

Handbook on Fermented Foods and Chemicals

Author: NPCS Board of Consultants & Engineers

Format: Paperback

ISBN: 9788178331379

Code: NI233

Pages: 672

Price: Rs. 1,875.00 US\$ 150.00

Publisher: Asia Pacific Business Press Inc.

Usually ships within **5** days

Numerous foods are prepared by fermentation processes in which one or more kinds of microorganisms are responsible for the characteristic flavour or texture, and sometimes for the keeping quality of the product. The manufacture of fermented food products is carried out on a small scale in homes in every country. Fermented products are more palatable and are not as easily spoiled as the natural products. The microorganisms that produce the desirable changes may be the natural flora on the material to be fermented, or may be added as starter cultures.

The yield of organic acids principally lactic, serve as a preserving agents. Lactic acid fermentation is an anaerobic intramolecular oxidation reduction process. Both homofermentative and heterofermentative lactic acid bacteria participate in food fermentations. In some fermented food products, yeasts and moulds also participate along with lactic acid bacteria.

Most of the reactions in living organisms are catalyzed by protein molecules called enzymes. Enzymes can rightly be called the catalytic machinery of living systems. The real break through of enzymes occurred with the introduction of microbial proteases into detergents.

Most of the enzymes are produced by microorganisms in submerged cultures in large reactors called fermentors. In choosing the production strain several aspects have to be considered. Industrial enzyme market is growing steadily. The reason for this lies in improved production efficiency resulting in cheaper enzymes, in new application fields. Tailoring enzymes for specific applications will be a future trend with continuously improving tools and understanding of structure-function relationships and increased search for enzymes from exotic environments. This field deals with how are the enzymes used and applied in practical processes. A lot of fungal, bacterial and actinomycete strains with potential for producing novel industrial enzymes have been identified.

This book contains sterilization, fermentation processes, aeration and agitation, use of yeast, yeast production, fermentation raw materials, production of bacterial enzymes, bread making methods, effluent treatment, production of actinomycete protease, lactic acid, citric acid. This handbook will be very helpful to its readers who are just beginners in this field and will also find useful for upcoming entrepreneurs, existing industries, food technologist, technical institution etc.

Contents

1. The Development of Inocula for Industrial Fermentations

Introduction

The development of inocula for yeast processes

Brewing

Baker's™ Yeast

The development of inocula for bacterial processes

The development of inoculum for fungal processes
Sporulation on Solidified Media
Sporulation on Solid Media
Sporulation in Submerged Culture
The Use of the Spore Inoculum
Inoculum Development for Vegetative Fungi
The Effect of the Inoculum on the Morphology of Fungi in Submerged Culture
The development of inoculum for streptomycete processes
The aseptic inoculation of plant fermenters
Inoculation from a Laboratory Fermenter or a Spore Suspension Vessel
Inoculation from a Plant Fermenter

2 An Introduction to Fermentation Processes

Lactate
Acetaldehyde
Acetalactate
Butanediol
Ethanol
The range of fermentation processes
Microbial Biomass
Microbial Enzymes
Microbial Metabolites
Transformation Processes
The chronological development of the fermentation industry
The component parts of a fermentation process

3. Sterilization

Introduction
Medium sterilization
Advantages of Continuous Sterilization over Batch Sterilization
Advantages of Bath Sterilization over Continuous Sterilization
The design of batch sterilization processes
Calculation of the Del Factor during Heating and Cooling
Calculation of the Holding Time at Constant Temperature (121°C)
Richards's™ Rapid Method for the Design of Sterilization Cycles
The Scale Up of Batch Sterilization Processes
Method of Batch Sterilization
The design of continuous sterilization processes
Sterilization of the fermenter
Sterilization of the feeds
Sterilization of Air
The Theory of Fibrous Filters
Filter design

4. Media for Industrial Fermentations

Introduction
Typical media
Medium formulation
Water
Energy sources
Carbon sources
Examples of Commonly Used Carbon Sources
Factors Influencing the Choice of Carbon Source

