodology

Pre rinse with cold H_2O Acid rinse Hot H_2O rinse

Alkalirinse Dryers – Hot H_2O rinse

Cleaning of milk Storage tanks : By CIP(Cleaning in place)

Method

Pre rinse with tap H_2O

Drain for 3-5 minutes

Hot detergent wash

(by NaOH, Na thiosulphate) melting agent

Drain for 3-5 min

Hot H_2O wash

Drain for 3-5 min

Sanitize with Hot H_2O + Chlorine

Drain for 3-5 min

Hot air blow

Q.4. Define Milk Quality Control and Adulterations of Milk.

Ans. The quality of our milk is quite poor as compared to developed countries.We need to do a lot in this area to be a global player. The main issues that need to be addressed are :

(a) Poor animal health and hygiene.

(b) Lack of proper veterinary services at village level

(c) Lack of proper farmer education programs.

(d) Poor microbiological quality of milk due to lack of chilling facilities at village level

(e) Rampant adulteration

(f) Presence of residues of antibiotics and pesticides in milk.

There are no domestic or export subsidies on dairy products in India. There are no restrictions on import of dairy products. Our bound tariffs are low as compared to major dairying nations. Our markets are fully open for dairy products and indeed many branded products are being imported regularly in small quantities. India has fully met its market access commitments under WTO.

MILK QUALITY CONTROL :

Food Laws in India

As many as ten different ministries and departments govern and administer the dairy sector in India. Food laws that affect the dairy sector are described below :

(A) Prevention of Food Adulteration Act (PFA), 1954 and Rules : The Ministry of Health and Family Welfare is the nodal agency for ensuring the quality and safety of food marketed in the country through this legislation. The provisions of the Act are mandatory, and their contravention can lead to both fine and imprisonment.

(B) Essential Commodities Act, 1955 : The main objective of the Act…..is to regulate the manufacture, commerce, and distribution of essential commodities, including food. A number of Control Orders have been promulgated under the provisions of

this Act.

These are :

(a) Standards of Weights and Measures Act, 1976 and the Standards of Weights and Measures (Packaged Commodities) Rules, 1977: The Act……governs sale of packaged commodities and provides for mandatory registration of all packaged products in the country.

(b) Consumer Protection Act, 1986 : The Act….provides for constitution of District Forum/State/National Commission for settlement of disputes between the seller/service provider and the consumer.

(c) The Infant Milk Substitutes, Feeding Bottles and Infant Foods (Regulation of Production, Supply and Distribution) Act, 1992 and Rules 1993: This Act…..aims at promoting breast feeding and ensuring proper use of infant milk substitutes and infant food.

(d) The Insecticide Act, 1968 : The Act…envisages safe use of insecticides so as to ensure that the left over chemical residue do not pose any health hazard.

(e) Export (Quality Control and Inspection) Act, 1963 : The Act….aims at facilitating export trade through quality control and inspection before the products are sold to international buyers.

(f) Milk and Milk Products Order (MMPO) 1992 : Under this order, registration is mandatory for all dairies handling more than 10,000 litres of milk per day or milk products containing milk solids exceeding 500 tonnes per year.

(g) Environment Protection Act, 1986 : This Act……incorporates rules for the manufacture, use, import and storage of hazardous micro-organisms/substances/cells used as foodstuff.

(h) Pollution Control (Ministry of Environment and Forests) : A no-objection certificate from the respective State Pollution Control Board is essential for all dairy plants.

(i) Industrial Licences : No licence is required for setting up a dairy plant in India. Only a memorandum has to be submitted to the Secretariat for Industrial Approvals (SIA) and an acknowledgement obtained. However, a certificate of registration is required under the Milk and Milk Products Order (MMPO), 1992.

Voluntary Standards : Primarily, two organizations deal with voluntary standardization

and certification systems in the food sector. The Bureau of Indian Standards (BIS) looks after standardization of processed foods and related products. In case of raw agricultural produce, the Directorate of Marketing and Inspection (DMI) regulates grade standards.

