RQF LEVEL 5

FOPAP503

FOOD PROCESSING

Analysis of Physicochemical Properties of Food

TRAINER'S MANUAL

October, 2024

ANALYSIS OF PHYSICOCHEMICAL PROPERTIES OF FOOD

KOICA Korea International Cooperation Agency

TQUM TVET Quality Management Project

2024

AUTHOR'S NOTE PAGE (COPYRIGHT)

The competent development body of this manual is Rwanda TVET Board ©, reproduce with permission.

All rights reserved.

- This work has been produced initially with the Rwanda TVET Board with the support from KOICA through TQUM Project
- This work has copyright, but permission is given to all the Administrative and Academic Staff of the RTB and TVET Schools to make copies by photocopying or other duplicating processes for use at their own workplaces.
- This permission does not extend to making of copies for use outside the immediate environment for which they are made, nor making copies for hire or resale to third parties.
- The views expressed in this version of the work do not necessarily represent the views of RTB. The competent body does not give warranty nor accept any liability

RTB owns the copyright to the trainee and trainer's manuals. Training providers may reproduce these training manuals in part or in full for training purposes only. Acknowledgment of RTB copyright must be included on any reproductions. Any other use of the manuals must be referred to the RTB.

© Rwanda TVET Board

Copies available from:

- *HQs: Rwanda TVET Board-RTB*
- *Web: www.rtb.gov.rw*
- **KIGALI-RWANDA**

Original published version: October 2024

ACKNOWLEDGEMENTS

The publisher would like to thank the following for their assistance in the elaboration of this training manual:

Rwanda TVET Board (RTB) extends its appreciation to all parties who contributed to the development of the trainer's and trainee's manuals for the TVET Certificate V in Food Processing, specifically for the module **"FOPAP503: Analysis of Physicochemical Properties of Food."**

We extend our gratitude to KOICA Rwanda for its contribution to the development of these training manuals and for its ongoing support of the TVET system in Rwanda.

We extend our gratitude to the TQUM Project for its financial and technical support in the development of these training manuals.

We would also like to acknowledge the valuable contributions of all TVET trainers and industry practitioners in the development of this training manual.

The management of Rwanda TVET Board extends its appreciation to both its staff and the staff of the TQUM Project for their efforts in coordinating these activities.

This training manual was developed:

Under Rwanda TVET Board (RTB) guiding policies and directives

Under Financial and Technical support of

COORDINATION TEAM

RWAMASIRABO Aimable

MARIA Bernadette M. Ramos

NTAHONTUYE Felix

Production Team

Authoring and Review

NDUWAYEZU Jean Claude

UWIZEYIMANA Marie Josée

Validation

AYEBARE Honorée

INGABIRE Pacifique

Conception, Adaptation and Editorial works

HATEGEKIMANA Olivier

GANZA Jean Francois Regis

HARELIMANA Wilson

NZABIRINDA Aimable

DUKUZIMANA Therese

NIYONKURU Sylvestre

NGENDAHAYO Henry Gabriel

Formatting, Graphics, Illustrations, and infographics

YEONWOO Choe
SUA Lim
SAEM Lee
SOYEON Kim
WONYEONG Jeong
KAYUMBA Fiston
IZERE Severin

Financial and Technical support

KOICA through TQUM Project

TABLE OF CONTENT

ACRONYMS

EDTA: Ethylene diamine tetracetic acid

FOP: Food Processing

GDP: Gross Domestic Product

GMP: Good Manufacturing Practices

KOH: Potassium hydroxide

KOICA: Korea International Cooperation Agency

NaOH: Sodium hydroxide

pH: Potential of hydrogen

PPE: Personal Protective Equipment

RPL: Recognition of Prior Learning

RQF: Rwanda Qualification Framework

RTB: Rwanda TVET Board

SOP: Standard Operating Procedure

TQUM: TVET Quality Management

TVET: Technical and Vocational Education and Training

UV: Ultraviolet

INTRODUCTION

This trainer's manual includes all the methodologies required to effectively deliver the module titled **"Analysis of Physicochemical Properties of Food."** Trainees enrolled in this module will engage in practical activities designed to develop and enhance their competencies.

The development of this training manual followed the Competency-Based Training and Assessment (CBT/A) approach, offering ample practical opportunities that mirror real-life situations.

The trainer's manual is organized into Learning Outcomes, which is broken down into indicative content that includes both theoretical and practical activities. It provides detailed information on the key competencies required for each learning outcome, along with the objectives to be achieved.

As a trainer, you will begin by asking questions related to the activities to encourage critical thinking and guide trainees toward real-world applications in the labor market. The manual also outlines essential information such as learning hours, didactic materials, and suggested methodologies.

This manual outlines the procedures and methodologies for guiding trainers through various activities as detailed in their respective trainee manuals. The activities included in this training manual are designed to offer trainees opportunities for both individual and group work. Upon completing all activities, you will assist trainees in conducting a formative assessment known as the end learning outcome assessment. Ensure that trainees review the key reading and the points to remember section.

MODULE CODE AND TITLE: FOPAP503 ANALYSIS OF PHYSICOCHEMICAL PROPERTIES OF FOOD

Learning Outcome 1: Prepare sample for physicochemical properties analysis
Learning Outcome 2: Test physical properties of food
Learning Outcome 3: Test chemical properties of food.

Learning Outcome 1: Prepare Sample for Physicochemical Properties Analysis

Indicative contents

1.1 Describing physical properties of food

1.2 Describing chemical properties of food

1.3 Collecting sample for food analysis

1.4.Preparing sample for analysis

Key Competencies for Learning Outcome 1: Prepare samples for physicochemical properties analysis

Knowledge	Skills	Attitudes
• Description of physical properties of food • Description of chemical properties of food • Identification of laboratory reagents • Identification Physicochemical laboratory rules and regulations • Description of sampling methods • Description of Preparation of sample • Description of sources of experimental errors	• Sampling • Preparing sample	• Being responsible when preparing sample • Being careful when taking sample • Being attentive when preparing reagent • Being accurate when preparing sample and reagent

Duration: 10 hrs

Learning outcome 1 objectives:

By the end of the learning outcome, the trainees will be able to:

1. Describe adequately the physical properties of the food
2. Describe effectively the chemical properties of the food
3. Describe properly the sampling methods of food
4. Take sample properly according to sampling methods and safety precautions
5. Identify properly physicochemical laboratory rules and regulations
6. Prepare correctly sample according to analytical method
7. Describe properly the sources of experimental errors according to analytical method