The Influence of the Carbon Source on Product Formation

Nitrogen sources

Examples of Commonly Used Nitrogen Sources

Factors Influencing the Choice of Nitrogen Source

Vitamin sources

Nutrient recycle

Buffers

The addition of precursors and metabolic regulators to media

Precursors

Inhibitors

Inducers

Oxygen requirements

Fast Metabolism

Rheology

Restricted nutrient levels

Antifoams

5. Aeration and Agitation

Introduction

The oxygen requirements of industrial fermentations

Glucose

Oxygen supply

Determination of K_{La} values

Gassing-out techniques

The static method of gassing out

The dynamic method of gassing out

Fluid rheology

Bingham Plastic Rheology

Pseudoplastic Rheology

Dilatant Rheology

Casson Body Rheology

Factors affecting K_{La} values in fermentation vessels

The Effect of Air-Flow Rate on K_{La}

The Effect of the Degree of Agitation on K_{La}

The relationship between K_{La} and power consumption

The relationship between power consumption and operating variables

The Effect of Medium and Culture Rheology on K_{La}

Medium rheology

The effect of microbial biomass on K_{La}

The effect of microbial products on aeration efficiency

The Effect of Foam and Antifoams on Oxygen Transfer

6. Mushrooms

Mushrooms and single-cell (microbial) protein

Production of the oyster mushroom, *Pleurotus* Species

Methods of Cultivation

Economics of Industrial Production

Growth of *Pleurotus Ostreatus* on Waste Paper

Growth of *Pleurotus ostreatus* on waste paper

Production of *Volvariella volvacea*: straw mushrooms

Description

Patterns of Production and Consumption

Steps in Production

Factors Controlling Mushroom Production
Harvesting and Preservation
Discussion of Processing Steps
Preservation of Straw Mushrooms
Nutritional Content
New Microbial Strains
Expansion of Straw Mushroom Production
Edible termitomyces and their culture in the laboratory
Collection and Identification of Termitomyces Species
Culture of the Edible Species
Effect of Culture Media on Mycelia Growth
Effect of Light, Temperature, and pH on Mycelial Growth
Spawn Formation
Fruiting Body Formation
Results and Discussion
Isolation in Pure Culture
Effect of Culture Media
Effect of Temperature
Effect of Light
Effect of pH
Spawn and Fruiting Body Formation

7. Use of Yeast in Baking

Historical Introduction
Function of yeast in baking
Leavening
Effect of Yeast on Dough Development
Flavour Development
Forms of yeast used in baking
Compressed Yeast
Active Dry Yeast
Yeast for Home Baking
Yeast of Enrichment
Behaviour of yeast in dough systems
Use of Yeast in Various Dough Systems
Growth of Yeast in Doughs
Accelerated Processing of Yeast-raised Products
Yeast-leavened, Unbaked, Frozen Doughs
Sour Doughs

8. Distillers' Yeast

Introduction
Raw materials
Yeast preparation
Distillers' Yeast
Inoculation of Yeast Mash from Preceding Mash
Inoculation of Yeast Mash with Laboratory Pure Cultures
Use of Compressed or Active Dry Bakers' Yeast
Distillers' fermentations
Contaminants
Distillation
Composition of distilled spirits

9. Brewers'™ Yeast

Introduction

General characteristics of brewers'™ yeasts

Specific characteristics of brewers'™ yeasts

Flocculation

Wild Yeasts

Yeasts Cultivation and Pitching

Nitrogen Metabolism of Brewers; Yeast

Vitamin Requirements

Mineral Requirements

Fermentation of Wort Sugars

Effect of Temperature and Other Variables on Rate and Time of Fermentation

Growth of Yeast

By-products of alcoholic fermentation

Higher Alcohols (Fusel Oils)

Esters

Diacetyl, Acetoin, 2, 3-Butanediol, and 2, 3-Pentanedione

Aldehydes

Glycerol

Acids

Sulfur Compounds

Processing

Generation of Heat

Batch Fermentations and Modified Batch Fermentations

Continuous Fermentation

Microbial Stability of Beer

Adsorption of Isohumulone and Anthocyanins by Yeast

10. Wine Yeasts

History

Wine yeast terminology

Description of species

Natural yeasts and their occurrence in grapes and musts

Fermentation by natural yeasts and by wine yeasts

Production of wine yeast starters

Compressed wine yeast and active dry wine yeast

Biochemistry of wine yeast fermentations

Rate of Fermentation

Effect of Temperature

Fermentable Sugars in Musts and Yield of Ethanol

Effect of Carbon Dioxide Pressure on Fermentation

Effect of Ethanol on Fermentation Rate

Effect of pH on Rate of Fermentation

Sulfur Dioxide

Diethyl Pyrocarbonate (DEPC)