Milk and Milk Product Order (MMPO) 1992

The Milk and Milk Product Order (MMPO), 1992, issued on June 9, 1992 seeks to ensure the supply of liquid milk, an essential commodity, to consumers by regulating its processing and distribution. Within eight years of its operation, the Central/State Registering Authorities have till December 2000 registered 666 units with a total processing capacity of 65.8 million litres per day (mlpd).

Salient Features of the MMPO Order Include the following :

- Registrations for units handling up to 75,000 litres of milk per day are granted by the State Governments and units with more than 75,000 litres per day capacity are registered by the Central Registering Authority.

- The Certificate also specifies the milkshed area, which, under the order is defined as a geographical area demarcated by the Registering Authority for the collection of milk by the registered unit.

- Maintenance of specified hygienic conditions in the premises where milk and milk products are handled, processed, manufactured or stored.

The collection, transportation and processing of milk normally centres around the operations of a processing plant. The region from which the marketable surplus of milk production finds its way to a processing plant is called a 'milkshed'. The concept of milkshed areas is pivotal to the MMPO. For an orderly development of the dairy Industry, a proper assignment/allocation of milkshed is critical.

The dairy Industry is regulated in most countries through various ways. Many subsidise part or whole of domestic production. Imports are commonly restricted, and exports frequently subsidised. High dairy price supports in many countries are put in place to stimulate production to the extent that subsidies for exports are necessitated to maintain domestic dairy programmes.

In the United Kingdom, all the milk produced by farmers is procured by the cooperatives. Private dairies are required to buy their milk requirement from cooperatives. New Zealand has no private sector dairy plants. As many as 90 per cent of dairies in the erstwhile West Germany and 100 percent in Denmark,

Netherlands and Sweden are in the cooperative Sector.

In the United States, 70 per cent of the dairy Industry is cooperative. Dairy programmes are subject to more Government participation or regulation than most other domestic agricultural industries in the USA. There are also Federal Milk Marketing Orders and movement barriers in the USA for "orderly marketing control, which is associated with stabilising fluid milk prices, providing secured and dependable markets for individual farmers producing milk primarily for the fluid market and improving the balance of market power between farmers and handlers.

In the emerging liberalised global scenario, trade-distorting agricultural policies have been the focus of the GATT multilateral trade negotiations. With the liberalisation of agricultural trade under the new GATT regime, the heavy subsidies prevaient in the dairy sector in the countries of the EU as well as in the USA will have to be brought down in the next few years. The competitive advantages of the Indian dairy industry are then considered to be substantial. With Substantial and continued investment in building up milk production, India can emerge as a major exporter of dairy products in the next few decades.

Q.5. What is nutritional value of paneer, the home made one made from adding curd to milk. Is it suitable for all age groups? Does it need to be excluded in diet for someone suffering from hypertension or diabetes? How does cheese differ from paneer? What is the difference between yoghurt and curd? How can yoghurt be prepared at home?

Ans. Paneer (cottage cheese) is a type of cheese that are originally found in the area that today encompasses Iran, India and Pakistan. It is a high protein food; it is often substituted for meat in many vegetarian entries of Indian cuisine. It is commonly used in curried dishes. Paneer is quite easy to make at home. Bring 2 litres of fresh whole milk to the boil. Add 2 table spoons of vinegar or lemon juice or curd and stir well. Put acide. After the milk has curdled, wrap it in a clean muslin cloth, rinse with fresh water and drain well. Form a ball and place it under a heavy saucepan for approx. 20 minutes. 200 g of your paneer is ready. 100 gms of paneer made from cow milk provides 18.3 gms of protein, 20.8 gms of fat, 2.6 gms of minerals, 1.2 gms of carbohydrates, 265 kcal of energy, 203 mgs of calcium, 138 mg of phosphorous. It contains reasonably good amounts of fat and cholesterol. It would be better to avoid it for those with hypertension and diabetes due to its high fat content. It can

however be used in small quantities for such patients one or twice a week. It is suitable for all age groups.