Resources

Equipment	Tools	Materials
• Ice box • Centrifuge • Grinder • Dryer • Desiccator • PPE	• Spatulas • Precision balance • Glass wares	• Food samples • Sample packaging materials • Gloves • Reagents

Advance Preparation:

Before delivering this learning outcome, you are recommended to:

- Avail the classroom
- Ensure that the Laboratory is available and well organized
- Avail cleaning product
- Avail food sample

- Avail standard reagent for prepare samples for physicochemical properties analysis
- Prepare teaching aids and didactic materials (manuals/guides, photos, audio-visuals, protocols) for Prepare samples for physicochemical properties analysis

Indicative content 1.1: Describing physical properties of food

Duration: 2 hrs

Theoretical Activity 1.1.1: Description of physical properties of food

Notes to the trainer:

- Trainer may use small groups to describe physical properties of food
- The use of drawings, pictures or videos as didactic materials is required for describing physical properties of food

Key steps:

While delivering this activity, pass through the following steps:

Step 1: Introduce the activity and ask trainees to answer the question below:

Basing on your understanding describe physical properties of food

Step 2: Ask trainees to write the findings on papers, flip chart, blackboard or white board.

Step 3: Ask trainees to present their findings to the trainer and whole class.

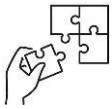
Step 4: Provide the expert view and clarify ideas.

Step 5: Address any questions or concerns.

Step 6: Ask trainees to read the key reading 1.1.1 in trainee manual

Points to Remember

- Physical properties of food are: Freezing point, Melting point, Boiling point, Water activity, Heat transfer, Appearance (color, size, volume, porosity, shape, deformation), Flavor, Aroma, Taste, Temperature, Density, Viscosity, Texture and solubility



Application of learning 1.1

ISHEMA Company Ltd plans to develop a new product derived from fruits and requires a skilled technician to identify and define the physical parameters that will ensure its quality. Ask trainees to help ISHEMA Company Ltd to describe physical properties of that product.

Checklist:

Points to check	**Observation**	
	Yes	**No**
1. Freezing point and Melting point are mentioned		
2. Boiling point and Heat transfer are mentioned		
3. Appearance (color, size, volume, porosity, shape, deformation) is mentioned		
4. Flavor, aroma and taste are mentioned		
5. Temperature, density and texture are mentioned		
6. Solubility and Relative humidity are mentioned		

Indicative content 1.2: Describing chemical properties of food

Duration: 2 hrs

Theoretical Activity 1.2.1: Description of chemical properties of food

Notes to the trainer:

- Trainer may use small groups to describe chemical properties of food
- The use of drawings, pictures or videos as didactic materials is required for describing chemical properties of food.

Key steps:

While delivering this activity, pass through the following steps:

Step 1: Introduce the activity and ask trainees to answer the following questions: Basing on your understanding, describe chemical properties of food

Step 2: Ask trainees to write the findings on papers, flip chart, blackboard or white board.

Step 3: Ask trainees to present their findings the trainer and whole class.

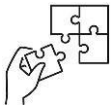
Step 4: Provide the expert view and clarify ideas

Step 5: Address any questions or concerns.

Step 6: Ask trainees to read the key reading 1.2.1 in trainee manual

Points to Remember

- Chemical properties of food are moisture content, protein properties, fat properties, starch properties, sugar properties, fiber's properties, acidity, pH, aroma pigment compound**,** bioactive compounds.



Application of learning 1.2.

ISHEMA Company Ltd plans to develop a new product derived from fruits and requires a skilled technician to identify and define the chemical parameters that will ensure its quality. Ask trainees to help ISHEMA Company Ltd to describe chemical properties of that product.

Checklist:

Points to check	**Observation**	
	Yes	**No**
1. Moisture content and protein properties are mentioned		
2. Fat properties and starch properties are mentioned		
3. Sugar properties and fiber's properties are mentioned		
4. Acidity and pH are mentioned		
5. Aroma pigment compound and bioactive compounds are mentioned		

Indicative content 1.3: Collecting sample for food analysis

Duration: 3 hrs

Theoretical Activity 1.3.1: Description of sampling methods

Notes to the trainer:

- Trainer may use small groups to describe sampling methods
- The use of drawings, pictures or videos as didactic materials is required for sampling methods

Key steps:

While delivering this activity, pass through the following steps:

Step 1: Introduce the activity and ask trainees to answer the following question:

i. Define the following terms:
   a. Sample
   b. Sampling protocol
   c. Characteristic
   d. Homogeneity
   e. Sampling error
   f. Batch
   g. Unit

ii. Give the purpose of sampling

iii. Outline the major sources of variability in nutrients composition

iv. Identify the physicochemical laboratory safety and regulations

v. Explain the following sampling methods
   a. Probability sampling
   b. Non-probability sampling

Step 2: Ask trainees to write the findings on papers, flip chart, blackboard or white board.

Step 3: Ask trainees to present their findings the trainer and whole class.

Step 4: Provide the expert view and clarify ideas

Step 5: Address any questions or concerns.

Step 6: Ask trainees to read the key reading 1.3.1 in trainee manual

Points to Remember

- Food sampling is a process of drawing a sample/ a small portion of food which is a representative of a population/lot of a food for testing, analysing, intended to show the nature and quality of the whole specimen.
- Purpose of sampling is: Representativeness, quality control, nutritional analysis and detection of contaminants
- Sampling Methods are probability sampling and non-probability sampling.

Practical Activity 1.3.2: Applying Sampling methods

Notes to the trainer

- The trainer may demonstrate how to take food sample in food chemistry laboratory for analyzing physicochemical properties.
- Avail food sample, tools and equipment for sampling

Key steps:

While delivering this activity, pass through the following steps:

Step 1: Introduce the activity and ask trainees to go in food chemistry laboratory to take food sample for analyzing physicochemical properties.

Step 2: Explain the task and provide clear work instruction (PPE, Time allocated)

Step 3: Demonstrate how to take food sample for analyzing physicochemical properties While demonstrating, explain sampling methods

Step 4: Ask trainees to take food sample for analyzing physicochemical properties and monitor the procedures.

Step 5: Verify whether food sample are well taken and provide feedbacks where necessary.

Step 6: Ask trainees to read key reading 1.3.2 in trainee manual

Step 7: Ask trainees to perform the task provided in application of learning 1.3

Points to Remember

- General Stages of sampling are: define the Population, determine the sampling frame, determine sample size, collect the sample, analyze the sample, draw conclusions and make inferences and report findings.