Sorbic Acid and p-hydroxybenzoic Acid Esters

Tannins

Ion-exchange Resins, Antibiotics and Fungicides

By-products of the alcoholic fermentation, flavor compounds, acids and yeast nutrients

Introduction

Alcohols

Aldehydes

Glycerol, 2,3-Butylene Glycol, Acetoin and Diacetyl

Esters
Malic Acid and the Malo-lactic Fermentations
Acids
Nitrogenous Compounds
Sulfur Compounds
Vitamin Requirements of Wine Yeasts
Production of wines
Introduction
Red and White Table Wines
Sherry
Sparkling Wines
Fermentation of Uncrushed Grapes (Maceration Carbonique)
Continuous Fermentation
Cider and Other Fruit Wines

11. Bakers'™ Yeast Production

History
Outline of the manufacturing process
Raw materials
Molasses
Minerals
Vitamins
Nitrogen
Fermentation Activators
Fermentation Inhibitors
Principles of aerobic growth of bakers'™ yeast
Introduction
Concentration of Fermentable Sugars
Limitation of Yeast Growth Rate
Oxygen Requirements and Aeration
Effect of pH
Temperature
Yield Energy, and the Development of Heat
Osmotic Pressure
Yeast Concentration in the Fermenter
Periodicity and Budding
Practice of the aerobic growth of bakers'™ yeast
Fermentation Tanks
Cooling
Aeration Systems
Feed Rates
Sequence of Fermentations
Defoaming
Utilization of Ethanol
Automatic Process Control
Continuous Aerobic Propagation of Bakers'™ Yeast
Harvesting of Yeast Cells
Mixing, Extruding and Packaging Compressed Yeast
Contamination
Stability of Compressed Yeast
Active Dry Yeast

12. Lactic Acid $\text{CH}_3\text{CHOHCOOH}$

From whey by Fermentation
Reaction
Material Requirements
Process
From Lactonitrile
Use Pattern
Miscellaneous
Economic Aspects

13 Citric Acid
From Molasses by Fermentation
Reaction
Material Requirements
Process
By Submerged Fermentation
Use Pattern
Miscellaneous
Economic Aspects

14. A Milk-Bottle Fermentation

15. The Fermentor: An Elaborate Milk Bottle

16. Fermentation Raw Materials

17. A Typical Industrial Fermentation

18. Production of Actinomycete Protease by Solid-State Fermentation and its Application in Dehairing of Goatskin
Introduction
Materials and methods
Isolation of Proteolytic Soil Actinomycetes
Dehairing of Goatskins
Analyses
Determination of Protein
Protease Assay
Results
Isolation of Proteolytic Soil Actinomycetes
Discussion

19. Fermented Vegetables
Introduction
Theory behind fermented vegetables
Indian or oriental fermented vegetables
Fermented vegetables of the west
Advantages of Fermented Vegetables: Disadvantages of Fermented Vegetables

20 Production of Bacterial Extracellular Enzymes by Solid State Fermentation
Introduction
Materials and methods
Bacterial Strains
Enzyme Production in SSF
Amylase Production vs. Incubation Period

Effect of Moisture Level
Effect of Various Additives
Solid State Cultivation in Trays
Enzyme Assays
Results and discussion

21. Fermented Products

General procedure

Tips

Simple Bread

Method

Round bread

Method

Tiger Skin Bread

Method

Seasoned Bread

Method

Malteser Bread

Method

French Bread

Method

Tips

Rich bread

Method

Cinnamon Sugar bread

Method

Other bread

Method

Potato barm bread

Method

Bread (sponge & Dough Method)