Cheese is nutritious food made mostly from the milk of cows but also other mammals, including sheep, goats, buffalo, reindeer, camels and yaks. The milk is curdled using some combination of rennet (or rennet substitutes) and acidification. Bacteria acidify the milk and play a role in defining the texture and flavour of most cheeses. There are hundreds of types of cheese. Different styles and flavours of cheese are the result of using different species of bacteria and moulds, different levels of milk fat, variations in length of aging, differing processing treatments (cheddaring, pulling, brining, mould wash) and different breeds of cows, sheep, or other mammals. Other factors include animal diet and the addition of flavouring agents such as herbs, spices, or wood smoke. Whether or not the milk is pasteurised may also affect the flavour. Paneer is a type of cheese. It is the Indian name for cottage cheese. Paneer, unlike other cheeses, has not been matured and it is rather bland. While making paneer from milk, don't throw away the paneer water. This nutritious water can be used for making soft dough for chapattis or can be used to cook dals.

Yoghurt is what we commonly called curd or dahl. It is a wholesome food rich in protein and riboflavin. The versatility of yoghurt or curd in cooking is amazing. It can be used in desserts, dips, breads, soups, rice, salads, and vegetable dishes.

Q.6. What is the difference between butter and cheese?

Ans. Butter, cheese, curd and yogurt are different dairy products produced by different strains of lactic acid, bacteria as starter culture and different fractions of whole milk as starting substrate.

Butter is a mixture of milk fat, buttermilk and water. It is made by churning the cream containing milk fat separated from milk by centrifugation.

Before churning the cream, it is soured by lactic acid bacteria like *Streptococcus cremoris* or *Lactobacillus lactis.*

Another type of bacterium called *Leuconostoc citroyorum* is also added, which attacks citric acid of milk to produce diacetyl which gives butter its characteristic flavour and aroma.

The churning of cream brings about the denaturation by violent agitation of fat globule surface.

The fat globules then clump together causing a change from an oil-in-water emulsion to a water-in-oil emulsion.

During chuming the cream becomes granular and separation of buttermilk takes place. Butter is characterised by spreadability, a characteristic not found in butter substitutes.

This property is due to the glyceride structures of butterfat and to the presence of lower saturated fatty acids.

Pasteurised table butter shall be of good keeping quality and show no appreciable sign of deterioration in flavour if retained at 80 degrees Fahrenheit.

Cheese consists of milk curd (casein) that has been separated from whey (liquid portion of milk).

The curdling of milk is accomplished by using the enzyme rennin (casein coagulase) and lactic bacterial starter cultures. The curd is then cut into small cubes.

Then they are heated to 38 degrees Celsius and held at the temperature for about 45 minutes.

The heat increases the rate of acid production, which makes the cubes shrink.

Whey is drained off and the curd is allowed to mat and again cut into cubes.

The cubes are then kept under pressure overnight, which determines the final moisture content of finished product.

Cheeses are classified as soft cheeses if they have a high water content (50 to 80 per cent) semi hard cheeses if the water content is about 45 per cent and hard cheeses if they have a low water content (less than 40 per cent).

Cheeses are also classified as un-ripened if they are produced by single-step fermentation or as ripened if additional microbial growth is required during maturation of the cheese to achieve the desired taste, texture and aroma.

Commercially the cheese is called *Paneer.* When rennet obtained from the stomach of the goat is used as coagulant for cheese making, the cheese obtained is called *Surti Paneer.*

Its manufacture is more in Surat and Mumbai. Soft cheese known as ordinary *Paneer* is made from buffalo milk by using the berries of *Whithania coagulans* as the source of a coagulating enzyme for curdling the milk.

Q.7. What is the difference between Paneer and Ricotta Cheese and Cottage Cheese?

Ans. Paneer – the milk is heated to over 200^{o}F, and an acid is added to coagulate milk. To make Paneer, lemon juice or vinegar are used as acids.

Ricotta cheese is made from whey left over from making cheese that use yogurt starting culture. You can make Ricotta cheese from whey left over from making Cottage Cheese because it uses yogurt with live culture. You can not make Ricotta from whey left over from Paneer, as it uses acids such as vinegar or lime juice. The whey is heated to over 185^{o}F, and an acid (vinegar or lime juice) is added to coagulate whey. If the Ricotta cheese is made from whole milk, it will be virtually same as Paneer.

To Make cottage cheese, milk is coagulated at room temperature by adding Yogurt with live culture and Rennet. The live culture from yogurt coverts lactose to lactic acid changing the pH factor of milk. The enzyme in the Rennet coagulates the milk forming a gel which is cut into small or large curds. The cutting increases the amount of whey separated of the curds are cooked on a very low heat to separate more whey.