Application of learning 1.3.

Organize trainees' practice in food chemistry laboratory, ask trainees to take food sample for analysing physicochemical properties of food.

Check list:

SN	Criteria	Indicator	Score	
			Yes	No
1	Food Sample is well taken	Sample size is identified		
		Sampling method is respected		
		Transport techniques of food samples is respected		
		Storage techniques of food sample is respected		
2	Report of Findings is well done	Product food sample name is mentioned		
		Time of food sampling is respected		
		Location of food sample is indicated		
		Person who took the food sample is mentioned		

Indicative content 1.4: Preparing sample for physicochemical food analysis

Duration: 3 hrs

Practical Activity 1.4.1: Preparing food sample for analysis

Notes to the trainer

- The trainer is supposed to demonstrate how to prepare food sample to use while analysing physicochemical properties.
- Avail food sample for analysis
- Avail tools and equipment for food sample preparation

Key steps:

While delivering this activity, pass through the following steps:

Step 1: Introduce the activity and ask trainees to go to prepare food sample for analysis of physicochemical properties.

Step 2: Explain the task and provide clear work instruction (PPE, Time allocated)

Step 3: Demonstrate how to prepare food sample for analysis of physicochemical properties While demonstrating, explain methods of sampling and procedure used

Step 4: **A**sk trainees to prepare food sample for analysis of physicochemical properties and monitor the procedures.

Step 5: Verify whether food sample are well prepared and provide feedbacks where necessary.

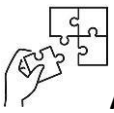
Step 6: Ask trainees to read key reading 1.4.1 in trainee manual

Step 7: Ask trainees to perform the task provided in application of learning 1.4

Points to Remember

Sample preparation is a critical step in ensuring accurate and reliable results in food analysis. Its purpose includes ensuring consistency, suitability, and accuracy

- Pre-treatment of sample for analysis involves cleaning of the sample, homogenization, dilution, evaporation, liquid-liquid extraction for liquid samples
- Prevention of changes in sample involves, enzymatic inactivation, chemical (lipid protection), microbial growth and contamination, and physical changes
- Sample identification considers product name, time of sampling, location sample was taken from, and person who took the sample
- Experimental error includes personal errors (blunders), random errors, systematic errors



Application of learning 1.4.

Organize trainees' practice in food chemistry laboratory at school, ask trainees to prepare food sample for analysis of physicochemical properties of food.

SN	Criteria	Indicator	Score	
			Yes	No
1	Pre-treatment of food sample is well done	Cleaning of the food sample is done		
		Homogenization of food sample is done		
		Drying is conducted		
		Dilution is done		
2	Food sample identification is well done	Product name is mentioned		
		Time of food sampling is respected		
		Location of food sample token is indicated		
		Person who took the food sample is mentioned		

Learning outcome 1 end assessment

Written assessment

I. Circle the letter corresponding to the right answer

1. The melting point of substance should be defined as:
    A. The temperature at which a substance turns from a solid to a liquid.
    B. The temperature at which a substance turns from a liquid to a solid.
    C. The temperature at which a liquid turns into vapor.
    D. The measurement of water availability for biological reactions.

Answer: A. The temperature at which a substance turns from a solid to a liquid.

2. Water activities in food products is:
    A. The temperature at which a substance boils.
    B. The availability of water for biological reactions and microbial growth.
    C. The resistance of a fluid to flow.
    D. The ratio of mass to unit volume of matter.

Answer: B. The availability of water for biological reactions and microbial growth.

3. Viscosity of food should define as:
    A. The temperature at which a liquid boils.
    B. The density of a substance relative to water.
    C. The resistance of a fluid to flow or change shape.
    D. The amount of water present in a substance.

Answer: C. The resistance of a fluid to flow or change shape.

4. Method of heat transfer within solid food is**:**
    A. Convection
    B. Radiation
    C. Conduction
    D. Evaporation

Answer: C. Conduction

5. Specific gravity defined as:
    A. The property of matter represented by a ratio of mass to unit volume.
    B. The measurement of the amount of water available for microbial growth.
    C. The ratio of the density of a substance to the density of pure water.
    D. The resistance of a liquid to flow.

Answer: C. The ratio of the density of a substance to the density of pure water.

6. Sampling method involves dividing the population into subgroups and then randomly sampling from each subgroup is:
    A. Simple Random Sampling
    B. Systematic Sampling
    C. Stratified Sampling
    D. Cluster Sampling

Answer: C. Stratified Sampling

7. Food proteins is defined as:
    A. Proteins are primarily important for energy storage in cells.
    B. Proteins are crucial for biological functions and cell structure.
    C. Proteins are mainly composed of triglycerides.
    D. Proteins are primarily used for thickening agents in food.

Answer: B. Proteins are crucial for biological functions and cell structure.

8. The purpose of sample preparation in food analysis is:
    A. To change the food's color for better analysis.
    B. To ensure the sample is representative of the defined whole and compatible with instrumental analysis.
    C. To increase the water activity of the sample.
    D. To reduce the viscosity of the sample.

Answer: B. To ensure the sample is representative of the defined whole and compatible with instrumental analysis.

9. Role bioactive compound is:
    A. ability to dissolve in solvents.
    B. Promoting good health and disease prevention.
    C. Their impact on the freezing point of foods.
    D. Ability to change the texture of food.

Answer: B. Their role in promoting good health and disease prevention.

Practical assessment

IGISUBIZO Company exports different food products including juices and pastries products, the company requires to take sample for analysing physicochemical properties of those food. The production manager of the company requests you to assist in taking sample for further analysis. This task must be completed within 1 hour.

Check list:

No	Criteria	Indicators	Score	
			YES	NO
1	Tools and equipment for food sampling are well selected	Glass ware are selected		
		Oven dryer is selected		
		Grinder/ homogenizer is selected		
		Desiccator is selected		
2	Food sample is well taken	Sample size is identified		
		Sampling method is respected		
		Transport techniques of food samples is respected		
		Storage techniques of food sample is respected		
3	Food sample is well prepared	Food sample is cleaned		
		Food sample is homogenized		
		Dilution/evaporation is conducted		
4	Food sample identification is well respected	Product food sample name is mentioned		
		Time of food sampling is respected		
		Location of food sample is indicated		
		Person who took the food sample is mentioned		

END

Further information to the trainer

AOAC International. (2023). Official methods of analysis of AOAC International (22nd ed.). Method 925.40 - Moisture in dry foods - Method I: Vacuum oven drying at 70°C.