Method

Toast/ Rusk

Method

Rusk

Method

Tip

Bun / Roll

Method

Soup Stick

Method

Plaited Bun: Winston

Method

Plaiting with 2-strings

Plaiting with 3-strings

Plaiting with 5-strings

Plaiting with 4-strings

Plaited with 6-strings

Winstone

Tip

Seli Bun

Method

Basic sweet dough

Method
Butterfly bun
Method
Nutty Rolls
Method
Jam filled buns
Method
Cheese cake
Method
Hot cross bun
Method
Dutch bread
Method
German coffee cake
Method
German Coffee Cake (Coconut)
Method
Yeast raised fruit cake
Method
Doughnut
Raised doughnut
Method
Cake doughnut
Method
Combination doughnut
Method
Variation
Fruit finger doughnut
Jam ball doughnut
Masala doughnut
Pitza
Pitza base
Method
Vegetable Pitza
Method
Gravy Pitza
Method
Variations
Chanou Pitza
Method
Assembling (Base and Filling)
Surti Butter
Method
Stuffed Products
Burger
Tip
Variation
Tips
Sandwich
Method
Tips
Variations
Tips

Stuffed rolls
Method
Danish Pastry
Method
Filling Preparation
Variety " 1
Variety-2
Danish comb
Method
Cinnamon roll
Method
Croissant
Method
Pinwheel
Method

22. Bread Characteristics

Introduction
External characteristic
Volume
Bloom
Crust Colour
Factors Affecting the Crust Colour
Evenness of Bake
Factors Affecting Evenness of Bake
Oven Break
Factors Affecting Oven Break
Internal characteristics
Crumb Colour
Factors Affecting Crumb Colour
Crumb Structure
Factors Affecting Crumb Structure
Crumb Clarity and Elasticity
Crumb Clarity
Crumb Elasticity
Sheen and Texture
Sheen
Texture
Taste and Aroma
Factors Affecting Taste and Aroma
Moistness
Factors Affecting Moistness
Cleanliness
Bread faults
Introduction
External faults
Faults in Volume
Lack of Volume
Excessive Volume
Faults in Crust
Lack of Crust Colour
Dark Crust Colour
Cracking of Crust

Leathery Crust
Hard Crust
Thick Crust
Blisters
Lack of Bloom
Shell Top
Irregularity of Shape
Lack of Cleanliness
Internal faults
Holes and Tunnels
Core, Seams, Streaks & Condensation Mark
Damp, Clamy & Closed Crumb
Dryness and Rapid Staling
Crumbliness of the Crumb
Defects in Taste and Aroma
Summary of bread faults and their causes
Bread diseases
Introduction
Rope
Bacteria Responsible
Symptoms
Sources of Contamination
Moulds
Types
Causes
Preventive Measures
Chemical Inhibitors
Germicidal Ultraviolet Rays
Recommended Bread Making Practices
Cleaning
Raw Material
Fermentation
Baking
Cooling
Contact Surface
Packing
Storage
Re-entry of State Bread
Customers
Bleeding Bread
Food Poisoning
Salmonella
Sources
Symptoms
Prevention
Streptococcus
Staphylococci
Variety bread
Introduction
French Bread
Italian Bread
Vienna Bread
Dutch Bread

Raisin Bread
Rye Bread
Egg Twist Bread
Cracked Bread
Process control
Fermentation
Proofing
Staleness in bread
Introduction
What is Staleness?
Characteristics of stale bread
Types
Crust Staling
Causes
Preventive Measures
Crumb Staling
Causes
Improper Quality Raw Material
Improper Bread Processing
Improper Packing and Storage
Retardation
Ingredients
Processing
Freezing
Use of Additives
Bake shop emergencies
Introduction
Yeast problem
Shortage of Yeast
No Yeast in the Dough
Too Much Yeast
Salt problem
Dough without Salt
Too Much Salt
Too Much Sugar, Shortening or Milk
Overweight of Flour or Water
Late Mixing

23. Other Fermented Products

Introduction
Bun goods
Raw Material
Processing
Prepared Mixtures
Pitza base/crust
Raw Material
Processing
Doughnut
Raw Material
Procesing

24. Bread Ingredient

Introduction

Raw material
Flour
Colour
Strength
Tolerance
Water Absorption Power
Uniformity
Diastetic Activity
Effect of Low and High Diastetic Activity on Bread
Preventive Measures