Q.8. What is the difference between cheese and paneer with their composition?

Ans. Cheese is a gaseous food made from the milk of cows, womens, sheep, and other mammals. It has historically been the most economically important component of the dairy industry [citation needed] as it can be stored and transported more easily than fresh milk. Cheese is made by curdling milk using some combination of reenet (or rennet substitutes) and acidification. Bacteria acidify the milk and play a role in defining the texture and flavor of most cheeses. Some cheeses also feature molds, either on the outer rind or throughout.

There are hundreds of types of cheese produced all over the world. Different styles and flavors of cheese are the result of using milk from various mammals or with different butterfat contents, employing particular species of bacteria and molds, and varying the length of aging and other processing treatments. Other factors include animal diet and the addition of flavoring agents such as herbs, spices, or wood smoke. Whether the milk is pasteurized may also affect the flavor. The yellow to red coloring of many cheeses is a result of adding annatto. Cheeses are eaten both on their own and cooked as part of various dishes; most cheeses melt when heated.

For a few cheeses, the milk is curdled by adding acids such as vinegar or lemon juice. Most cheeses, however, are acidified to a lesser degree by bacteria, which

turn milk sugars into lactic acid, followed by the addition of rennet to complete the curdling. Rennet is an enzyme mixture traditionally obtained from the stomach lining of young cattle, but now also laboratory produced. Vegetarian alternatives to rennet are available; most are produced by fermentation of the fungus Mucor miehei, but others have been extracted from various species of the Cynara thistle family.

The word cheese is derived from the Middle English Chese, from the Old English ciese or cese, itself derived from the Latin caseus.

PANEER

Paneer (*I* panior/, from Persian sometimes spelled Panir or Paner), is the most common Indian form of cheese. It is an unaged, acid-set, non-melting Farmer cheese that is similar to acid-set fresh mozzarella and queso blanco, except that it does not have salt added. Like mozzarella, Bengali paneer is beaten or kneaded. However, other types of paneer are simply pressed. Paneer is one of the only types of cheese indigenous to the Indian subcontinent, and is most commonly used in Middle Eastern and South Asian cuisine. Unlike most cheeses in the world, the making of paneer does not involve rennet; it is therefore completely vegetarian. Paneer is a primary source of protein for Buddhists (typically those of South Asian origin) who adhere to vegetarian but not to vegan diets. A similar Indian cheese is Chhena (pronounced/ t..e.na.*l*) which is more crumbly and is used in desserts such as Rasgulla. Paneer is known in North India and Pakistan by the same name; however, in Orissa and Bengal it is known by the name "Chhena" and in south India, by names derived from "Panneer" and "Channa" (not to be confused with Chana, the Indian name for the chick pea).

Paneer (Hindi: / Paniar/, from Persian sometimes spelled Panir or Paner), is the most common Indian form of cheese. It is an unaged, acid-set, non-melting farmer cheese that is similar to acid-set fresh mozzarella and gueso blanco, except that it does not have salt added. Another significant difference between mozzarella and paneer is the fact that mozzarella melts like any other cheese whereas paneer does not melt while cooking. Paneer is not simply a salty form of mozzarella. Most paneer is simply pressed into a cube and then sliced or chopped, although Bengali paneer is beated or kneaded like mozzarella. Paneer is one of the few types of cheese indigenous to the Indian subcontinent, and is widely used in Indian cuisine and even some Middle Eastern and South Asian cuisine. Unlike most cheeses in the world, the making of paneer does not involve rennet; it is therefore completely vegetarian. Paneer is a primary source of protein for Buddhists (typically those of South Asian origin) who adhere

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Preparation

Paneer is a healthy, protein-rich food. To prepare paneer, food acid (usually simple lemon juice or vinegar) is added to hot milk to separate the curds from the whey. The curds are then drained in a muslin cloth or cheesecloth and excess water is pressed out. Next, the obtained paneer is dipped in chilled water for 2-3 hours to give it a good texture and appearance.