Lawless, H. T., & Heymann, H. (2010). Sensory evaluation of food: Principles and practices (2nd ed.). Springer.

Nielsen, S. S. (2010). Food analysis (4th ed.). Springer. (Chapter 5: Protein)

Rao, M. A. (2014). Rheology of fluid and semi-solid foods: Principles and applications (2nd ed.). Springer.

Steffe, J. F. (1996). Rheological methods in food process engineering (2nd ed.). Freeman Press.

Stone, H., & Sidel, J. (2004). Sensory evaluation practices (3rd ed.). Elsevier.

Indicative contents

2.1. Testing organoleptic properties of food

2.2. Testing rheological properties of food

2.3. Measuring density in food

2.4. Measuring temperature in food

Key Competencies for Learning Outcome 2: Test physical properties of food

Knowledge	Skills	Attitudes
• Description of food organoleptic properties testing methods • Description of food rheology testing technique • Description of food density measuring methods • Description of food temperature measuring methods	• Applying food organoleptic properties testing methods • Applying Rheometry techniques • Applying food gravimetric density measuring techniques • Applying temperature measuring methods in food	• Being responsible in food organoleptic properties testing methods • Being careful when measuring temperature in food • Having team working spirit when measuring density in food.

Duration: 30 hrs

Learning outcome 2 objectives:

By the end of the learning outcome, the trainees will be able to:

1. Describe clearly food organoleptic properties testing methods of food products
2. Apply effectively food organoleptic properties testing methods in food products
3. Describe correctly food rheology testing technique of food products
4. Apply effectively Rheometry technique in food products
5. Describe clearly food density measuring methods of foods products
6. Apply exactly food gravimetric density measuring techniques as required
7. Describe correctly food temperature measuring methods of food products
8. Apply exactly temperature measuring methods in food products

Resources

Equipment	Tools	Materials
• Rotational rheometer • Capillary rheometer • Oscillator rheometer	• Thermometers • Pycnometer • Glassware	• Hedonic Scorecard • Papers • Different food samples

Advance Preparation:

Before delivering this learning outcome, you are recommended to:

- Avail the classroom
- Ensure that the Laboratory is available and well cleaned and organized
- Avail standard reagent for prepare samples for physicochemical properties analysis
- Prepare teaching aids and didactic materials (manuals/guides, photos, audio-visuals),

Indicative content 2.1: Testing organoleptic properties of food

Duration: 6hrs

Theoretical Activity 2.1.1: Description of food organoleptic properties testing methods

Notes to the trainer:

- Trainer may use small groups to describe food organoleptic properties testing methods
- The use of drawings, pictures or videos as didactic materials is required.

Key steps:

While delivering this activity, pass through the following steps:

Step 1: Introduce the activity and ask trainees to answer the following question:

a) What is the purpose of testing organoleptic properties of food?
b) Describe food organoleptic properties testing methods?

Step 2: Ask trainees to write the findings on papers, flip chart, blackboard or white board.

Step 3: Ask trainees to present their findings the trainer and whole class.

Step 4: Provide the expert view and clarify ideas if any

Step 5: Ask trainees to read the key reading 2.1.1 in trainee manual

Points to Remember

- The primary purpose of organoleptic testing is to ensure food products meet quality standards and consumer expectations.
- Organoleptic evaluation of food is a scientific approach to assess the product's sensory attributes across the senses: taste, smell, sight, and touch.
- Organoleptic testing methods are qualitative and quantitative
- Qualitative method used is paired comparison while quantitative methods include descriptive analysis, hedonic testing, ranking testing, and triangle test.

Practical Activity 2.1.2: Applying food organoleptic properties testing methods

Notes to the trainer

- Trainer may use small groups to discuss on the application of food organoleptic properties testing methods
- Avail food sample

Key steps:

While delivering this activity, pass through the following steps:

Step 1: Introduce the activity and ask trainees to go in food chemistry laboratory to apply food organoleptic properties testing methods (qualitative and quantitative methods)

Step 2: Explain the task and provide clear work instruction

Step 3: Demonstrate how to apply food organoleptic properties testing methods (qualitative and quantitative methods).

Step 4: Ask trainees to apply food organoleptic properties testing methods (qualitative and quantitative methods) and monitor them.

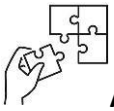
Step 5: Verify whether food organoleptic properties testing methods (qualitative and quantitative methods) are well applied and give clarification if any.

Step 6: Ask trainees to read key reading 2.1.2 in trainee manual

Step 7: Ask trainees to perform the task provided in application 2.1

Points to Remember

- In organoleptic evaluation, four senses are used: taste, smell, sight, and touch. Taste assesses flavor profiles, smell focuses on aroma, sight evaluates appearance, and touch measures texture, including factors like crunchiness. Each sense offers unique insights into a product's overall quality and consumer appeal.



Application of learning 2.1.

Organize trainees' practice in food laboratory, ask trainee to perform food organoleptic properties testing methods.

Checklist

SN	Criteria	Indicators	Yes	No
1	Qualitative method is well done	1.1.Aroma is tested		
		1.2.Flavor is tested		
		1.3.Texture is tested		
		1.4.Appearence is tested		
		1.5.Paired comparison test is done		
2	Quantitative method is well done	2.1.Descriptive analysis is done		
		2.2.Hedonic testing is done		
		2.3.Ranking testing is done		
		2.4.Triangle testing is done		

Indicative content 2.2: Testing rheological properties of food

Duration: 8hrs

Theoretical Activity 2.2.1: Description of food rheology testing technique

Notes to the trainer:

- Trainer may use small groups to describe food rheology testing technique
- The use of drawings, pictures or videos as didactic materials is required.

Key steps:

While delivering this activity, pass through the following steps:

Step 1: Introduce the activity and ask trainees to answer the following question:

i. Define the term "rheology".
ii. Explain the purpose of food rheology testing
iii. Describe the technique used in food rheology testing

Step 2: Ask trainees to write the findings on papers, flip chart, blackboard or white board.

Step 3: Ask trainees to present their findings the trainer and whole class.