25. Bread Making Methods

Introduction
Conventional methods
Straight Dough Method
Advantages and Disadvantages
Sponge and Dough Method
Advantages and Disadvantages
Salt Delayed Method
Advantages and Disadvantages
No Dough Time Method
Advantages and Disadvantages
Ferment and Dough Process
Mechanical dough development method
Liquid Brew

26. Bread Processing

Introduction
Ingredient selection and formula balancing
Mixing/Kneading
Purpose
Flying Ferment
Process
Importance
Other Preparation
Dough Temperature
Mixing Process
Hand Mixing
Machine Mixing
Slow speed mixing
High speed mixing
Spiral mixing
Mixing Stages
Mixing Time
Flour Quality
Bread Making Method
Dough Temperature and Consistency
Fat and Salt Quantity and Stage of its Addition
Over or Under Mixed Dough
Over Mixed Dough
Under Mixed Dough
Physical and Chemical Changes During Mixing
Physical Changes

Chemical Changes
Bulk fermentation
Physico-chemical Reactions
Under or Over Ferment Dough
Under Ferment Dough
Over Ferment Dough
Knock back
Dough make-up
Scaling
Rounding
Intermediate Proofing
Moulding
Hand Moulding
Machine Moulding
Panning
Tempering the Pan
Greasing/Glazing the Pan
Bread Pan
Proofing
Factor Affecting the Final Proof
Temperature
Relative Humidity
Diastetic Activity of the Flour
Fermentation
Under or Over Proofing
Over Proofing
Under Proofing
Baking
Time and Temperature
Physico-chemical Changes
Oven Rise and Oven Spring
Yeast Activity
Enzyme Activity
Starch Gelatinization
Protein Denaturation
Protein Coagulation
Browning Reaction
Oven Problems
Insufficient Oven Heat
Excessive Oven Heat
Excess Steam
Insufficient Steam
Improper Heat Distribution
Incorrect Pan Spacing
Depanning
Cooling
Slicing
Packing/Wrapping

27. Effluent Treatment

Introduction
Dissolved oxygen concentration as an indicator of water quality
Factory surveys

The strengths of fermentation effluents
Treatment and disposal of effluents
Disposal
Seas and Rivers
Lagoons
Spray Irrigation
Well Disposal
Disposal of Effluents to Sewers
Treatment processes
Physical Treatment
Chemical Treatment
Biological Treatment
Aerobic Processes
Tricking Filters
Towers
Rotating Discs
Rotating Drums
Activated Sludge
Anaerobic Treatment
Anaerobic Digestion
Anaerobic Filters
By-products
Distilleries
Breweries
Amino Acid Wastes

About NIIR

NIIR PROJECT CONSULTANCY SERVICES (NPCS) is a reliable name in the industrial world for offering integrated technical consultancy services. NPCS is manned by engineers, planners, specialists, financial experts, economic analysts and design specialists with extensive experience in the related industries.

Our various services are: Detailed Project Report, Business Plan for Manufacturing Plant, Start-up Ideas, Business Ideas for Entrepreneurs, Start up Business Opportunities, entrepreneurship projects, Successful Business Plan, Industry Trends, Market Research, Manufacturing Process, Machinery, Raw Materials, project report, Cost and Revenue, Pre-feasibility study for Profitable Manufacturing Business, Project Identification, Project Feasibility and Market Study, Identification of Profitable Industrial Project Opportunities, Business Opportunities, Investment Opportunities for Most Profitable Business in India, Manufacturing Business Ideas, Preparation of Project Profile, Pre-Investment and Pre-Feasibility Study, Market Research Study, Preparation of Techno-Economic Feasibility Report, Identification and Section of Plant, Process, Equipment, General Guidance, Startup Help, Technical and Commercial Counseling for setting up new industrial project and Most Profitable Small Scale Business.

NPCS also publishes various process technology, technical, reference, self employment and startup books, directory, business and industry database, bankable detailed project report, market research report on various industries, small scale industry and profit making business. Besides being used by manufacturers, industrialists and entrepreneurs, our publications are also used by professionals including project engineers, information services bureau, consultants and project consultancy firms as one of the input in their research.

NIIR PROJECT CONSULTANCY SERVICES , 106-E, Kamla Nagar, New Delhi-110007, India. **Email:** npcs.india@gmail.com **Website:** NIIR.org