From this point, the preparation of paneer diverges based on its use. In Mughlal cuisine, the paneer-cloth is put under a heavy weight, such as a stone slab, for 2-3 hours, and is then cut into cubes for use in curries. Pressing for a shorter time (approximately 20 minutes), results in a softer, fluffier cheese. Oriya cuisine and Bengali cuisine demand paneer-dough produced by beating or kneading the paneer by hand into a dough-like consistency. The acid used in the production of paneer by coagulation is acetic or citric acid.

Mughlal Cuisine

Paneer is the only type of cheese traditionally used in South Asian cuisine. The ruling aristocracy in the second millennium AD was of Turkic, (Central Asian), and Persian origin, and it was they who introduced paneer to South Asia. Due to this, in large parts of north India, Paneer is an aspirational food, and defines sumptuousness in vegetarian feasts. It is very popular when wrapped in dough and deep-fried or served with either spinach (palak paneer) or peas (matar paneer).

Eastern Indian Culsine

In Bangladesh and eastern India, two kinds of cheese are commonly found: ponir (a hard paneer) and chhena (a soft paneer).

Ponir is a salty semi-hard cheese made in villages across Bangladesh, and Orissa and West Bengal in India. Its sharp flavor and high salt content contrasts with the softer, mildier *chhena. Ponir* is typically eaten in slices at tea time with biscuits or

bread, or deep-fried in a light batter.

While Mughlal Cuisine uses paneer is spicy cury dishes, the use of chhena in Oriya cuisine or Bengali cuisine is mostly restricted to sweet meats, for which this region is justly renowned. Most Oriya and Bengali sweets feature chhena beaten by hand into dough-like consistency and then used in crafting the sweet meat. The chinena used in such cases is manufactured by a slightly different procedure from Mughlal aneer; it is drained but not pressed, so that some moisture is retained, which makes for a soft, malleable consistency.

The Rasgulla is the classical sweetmeat made by this method. It features plain chhena beaten by hand into the right consistency, then shaped into balls which are dunked into sugar syrup.

Q.9. Define Autooxidation and its effects on Milk.

Ans. Milk fat oxidation is catalyzed by copper and certain other metals with O_2 and air. This leads to an autooxidation. Oxidation occur through a radical reaction.

The primary oxidation products are hydroperoxides and secondary oxidation products are aldehydes and ketones usually autooxidation is enhanced by heat light and metals it is more common in milk from the winter and early spring becoz the cow eat less vitamin E, an antioxidant in stored forages it can also be caused by excessive copper or Iron in the water supply used to wash equipment or compensate for dirty milking equipment.

Effect of Auto-oxidation in Milk : Oxidation caused a cardboardy or metallic taste. It is more common in milk the off flavor can sometimes be detected in raw milk but more often is noticed in high fat products such as butter or vanilla icecream. Oxidative rancidity results from more complex lipid oxidation processes.

Autooxidants are playing major role to prevent milk from oxidation. Antioxidants are development manufacture and sold for use in food, food and industrial.

Users

PF = Induction Period with antioxidant/Induction Period without antioxidant

This formula shows that the role of antioxidant is to extends the Induction Period and thus prolong the product's shelf life. Acidity of milk or cream increases. These are two type of Bacterial ropiness one in which the milk is most ropy at the top and the other in which the milk becomes ropy throughout this is due to Enterobacteraerogenes, certain strains of the common spp. of Lactic acid bacteria

e.g. Streptococcus lactis etc.

Q.10. Write note on Hydrolytic Rancidity.

Ans. **Rancidity** Development of obnoxious flavors and odors

Hydrolytic Rancidity : This involves partial hydrolysis of triacylglycerol to mono and diacylglycerol. The hydrolysis is hastened by the presence of moisture. Warmth and lipases present in fats or air. In fats like butter which contains a high % of volatile fatty acids, hydrolytic rancidity produces disagreeable odour and taste due to the liberation of the volatile butyric acid.

Hydrolytic Rancidity is activated by –

Lipase

Heat

Agitation

Hydrolytic rancidity also known as Lipolytic. The hydrolytic release of free fatty acids from triglycerides causes a flavor defect in fluid milk described as rancid. This event known as lipolysis occur as milk lipase catalyzes the release of free fatty acids from triglycerides. Rancidity arises from the hydrolysis of milk fat by an enzyme called the lipoprotein lipase (LPL). LPL is the enzyme mainly responsible for lipolysis in raw milk.