Step 4: Provide the expert view and clarify ideas if any

Step 5: Ask trainees to read the key reading 2.2.1 in trainee manual

Points to Remember

- Rheology is a branch of physics that studies the flow and deformation of materials, particularly focusing on how substances respond to applied forces
- Food rheology testing involves the use of various techniques to measure the flow, deformation, and texture properties of food materials.
- The technique used in testing food rheology is rheometry.
- Instrument used in rheometry is rheometer
- Types of rheometers are rotational rheometer, dynamic shear rheometer and capillary rheometer

Practical Activity 2.2.2: Applying Rheometry Technique

Notes to the trainer

- Trainer may use small groups to discuss on the application of rheometry
- Avail tools, equipment and food sample for rheometry technique

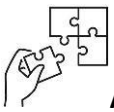
Key steps:

While delivering this activity, pass through the following steps:

Step 1: Introduce the activity and ask trainees to apply rheometry technique
Step 2: Explain the task and provide clear work instruction
Step 3: Demonstrate how to apply the rheometry techniques
Step 4: Ask trainees to apply the rheometry technique and monitor them.
Step 5: Verify whether rheometry technique is well applied and give clarification if any.
Step 6: Ask trainees to read key reading 2.2.2 in trainee manual
Step 7: Ask trainees to perform the task provided in application 2.2

Points to Remember

- Rheometry is applied by preparing the sample, selecting the right test method, configuring the rheometer with appropriate conditions (shear rate, temperature), and running tests that reveal key properties like viscosity, elasticity, or flow behavior.



Application of learning 2.2.

Organize trainees' practice in food laboratory and ask trainees to perform food rheology testing technique

Checklist

SN	Criteria	Indicators	Yes	No
1	Rheometry technique is applied	The sample is prepared		
		The right rheometer is chosen		
		The rheometer is set		
		Rheological Test is runed		
		Results are analysed		

Indicative content 2.3: Measuring density in food

Duration: 8hrs

Theoretical Activity 2.3.1: Description of food density measuring methods

Notes to the trainer:

- Trainer may use small groups to describe food rheology testing technique
- The use of drawings, pictures or videos as didactic materials is required.

Key steps:

While delivering this activity, pass through the following steps:

Step 1: Introduce the activity and ask trainees to answer the following question:

a) What is the purpose of measuring density in food?

b) Describe food density measuring methods?

Step 2: Ask trainees to write the findings on papers, flip chart, blackboard or white board.

Step 3: Ask trainees to present their findings the trainer and whole class.

Step 4: Provide the expert view and clarify ideas

Step 5: Address any questions or concerns.

Step 6: Ask trainees to read the key reading 2.3.1 in trainee manual

Points to Remember

- Measuring density in food serves several important purposes that are crucial for quality control, consistency, and safety, namely quality control, consistency and homogeneity, nutritional information, process optimization, safety considerations, regulatory compliance.
- While measuring food density we use gravimetric method which is a technique used to determine the concentration of a substance by measuring its mass. This method can be divided into two primary approaches: hydrometry and pycnometry.

Practical Activity 2.3.2: Applying food gravimetric density measuring techniques

Notes to the trainer

- Trainer may use small groups to discuss on application of food gravimetric density measuring techniques
- Avail tools, equipment and food sample for density measuring techniques

Key steps:

While delivering this activity, pass through the following steps:

Step 1: Introduce the activity and ask trainees to go in food chemistry laboratory to apply food gravimetric density measuring techniques

Step 2: Explain the task and provide clear work instruction

Step 3: Demonstrate how to apply food gravimetric density measuring techniques

Step 4: Ask trainees to apply food gravimetric density measuring techniques and monitor them.

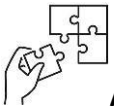
Step 5: Verify whether food gravimetric density measuring techniques are well applied and give clarification if any.

Step 6: Ask trainees to read key reading 2.3.2 in trainee manual

Step 7: Ask trainees to perform the task provided in application 2.3

Points to Remember

- Procedures of gravimetric methods are preparation of sample, measure mass in air, measure volume displacement, calculate density and analyzing results.



Application of learning 2.3.

Organize trainees' practice in food laboratory nearly the school, ask trainee to perform food gravimetric density measuring methods

Checklist

SN	Criteria	Indicators	Yes	No
1.	Food gravimetric density measuring techniques are well applied	Hydrometric method is done		
		Pycnometric method is done		
		The results are interpreted		

Indicative content 2.4: Measuring temperature in food

Duration: 8hrs

Theoretical Activity 2.4.1: Description of food temperature measuring methods

Notes to the trainer:

- Trainer may use small groups to describe food rheology testing technique
- The use of drawings, pictures or videos as didactic materials is required.

Key steps:

While delivering this activity, pass through the following steps:

Step 1: Introduce the activity and ask trainees to answer the following question:

a).What is the purpose of measuring temperature of food?
b).Describe food temperature measuring methods

Step 2: Ask trainees to write the findings on papers, flip chart, blackboard or white board.

Step 3: Ask trainees to present their findings the trainer and whole class.

Step 4: Provide the expert view and clarify ideas

Step 5: Address any questions or concerns.

Points to Remember

- The primary purpose of measuring the temperature of food is to ensure that it has reached a safe internal temperature sufficient to destroy harmful bacteria and pathogens that can cause foodborne illnesses.
- There are two primary food temperature measurement methods: direct contact methods and non-contact methods.

Practical Activity 2.4.2: Applying temperature measuring methods in

Notes to the trainer

- Trainer may use small groups to discuss on application of temperature measuring methods in food
- Avail tools, equipment and food sample for temperature measuring methods

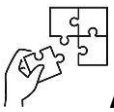
Key steps:

While delivering this activity, pass through the following steps:

Step 1: Introduce the activity and ask trainees to go in food chemistry laboratory to apply temperature measuring methods in food
Step 2: Explain the task and provide clear work instruction
Step 3: Demonstrate how to apply the temperature measuring methods in food
Step 4: Ask trainees to apply the temperature measuring methods in food and monitor them.
Step 5: Verify whether temperature measuring methods are well applied and give clarification if any.
Step 6: Ask trainees to read key reading 2.4.2 in trainee manual
Step 7: Ask trainees to perform the task provided in application 2.4

Points to Remember

- Procedure of direct contact method are calibrating the thermometer, insert the probe, wait for stabilization and clean after use
- Procedure of non-contact method are ensuring proper calibration, maintain distance guidelines, aim at surface area, record temperature quickly and consider surface conditions



Application of learning 2.4.

