

# Food Flavours Technology Handbook

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No doubt flavour is one of the most important attributes of the food products we eat in our daily life. Man does not eat simply to live but even more so lives to eat. Flavourings are focused on altering or enhancing the flavours of natural food product or creating flavour for food products that do not have the desired flavours for example bakery goods and other snacks. Flavour is generally defined in terms of three components; odour, taste and texture. Its characterization is concern with the similarities in human flavour perception using methods that designed to average out the differences. The flavour of foods may be classified as natural flavour (pre existing in diet particularly in fruits, vegetables and spices), process flavour (arising in end products as a result of conventional processes), compounded flavour (intentionally added flavouring), taste modifiers and abnormal taste and taints. Some of the flavouring materials produced by processing are chocolate, cheese, blue cheese, yogurt, wine, aroma chemicals etc. The flavour industry has become a vital element in the growth and success of food and beverage industries worldwide. The flavours industry remains very country specific and complex, with product formulations and flavours varying from country to country, as well as from region to region within countries. Processed foods, their flavours and textures, are adapted to local consumer preferences. Local or traditional foods have unique flavours evolving from the indigenous climate, land, etc. Generally speaking, trends in flavours closely mirror those in the packaged food and drink market. This includes the trends toward premium quality, savoury, natural and authentic, and health and wellness. The global flavour industry can be characterized as highly technical, specialized, and innovative. This industry is highly competitive and concentrated, compared to other product categories within the food and beverage market. The global flavours market is predicted to grow at a Compound Annual Growth Rate (CAGR) of 2% per annum.

This book majorly deals with flavour in fruits and vegetables, additional pathways for vegetable flavour, change in food flavour after processing, flavours formed via fermentation, odd flavours in foods, odd flavours due to chemical changes in the food, relationships between the food and flavour manufacturers, flavour characters of herbs preparation of herbs for marketing, flavour constituents of grapes and wine, dried inactive yeast powder, synthetic flavouring materials, flavour potentiators, baked goods and bakery products, sugar and chocolate confectionery, techniques of sensory testing, fruit based products, gas chromatography, microbiological analysis

The present book contains formulae, processes of various flavours applied in food and beverage industries. This book is intended to be a practical companion to the flavourist, technologists, entrepreneurs, libraries or for those who are already in the field of manufacturing.

## 1. Flavour Characterization

Psychophysics

Flavour Chemistry

## 2. Flavour in Fruits and Vegetables

Fruit Aroma

Flavours from Fatty Acid Metabolism

Flavours from Amino Acid Metabolism

Flavours Formed from Carbohydrate Metabolism

Flavour Formation from Cysteine Sulfoxide

Derivatives

Flavour Formation from Glucosinolates

Additional Pathways for Vegetable Flavour  
Formation

Location of Flavour in Plant

Plant Foods

Genetics

Environmental Effects on Flavour Development

Influence of Maturity on Flavour Development

Effects of Postharvest Storage Conditions on  
Flavour Development

Animal Products

## 3. Change in Food Flavour after processing

Non-enzymatic Browning

General Overview of Non-enzymatic Browning

Factors Influencing Browning Rate

Formation of Flavour Compounds

Carbonyls

Pyrazines

Pyrroles

Pyrroles

Pyridines

Miscellaneous Nitrogen Heterocyclics

Furanones and Pyranones

Sulfur Heterocyclics

Oxazones and Oxazolines

Flavours from Lipids

Deep Fat Fried Flavour

Lactones

Secondary Reactions

Flavours Formed via Fermentation

Esters

Acids

Carbonyls

Alcohols

Terpenes

Lactones

Pyrazines

Conclusion

## 4. Odd Flavours in Foods

Environmental Contamination

Airborne Sources

Waterborne Sources

Disinfectants, Pesticides, and Detergents

- Packaging Sources
- Odd-Flavours Due to Genetics or Diet
  - Genetics
  - Diet
- Odd Flavours Due to Chemical Changes in the Food
- Lipid Oxidation
- Nonenzymatic Browning
- Photo-Induced Odd-Flavours
- Microbial Odd-Flavours
- 5. Flavours and Flavouring Materials
  - Food Acceptance
    - Taste
    - Odour
  - Flavour materials
    - Natural Flavourings
    - Artificial Flavourings
  - Progressive Use of Synthetics
  - Typical Synthetics
  - Compounding
  - Flavour Precursors
  - Flavourings in Foods
    - Added Flavourings
    - Compounded Flavourings
  - Flavouring Materials
    - Solid Flavouring Materials
    - Liquid Flavouring Materials
    - Semi-fluid or Paste Flavouring Products
  - The Flavour Industry
  - Relationships between the Food and Flavour Manufacturers
- 6. Isolation of Food Flavours
  - Headspace Method
  - Direct Injection
  - Adsorbent trapping
  - Isolation of Flavours by Distillation Methods
  - Equipment and Procedures
  - Solvent Selection
  - Solvent impurities
  - Solvent Extraction of Fatty Foods
  - Isolation of individual Classes of Volatile Flavours
  - Sulfur Compounds
    - Acids
    - Alcohols
    - Carbonyls
    - Amines
  - Concentration of Dilute Organic and Aqueous
  - Flavour Isolates
    - Evaporation
    - Freeze Concentration
    - Adsorption
  - Flavour Analysis by Direct injection
  - Gas Chromatography
  - Fractionation of Flavour Isolates