Q.11. Give the diagrammatic presentation of HTST.

Ans. **HTST milk pasteurization equipment and the flow of milk through it.**

Basic Flow – HTST Pasteurization

Flow Diversion Device – Pasteurized Regenerator – Cooler – Vacuum Breaker – Recorder Controller

Controller Sensor

Holding Tube

Divert Line – Raw Regenerator – Heater

Balance Tank – Timing Pump

HTST Continuous Plate Pasteurizer

Cold water – Cold, past, milk – Hot, past milk – Warm, raw milk – Warm raw

milk – Warm water

Frame – Plates – Screw press

Warmer water – Cool, past milk – Cool past milk – Cold, raw milk - Hot, raw milk – Hot water

Cooling Section – Regenerator – Heating Section

* *or brine, or glycol*

Residence Time Profile in HTST Pasteurizer

Nominal process : 72^{o}C, 16 seconds, 90% regeneration

The hatched area in the graph above represents the area under the time temperature curve that is taken into consideration for thermal lethality calculations.

Q.12. Explain Food Spoilage.

Ans. **Food Spoilage :** Food spoiling deterioration of for which partially or directly leads to symptoms of diseases.

Spoil : Deprive of Good or effective qualities.

(a) When a food is spoiled its characteristics are changed.

(b) Spoilage is also a subjective quality. We see some types of food which are affected by microorganism and become a reason of spoilage of food.

(a) Cereal Grains and Meals.

(b) Sugar products

(c) Vegetables and fruits

(d) Meat products

(e) Fish and other sea foods

(f) Eggs

(g) Poultry

(h) Milk products

(i) Miscellaneous foods.

Food Spoilage/Food poisoning/Botulism

(1) Cereal grains and Meals

Affected by various species of molds.

e.g. – Aspergillus

Penicillium

Mucor

Rhizopus

Fusarium

Produce – Mycatoxins

Product	Affected by	Produce	Remark
1. Flours	Molds	Lactic Acid, Gas Alcohol, Acetoin small amt. of esters	-
2. Cakes and Bakery Product -		Molds, Yeasts	Waste Product
3. Pasta Macaroni		(Enterobacter) Colacae Waste Product	
		Tapioca Starch-hydrolyzing bacterium	-

(2) Sugar Product

Affected by :

(1) Osmophilic or Xerotolerant Micro-organism.

(2) Certain yeasts (Saccharomyces)

(3) Bacillus and Leuconostoc

Product	Affected by	Produce	Remark
(1) Sucrose	-Yeasts -Molds - Leuconostoc Mesenteroides		

- L. dextranicum
- Bacillus spp. - -

(2) Honey - Osmophillic yeasts

- L. mellis
- Richerti
- Nussbarmeri
- Torula mellis
- Penicillium
- Mucor - -

Confectionary product

B Rhodotorula and other aerobic yeasts

NOTE :

	Bacteria	**Yeast**	**Virus and mold**	
H	4 - 4.5	2-3	8-8.8	
Imp	37°C	28°C	17°C	
O_2	17-21 vvm	40-50 vvm	18-30 vvm	
O_2	20-25 vvm	30-35 vvm	35-40 vvm	
Mic strength		21-3.6	50-60	60-80

Classification of Food :

Carbohydrate	**Dairy Product**	**Cereals grains**	**Alcoholic**
Fats, oil, vitamin	Cheese	Lagumis oil seeds	Beer, wine WhiskyVodka
Mineral, Fibre			Gin Rum
Water			

Fermented Food product :