Organize trainees' practice in food laboratory nearly the school, ask trainee to perform temperature measuring methods

Checklist

SN	Criteria	Indicators	Yes	No
1.	Food temperature measuring methods are well applied	Direct Contact method is used		
		Non-Contact Method is used		
		The results are interpreted		

Learning outcome 2 : End assessment

Written assessment

I. Read the following statement on food organoleptic properties testing methods and circle the letter corresponding to the correct answer

1. How can organoleptic testing methods help in quality control of food products?

a. By providing exact nutritional values
b. By ensuring that sensory characteristics meet consumer expectations
c. By detecting the presence of pathogens
d. By analysing food packaging materials

Answer: b) By ensuring that sensory characteristics meet consumer expectations

2. During organoleptic testing, the hedonic scale is used to:

a. Determine the shelf life of a product
b. Measure how much a consumer likes or dislikes a product
c. Assess the chemical composition of the food
d. Compare the food's nutritional content

Answer: b) Measure how much a consumer likes or dislikes a product

3. What type of test is commonly used to evaluate the aroma of a food product?

a. Descriptive sensory analysis
b. Paired difference test
c. Visual examination
d. Conductivity test

Answer: a) Descriptive sensory analysis

1. In a paired comparison test, participants are asked to:

a. Choose between two samples based on a specific sensory attribute
b. Rank multiple samples in order of preference
c. Identify the sample that is most different from the others
d. Evaluate all organoleptic properties of a product

Answer: a) Choose between two samples based on a specific sensory attribute

5. Why is organoleptic testing crucial for new product development in the food industry?

a. To determine chemical stability
b. To assess consumer preferences and ensure product appeal
c. To evaluate environmental sustainability
d. To analyze supply chain efficiency

Answer: b) to assess consumer preferences and ensure product appeal

II. Read the statement related to testing the rheological properties of food, and answer by True if the statement is correct and false if the statement is wrong

1. Rheological properties of food refer to the study of its flow and deformation behaviour. **True**

2. Viscosity is a measure of how easily a food flows, and it is a key rheological property. **True**

3. Rheological testing is only relevant for liquid foods, not for semi-solid or solid foods. **False**

4. Rheological properties do not change with temperature, making it unnecessary to control temperature during testing. **False**

5. Elasticity, viscosity, and plasticity are examples of rheological properties that can be measured in food. **True**

6. Rheological tests are unnecessary for determining the shelf life of a food product. **False**

Practical assessment

IMENA Dairy, located in Busasamana Sector of Rubavu District in the Western Province, specializes in producing various products from raw milk. The facility includes both a processing room and a storage room. The company requires testing of the organoleptic and rheological properties of their products, as well as measurements of density and temperature. The quality assurance officer of company asks you to assist IMENA Dairy to perform these tests and measurements. The task must be completed within 3 hours

Checklist

SN	Criteria	Indicators	Score	
			Yes	No
1	Rheometry technique is well applied	1.1 The sample is prepared		
		1.2 The right rheometer is chosen		
		1.3 The rheometer is set		
		1.4 Rheological Test is runed		
		1.5 Results are analysed		
2	Food gravimetric density measuring techniques are well applied	2.1 Hydrometric method is done		
		2.2 Pycnometric method is done		
		2.3 The results are interpreted		
3	Food temperature measuring methods are well applied	3.1 Direct Contact method are used		
		3.2 Non-Contact Method is used		
		3.3 The results are interpreted		

END

Further information to the trainer

AOAC International. (2023). Official methods of analysis of AOAC International (22nd ed.). Method 925.40 - Moisture in dry foods - Method I: Vacuum oven drying at 70°C.

Lawless, H. T., & Heymann, H. (2010). Sensory evaluation of food: Principles and practices (2nd ed.). Springer.

Nielsen, S. S. (2010). Food analysis (4th ed.). Springer. (Chapter 5: Protein).

Rao, M. A. (2014). Rheology of fluid and semi-solid foods: Principles and applications (2nd ed.). Springer.

Steffe, J. F. (1996). Rheological methods in food process engineering (2nd ed.). Freeman Press.

Stone, H., & Sidel, J. (2004). Sensory evaluation practices (3rd ed.). Elsevier.

Indicative contents
3.1. Determining proximate composition of food
3.2. Determining Titratable acidity in food
3.3 Determining Total soluble solids (Brix) in food
3.4 Determining vitamin in food
3.5 Determining mineral content in food

Key Competencies for Learning Outcome 3: Test chemical properties of food

Knowledge	Skills	Attitudes
• Description of the Purpose of food proximate composition analysis • Description of analytical methods • Interpretations of results	• Determining Moisture content in food • Determining Ash content in food • Determining Proteins content in food • Determining Fat content in food • Determining Titratable acidity in food • Determining Total soluble solids (Brix) in food • Determining Vitamin A and c in food • Determining Calcium and Magnesium content in food • Interpreting the results	• Being careful and accuracy during testing chemical properties of food • Being decision maker during interpretation of result

Duration: 30 hrs

Learning outcome 3 objectives:

By the end of the learning outcome, the trainees will be able to:

1. Determine properly Proximate composition according to the method and protocol
2. Determine exactly Vitamin A and C in food according to the method and protocol
3. Determine perfectly Calcium and Magnesium content in food according to the method and protocol
4. Determine effectively Titratable acidity in food according to the method and protocol
5. Determine exactly Total soluble solids (Brix) in food according to the method and protocol
6. Interpret correctly the results referring to food specifications

Resources

Equipment	Tools	Materials
• Karl Fischer titration Apparatus • Drying oven • Freezer • Kjeldahl apparatus • Precision balance • Soxhlet extractor • Computer • UV Spectrophotometer • Tissue Homogenizer Analytical Balance	• Moisture meter • Crucibles • Tongues • Spatula • Refractometer • Glassware • Pipette with desiccant • pH meter capable of measuring pH ranging 1.0 to 14.0	• Sulphuric acid • Sodium sulfate • NaOH, Boric acid • Hydrochloric acid • KOH • Phenolphthalein indicator, Eriochrome Black T • EDTA • Calcium chloride

• Blender • Water bath • Hot plate • Furnace • Centrifuge • vortex mixer • Desiccator	• Glass funnel suitable for use with a fluted filter paper • Glass rod • Centrifuge tube.	• Ascorbic acid reference standard, 2, 6 • Dichloroindophenol • Metaphosphoric acid pellets • Standard Buffer (Fisher, pH 4, 7, & 10) • Filter paper (Whatman No. 541) • Deionised water • Nitric Acid, 1N • Stock standard for minerals.