Gas Chromatography of Flavour Concentrates

Capillary Column GC

GC Detectors

7. High Resolution Infrared Spectra of Some  
Naturally Isolated Food Flavours

8. Flavouring Materials of Natural Origin

Natural Flavours and Flavourings:

Sources of Natural Flavouring Materials

Standards of Purity

Sensory Assessment

Flavour Profiles

Spice Importation

Herbs and Spices

Herbs

Spices

Historical Associations

Commercial Considerations

Relationships of Components and Profiles

Classification of Herbs and Spices

Flavour Characters of Herbs

Preparation of Herbs for Marketing

Production and Economic Aspects

Recent Developments

Specifications Analysis and Quality

Purchasing and Processing

Use of Spices

Individual Spices

Anise Seed

Basil Sweet Basil

Bay Laurel Leaves.

Benne Also Benni or Bene

Capsicum.

Caraway Seed

Cardamom Seed

Cayenne

Celery Seed

Chilli Powder

Chilies

Cinnamon

Cloves

Coriander Seed

Cumin Seed

Curry Powder

Dill Seed

Fennel Seed

Fenugreek Seed Foenugreek

Garlic Powder

Garlic Salt

Ginger

Mace

Marjoram (Sweet Marjoram)

Mint

Mustard

Nutmeg  
Onion Powder  
Onion Salt  
Oregano  
Parsley (Parsley Flakes)  
Parsley Seed  
Pepper, Black  
Pepper, White  
Poppy Seed  
Red Pepper  
Rosemary  
Saffron  
Sage  
Savory Summer Savory  
Sesame Seed Benne, Benni, or Bene Seed  
Tarragon Estragon  
Thyme  
Turmeric Curcuma  
Vanilla  
Spice Processing-Milling  
Microbiology of Spices  
Gas Sterllization of Spices  
Spice Essential Oils  
Distillation ot Volatile Oils  
Gamma Irradiation  
Spice Essential Oils  
Application of Spice Essential Oils  
Essential Oil Content of Spices  
Extraction and Oleoresins  
Solvents  
The Extraction Process  
Quality of Oleoresins  
Application of Oleoresins  
Seasonings  
Flavour Index and Formulation  
Plants as Sources of Essential Oils  
Citrus Fruits  
Processed Citrus Oils  
Other Citrus Peel Oils  
Citrus Leaf and Flower Oils  
Peppermint  
Spearmint  
Blended Peppermint Oils  
Composition of Mint Oils  
Other Commercially Important Sources  
Fruit, Fruit Juices and Concentrates  
Classification of Fruits  
Fruit Juice and Flavour  
Fruit Juice Extraction  
Preservation of Fruit Juices  
Concentrated Fruit Juices  
Recovery of Aromatics  
Brix Value

Blending of Fruit Juices-WONF  
Depectinized Juices  
Dehydrated Fruit Juices  
Fruit Pastes and Comminutes  
Historical Introduction  
The Vanilla Plan  
The Curing Process  
Classification and Grading of Vanilla Beans  
The Flavour of Vanilla  
The Chemistry of Vanilla Flavour  
Precursors and the Development of Flavour  
during Curling  
Vanilla Absolute  
Vanilla Sugar  
Authenticity of Vanilla Extracts  
Vanillin and Ethyl Vanillin  
Beverage Flavours  
Cacao (Cocoa)  
The Flavour of Cocoa  
Chocolate  
Coffee  
The Flavour of Coffee  
Caffeine  
Tea  
Onion  
The Flavour of Onion  
Dehydrated Onion  
The Flavour of Garlic  
9. Chemical Modification of Turmeric Oil to  
more value added products  
Results and Discussion  
Conclusion  
Experimental  
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Acetates of turmerols:  
Propionates of turmerols:  
Butyrates of turmerols  
Catalytic hydrogenation of turmerones  
Reduction of dihydro-turmerones to dihydro-  
turmerols  
Acetates of dihydro-turmerols  
Propionates of dihydro-turmerols  
Butyrates of dihydro-turmerol  
Acknowledgement  
10. Flavouring Materials made by Processing  
Natural Products Made by Roasting:  
Cocoa/Chocolate  
Production of Cocoa Powder  
The Dutch Process  
Chocolate  
Reaction Flavours:  
Imitation Meat Flavours  
Imitation Meat Flavours