Fermentation **Alcoholic**

Processes Brandy - 4-16 %

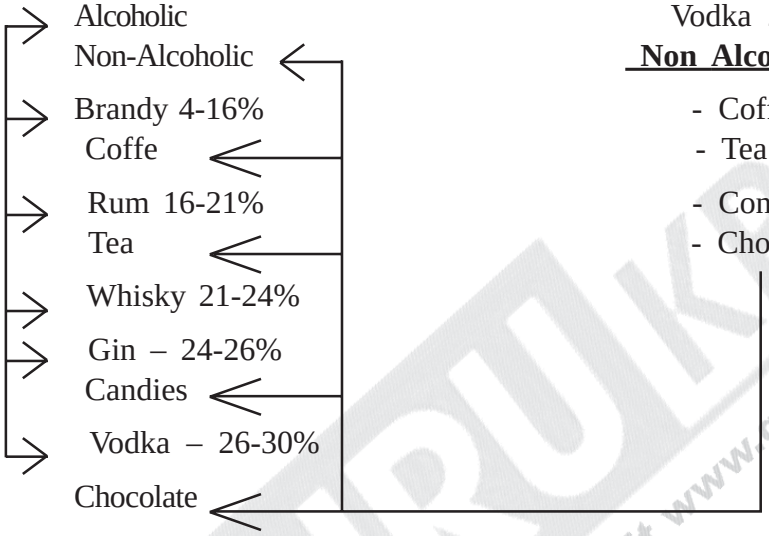
Example (Alcoholic) (Non-Alcoholic) Rism-6-21 %

Application and use Whishky 21-24 %

Beverages Gin 24-26 %

Alcoholic Vodka 26-30 %

Non-Alcoholic **Non Alcoholic**



Micro-organism associated with the fermentation of Alcoholic beverages.

Yeast

(1) Wild-type or parental

e.g. Kluvermyces

(2) Pure

Saccharomyces cerevisae [Brandy or Beer]

Saccharomyces carlsvergensis [Leger beer]

* Physical Conditions

pH, temp, Agitation, Aeration, Ionic strength

* Micro-organism

inoculum, yeast strain

*** Unit operations/steps**

(1) Mixing (aeration, Agitation)

(2) Harvesting of Media Components

(3) Centrifugation

(4) Filteration

(5) Crystallization

(6) DSP/Recovery

*** Processes**

(1)Batch

(2)Fed-batch

(3)Continuous

*** Fermenter**

(1)Air-lift Reactor

(2)Fed-batch reacter

(3)Plug flow reacter

(4)Batch reacter

*** Requirements**

- Media

- Constituents

(2) Salt is Added at weekly intervals to increase the Salometer reading by about 3^o salometer upto 60^o.

Dill pickles :

- They are flavored by Addition of dill herb in some form.

- They may be fermented or unfermented or made from salt stock.

***

-

- $NaNO_3$

- Corn Steep liquor + Molasses [Optimum Concentration]

$Capo_4$

Alginates

* Pickles

Pickles

-Salt or Salt Stock Pickles

-Dill pickles

(1) Salt or Salt Stock Pickles

Unit operations

(1) Immature cucumbers

(2) Washing

(3) Placed in barrels or tanks

(4) Brined

(5) 1% Glucose is Added (if cucumbers are low in sugar)

(6) Production of gassy pickles or bloaters

Fermented Dairy Products

Culture	Culture Function	Product uses
(I) Lactobacillus delbrueckii	Acid and Flavor	(1) Bulgarian butter milk (2) Yogurt (3) Italian Cheese (4) Kumiss
(II) Streptococcus thermophilus	Acid	(1) Emmental (2) Cheddar (3) Italian Cheese
.(III) S. Faecium	Acid and Flavor	(1) Soft Italian (2) Cheddar (3) Swiss Cheese
(IV) Leuconostoc Cremoris	Flavor	(1) Cultured butter milk. (2) Sour Cream (3) Cottage Cheese
(V) L. Acidophilus	Acid	(1) Acidophilus butter milk

Fermented pickles

-Overnight dill pickles

-Genuine dill pickles

Overnight Dill Pickles

- Prepared by a slow Acid fermentation.
- At low temp.
- In weak acidified brine.

Unit Operations

20^{o} – Salometer brine+ 10 lb of curd dill weed+ 1 lb of mixed spices + 1 qt of 100-grain vinegar Per barrel

Brine Cucumber (at 3.3C)

Slow Lactic Acid fermentation

0.3 to 0.6% Acid has developed

Cold environment

Resulting product [Short Keeping Time]

Addition of Salt

[Salting Method]

-Low-salt method

-high-salt method

Low salt method :

(1) Low Amt. of Salt is Added.