Advance Preparation:

Before delivering this learning outcome, you are recommended to:

- Avail the classroom
- Ensure that the Laboratory is available and well organized
- Avail standard reagent for test chemical properties of food
- Avail tools, equipment and food sample for testing chemical properties of food

Indicative content 3.1: Determination of proximate composition of food

Duration: 15 hrs

Practical Activity 3.1.1: Determining moisture content in food

Notes to the trainer

- The trainer may demonstrate how to determine moisture content in food.
- Avail food sample, tools and equipment for moisture content determination

Key steps:

While delivering this activity, pass through the following steps:

Step 1: Introduce the activity and ask trainees to go in food chemistry laboratory to determine moisture content in food.

Step 2: Explain the task and provide clear work instruction (PPE, Time allocated)

Step 3: Demonstrate how to determine moisture content in food. While demonstrating, explain methods of determine moisture content in food and procedure used

Step 4: Ask trainees to determine moisture content in food and monitor the procedures.

Step 5: Verify whether moisture content is well determined and provide feedbacks where necessary.

Step 6: Ask trainees to read key reading 3.1.1 in trainee manual

Points to Remember

- The two main types of moisture meters are capacitive moisture meters and resistance moisture meters
- The procedures of moisture meters are calibration, sample preparation, measurement and reading the results
- The procedures of determination of moisture content in food by using karl fischer titration are sample preparation, titration, monitoring and calculation

- Gravimetric methods used in determination of moisture content in food are oven drying, vacuum oven drying and freeze drying.

Practical Activity 3.1.2: Determining ash content in food

Notes to the trainer

- The trainer is supposed to demonstrate how to determine ash content in food.
- Avail food sample, tools and equipment for ash content determination

Key steps:

While delivering this activity, pass through the following steps:

Step 1: Introduce the activity and ask trainees to go in food chemistry laboratory to determine ash content in food.

Step 2: Explain the task and provide clear work instruction (PPE, Time allocated)

Step 3: Demonstrate how to determine ash content in food While demonstrating, explain methods of determine ash content in food and procedure used

Step 4: Ask trainees to determine ash content in food and monitor the procedures.

Step 5: Verify whether ash content is well determined and provide feedbacks where necessary.

Step 6: Ask trainees to read key reading 3.1.2 in trainee manual

Points to Remember

- The two primary methods used in determination of ash content in food are dry ashing and wet ashing.

Practical Activity 3.1.3: Determining protein content in food

Notes to the trainer

- The trainer may demonstrate how to determine protein content in food.
- Avail food sample, reagent, tools and equipment for protein content determination

Key steps:

While delivering this activity, pass through the following steps:

Step 1: Introduce the activity and ask trainees to go in food chemistry laboratory to determine protein content in food.

Step 2: Explain the task and provide clear work instruction (PPE, Time allocated)

Step 3: Demonstrate how to determine protein content in food While demonstrating, explain methods of determine protein content in food and procedure used

Step 4: Ask trainees to determine protein content in food and monitor the procedures.

Step 5: Verify whether protein content is well determined and provide feedbacks where necessary.

Step 6: Ask trainees to read key reading 3.1.3 in trainee manual

Points to Remember

- The two direct methods of determination of protein content are kjeldahl method and dumas method
- The procedures of kjeldahl method are sample preparation, digestion, neutralization and distillation, titration and calculations.
- The procedures of dumas method are sample preparation, combustion, gas purification, nitrogen measurement and calculation

Practical Activity 3.1.4: Determining fat content in food

Notes to the trainer

- The trainer may demonstrate how to determine fat content in food.
- Avail food sample, reagent, tools and equipment for fat content determination

Key steps:

While delivering this activity, pass through the following steps:

Step 1: Introduce the activity and ask trainees to go in food chemistry laboratory to determine fat content in food.

Step 2: Explain the task and provide clear work instruction (PPE, Time allocated)

Step 3: Demonstrate how to determine fat content in food While demonstrating, explain methods of determine fat content in food and procedure used

Step 4: Ask trainees to determine fat content in food and monitor the procedures.

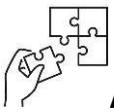
Step 5: Verify whether fat content is well determined and provide feedbacks where necessary.

Step 6: Ask trainees to read key reading 3.1.4 in trainee manual

Step 7: Ask trainees to perform the task provided in application of learning 3.1

Points to Remember

- The two methods used in determination of fat content in food are semi-continuous methods and non-solvent wet extraction
- The procedures of determination of fat content in food by using semi-continuous method (soxhlet extraction) are sample preparation, extraction, solvent evaporation, drying, weighing and calculation
- The two methods of determination of fat content in food by using non-solvent wet extraction are babcock method and gerber method



Application of learning 3.1.

Organize trainees' practice in food chemistry laboratory and ask trainees to determine proximate composition of food.

Check list:

SN	Criteria	Indicator	Score	
			Yes	No
1	Moisture content is well determined	1.1 Moisture meter is used		
		1.2 Karl Fischer titration is used		
		1.3 Oven Drying is used		
		1.4 Vacuum Oven Drying is used		
		1.5 Freeze Drying is used		
		1.6 Results are interpreted		
2	Ash content is well determined	2.1 Dry ashing method is used		
		2.2 Wet ashing method is used		
		The results are interpreted		
3	Proteins content in food is well determined	3.1 Kjeldahl Method is used		
		3.2 Dumas Method is used		
		3.3 Results are interpreted		
4	Fat content in food is well determined	4.1 Soxhlet Extraction method is used		
		4.2 Babcock Method is used		
		4.3 Gerber Method is used		
		4.4 Results are interpreted		

Indicative content 3.2: Determination of Titratable acidity in food

Duration: 3hrs

Practical Activity 3.2.1: Determining Titratable acidity in food

Notes to the trainer

- The trainer is supposed to demonstrate how to determine Titratable acidity in food.
- Avail food sample, reagent, tools and equipment for titratable acidity determination

Key steps:

While delivering this activity, pass through the following steps:

Step 1: Introduce the activity and ask trainees to go in food chemistry laboratory to determine Titratable acidity in food.

Step 2: Explain the task and provide clear work instruction (PPE, Time allocated)

Step 3: Demonstrate how to determine Titratable acidity in food While demonstrating, explain methods of determine Titratable acidity in food and procedure used

Step 4: Ask trainees to determine Titratable acidity in food and monitor the procedures.

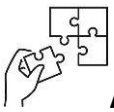
Step 5: Verify whether Titratable acidity is well determined and provide feedbacks where necessary.