Hydrolyzed Vegetable Protein-H VP  
Autolyzed Yeast Extract  
Enzymatically Derived Flavourings: Butter, Cheese  
Butter  
The Flavour of Butter  
Enzymatic Production of Butter Flavours  
Butter Oil  
Cheese  
Cheese Flavour  
Cheddar Cheese Flavour  
Blue Cheese Flavour  
Enzyme-Modified Cheese (EMC)  
Lactic Acid Fermentation-Yogurt  
Yogurt Flavour  
Flavourings for Yogurt  
Flavours Made by Fermentation  
Yeasts  
Vinegar/Acetic Acid  
Wines  
Quality Factors  
Wine Making  
Flavour Constituents of Grapes and Wine  
Dried Inactive Yeast Powder  
Biotechnology: Production of Aroma Chemicals  
Micro-organisms in Flavour Formation  
Flavours Made by Pyrolysis: Smoke Flavours  
The Smoking of Foods  
Natural Liquid Smoke Flavourings  
Pyroligneous Acid  
Smoke Condensates  
Chemistry of Smoke Flavours  
Flavour Chemicals  
Colour Compounds  
Polycyclic Aromatics  
Methods of Application  
11. Synthetic Flavouring Materials  
Imitation Flavourings:  
Matching Nature  
Synthetic Organics  
Quality Control  
Consumer Attitudes toward Synthetic Chemicals  
Classification of Flavourants by Molecular Structure  
Sensory Characters of Organics  
Hydrocarbons  
Carboxylic Acids  
Acetals  
Alcohols  
Carbonyls  
Ketones  
Esters  
Heterocyclic Compounds  
Ketals  
Lactones

## Nitrogen-Containing Compounds

Amines

Imines

Amino Acids

Isothiocyanates

Phenols

## Sulfur-Containing Compounds

Sulfides

Solvents

Extraction Solvents

## Nomenclature of Organic Chemicals

### 12. Flavour Potentiators

Chemical Properties

Structure

Stability

Sensory Properties

Influence on Taste

Influence on Aroma

Synergism

Mode of Action

Flavour Potentiators in Foods

Naturally Occurring

Added to Foods

Source of Commercial Potentiators

Toxicity

Monosodium Glutamate

Other Potentiators

### 13. Application of Flavouring

Flavours in Foods

Achieving Flavour Balance

Consumer Acceptance

Flavour Defects

Flavour Intensification

Flavour Suppression

Criteria for Application of Flavourings

Acceptability to the Consumer

Legal Acceptability

Nature of Product as Sold and as Consumed

Processing Conditions

Available Flavourings

Processing Parameters

Temperature and Time

Open or Closed System

The Mixing Sequence

Pressure

Contact with Air

Specific Flavouring Applications

Meat Products

Baked Goods and Bakery Products

Snack Foods

Baked Goods and Bakery Products

Sugar and Chocolate Confectionery

Soft Drinks



## 14. Flavour Production

Liquid Flavourings

Emulsions

Dry Flavourings

Extended or Plated Flavours

Phase Separation/Coacervation Processes

Addition and Mixing

Emulsification

Solidification and Hardening

Separation

Washing

Drying

Dehydration Processes

Emulsification

Dehydration

Extrusion

## 15. Sensory Testing Method

Test Purpose and Objectives

Applications

Panel Selection and Indoctrination

Types of Judges

Eligibility

Indoctrination

Panel Morale

Conditions of Testing

Techniques of Sensory Testing

Sample Handling

Sample Carriers

Sample Presentation.

Sample Coding

Testing Methods

Analysis and Reporting of Test Results.

Directional Triangle Tests

Paired Difference Testing

Paired Intensity Testing

## 16. Quality Control

Natural Plant Materials

General tests

Tests of limited application

Additional specific tests

Essential Oils

General tests

Tests of limited application

Instrumental tests

Specific tests for constituents

Tests specific for citrus oils

Oleoresins

General tests

Specific tests

Plated or Dispersed Spices

General tests

Tests of limited application

Synthetic Chemicals

General tests-liquids  
General tests-solids  
Specific tests for chemical identity and  
purity-Instrumental methods  
Flavourings  
General tests-liquid flavourings  
General tests-emulsions  
General tests-encapsulated dry flavourings  
Vanilla Extract  
Fruit-Based Products  
General tests  
Special tests  
Specific Gravity  
Refractive Index  
Optical Rotation  
Alcohol Content  
Residual Solvent  
Particle Size of Emulsions  
Volatile Oil  
Surface Oil  
Moisture Content  
Gas Chromatography  
Microbiological Analysis

## About NIIR

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business, entrepreneurs are often faced with the dilemma of zeroing in on a suitable product/line.

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