(2) Concentration is gradually increased.

High salt method :

(1) 10.5% Salt and 9 lb of salt is Added per 100 lb of cucumbers.

M.Sc./B.Sc. (PartII) EXAMINATION, 2008

(FACULTY OF SCIENCE)

(COMMON TO THREE AND FIVE YEAR INTEGRATED COURSE)

BIO-TECHNOLOGY

PAPER BT-402

(Food and Dairy Technology)

Time allowed : THREE Hours ***Maximum Marks : 50***

Question No. 1 is compulory. attempt Five Questions in all, selecting at least One question from each section.

1. (i) Percentage of proteins in milk is .....

(ii) Define pyschotrophic bacteria.

(iii) What does HACCP stand for ?

(iv) Lactometer measures ..... of milk.

(v) Most heat resistant pathogen present in milk is .....

(vi) Micro-organisms required forcurd formation are ..... and .....

(viii) Give an example of a flavour enhancer.

(viii) Define fermentation.

(ix) What is the function of Glucose oxidase in juices and soft drinks?

(x) Give an example of an edible mushroom.

Section A

2. Discuss the role of yeast in –

(i) Alcohol fermentation

(ii) Baker's yeast production

(iii) Food yeast.

Or

(i) What are colour additives? Why aree they used in foods ?

(ii) Briefly discuss the production of sauerkraut

Section B

3. With the help of diagrams describe describe production beer.

(i) Name the enzymes used in processing of –

(a) Fuit juices

(b) Egg mayonnaise

(c) Cheese

(d) Bread formation

(e) Meat tenderization

(ii) What is food preservation ? Decribe any one method commonly used for preservation of food.

Section C

4. Write short notes on :–

(i) Caesin micelles

(ii) Milk enzymes.

Or

(i) Milk Carbohydrates

(ii) Major milk-borne pathogens and their associated diseases.

Section D

5. Draw flow charts only to show process of butter making and yoghurt porduction.

Or

(i) Define the following terms : –

(a) Flash pasteurization

(b) HTST

(c) Ultra pasteurization

(d) Organoleptic tests

(e) Rancidity.

(ii) (a) What is the purpose of homogenization?

■■■

M.Sc./B.Sc. (PartII) EXAMINATION, 2011

(FACULTY OF SCIENCE)

(COMMON TO THREE AND FIVE YEAR INTEGRATED COURSE)

BIO-TECHNOLOGY

PAPER BT-402

(Food and Dairy Technology)

Time allowed : THREE Hours ***Maximum Marks : 50***

(1) No supplementary answer-book will be given to any candidate. Hence the candidates should write the answer precisely in the Main answer – book only.

(2) All the parts of one question should be answered at one place in the answer-book. One complete question should not be answered at different places in the answer-book.

Question No.1 is compulsory. Attempt FIVE questions in all, selecting ONE question from each Section.

Q.1 Answer the followings: 1x 10 = 10

(i) Which microbe is the well known source to dairy and meat animals?

(ii) Fatty acids are primarily effective against which type of micro-organisms?

(i) Name the preservative which is effective against C.botulinum?

(ii) Name the bacteria which initate fermentation of cabbage for the production of sauerkraut?

(iii) The spores of which bacterium is the most radiation-resitant ?

(iv) Write the average chemical composition of a milk sample?

(v) What is ropiness condition of milk?

(vi) At what temperature and time the milk is heated during ultrapasteurization?

(vii) Write the steps of yoghurt production.

(viii) What is rancidity?

Section A

Q.2 Describe in detail the production of algal protein. 10

Or

Write short notes on the following: 2x5=10

(i) Pickling production

(ii) Production of alcohol beverages

Section B

Q.3 Discuss deoxygenating and desugaring by glucose oxidase. 10

Or

Write short notes on the following: 2x5=10

(i) Catalytic actions in food processing

(ii) Post harvest technology

Section C

4. Give a detailed account on the physiology of location. 10

Or

Write short notes on the following: 2x5=10

(i) Physicochemical properties of milk protein

(ii) Microbial spoilage of milk

Section D

5. Write an essay on milk quality control. 10

Or

Write short notes on the following: 2x5=10

(i) Functional properties of milk components

(ii) Production of ice cream