Step 6: Ask trainees to read key reading 3.2.1 in trainee manual

Step 7: Ask trainees to perform the task provided in application of learning 3.2

Points to Remember

- Titratable acidity is a measure of the total acid content in a food sample. It is determined by neutralizing the acidic components with a standard alkaline solution.
- The procedures of determination of titratable acidity are sample preparation, titrant preparation, titration setup, titration and calculation



Application of learning 3.2.

Organize trainees' practice in food chemistry laboratory and ask trainees to determine titratable acidity in food.

Check list:

SN	Criteria	Indicator	Score	
			Yes	No
1	Acidity is well determined	1.1 Sample is prepared		
		1.2 Titrant is prepared		
		1.3 Titration is done		
		1.4 Calculation is done		
		1.5 Results are interpreted		

Indicative content 3.3: Determination of Total soluble solids (Brix) in food

Duration: 3hrs

Practical Activity 3.3.1: Determining Total soluble solids (Brix) in food

Notes to the trainer

- The trainer is supposed to demonstrate how to determine Total soluble solids (Brix) in food.
- Avail food sample, reagent, tools and equipment for Total soluble solids (Brix) determination

Key steps:

While delivering this activity, pass through the following steps:

Step 1: Introduce the activity and ask trainees to go in food chemistry laboratory to determine Total soluble solids (Brix) in food.

Step 2: Explain the task and provide clear work instruction (PPE, Time allocated)

Step 3: Demonstrate how to determine Total soluble solids (Brix) in food While demonstrating, explain methods of determine Total soluble solids (Brix) in food and procedure used

Step 4: Ask trainees to determine Total soluble solids (Brix) in food and monitor the procedures.

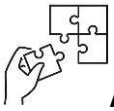
Step 5: Verify whether Total soluble solids (Brix) are well determined and provide feedbacks where necessary.

Step 6: Ask trainees to read key reading 3.3.1 in trainee manual

Step 7: Ask trainees to perform the task provided in application of learning 3.3

Points to Remember

- The two types of refractometers are handheld refractometer and digital refractometer



Application of learning 3.3.

Organize trainees' practice in food chemistry laboratory and ask trainees to determine brix content in food.

Check list:

SN	Criteria	Indicator	Score	
			Yes	No
1.	Brix is well determined	1.1 Hand held Refractometer is used		
		1.2 LCD Digital model refractometer is used		
		1.3 Results are interpreted		

Indicative content 3.4: Determination of Vitamin in food

Duration: 6hrs

Practical Activity 3.4.1: Determining vitamin A in food

Notes to the trainer

- The trainer is supposed to demonstrate how to determine Vitamin A in food.
- Avail food sample, reagent, tools, and equipment for Vitamin A determination

Key steps:

While delivering this activity, pass through the following steps:

Step 1: Introduce the activity and ask trainees to go in food chemistry laboratory to determine Vitamin A in food.

Step 2: Explain the task and provide clear work instruction (PPE, Time allocated)

Step 3: Demonstrate how to determine Vitamin A in food While demonstrating, explain methods of determine Vitamin A in food and procedure used

Step 4: Ask trainees to determine Vitamin A in food and monitor the procedures.

Step 5: Verify whether Vitamin A is well determined and provide feedbacks where necessary.

Step 6: Ask trainees to read key reading 3.4.1 in trainee manual

Points to Remember

- Vitamin A is a fat-soluble vitamin that plays a crucial role in various physiological functions, including vision, immune function, and skin health.
- The procedures of determining vitamin A in food are sample preparation, calibration curve preparation and measurement procedure

Practical Activity 3.4.2: Determining vitamin C in food

Notes to the trainer

- The trainer is supposed to demonstrate how to determine Vitamin C in food.
- Avail food sample, reagent, tools, and equipment for Vitamin C determination

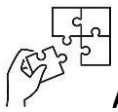
Key steps:

While delivering this activity, pass through the following steps:

Step 1: Introduce the activity and ask trainees to go in food chemistry laboratory to determine Vitamin C in food.
Step 2: Explain the task and provide clear work instruction (PPE, Time allocated)
Step 3: Demonstrate how to determine Vitamin C in food While demonstrating, explain methods of determine Vitamin C in food and procedure used
Step 4: Ask trainees to determine Vitamin C in food and monitor the procedures.
Step 5: Verify whether Vitamin C is well determined and provide feedbacks where necessary.
Step 6: Ask trainees to read key reading 3.4.2 in trainee manual
Step 7: Ask trainees to perform the task provided in application of learning 3.4

Points to Remember

- Vitamin C, also known as ascorbic acid, is an essential nutrient that plays a critical role in various biological functions, including collagen synthesis, antioxidant activity, and immune function.
- The procedures of determination of vitamin c by iodometric titration are sample preparation, preparation of reagents, titration process and calculating vitamin c content.



Application of learning 3.4.

Organize trainees' practice in food chemistry laboratory and ask trainees to determine vitamin A and vitamin C in food.

Check list:

SN	Criteria	Indicator	Score	
			Yes	No
1	Vitamin A content is well determined	1.1 Sample is prepared		
		1.2 Calibration Curve is prepared		
		1.3 Measuring Procedures are respected		
		1.4 Results are interpreted		
2	Vitamin C content is well determined	2.1 Sample is prepared		
		2.2 Reagent is prepared		
		2.3 Titration Process are respected		
		2.4 Calculation is done		
		2.5 Results are interpreted		

Indicative content 3.5: Determination of Mineral content in food

Duration: 3hrs

Practical Activity 3.5.1: Determining Calcium and Magnesium content in food

Notes to the trainer

- The trainer is supposed to demonstrate how to determine calcium and magnesium content in food.
- Avail food sample, reagent, tools and equipment for determination calcium and magnesium content in food

Key steps:

While delivering this activity, pass through the following steps:

Step 1: Introduce the activity and ask trainees to go in food chemistry laboratory to determine calcium and magnesium content in food.

Step 2: Explain the task and provide clear work instruction (PPE, Time allocated)

Step 3: Demonstrate how to determine calcium and magnesium content in food While demonstrating, explain methods of determine calcium and magnesium content in food and procedure used

Step 4: Ask trainees to determine calcium and magnesium content in food and monitor the procedures.

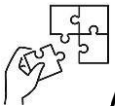
Step 5: Verify whether calcium and magnesium are well determined and provide feedbacks where necessary.

Step 6: Ask trainees to read key reading 3.5.1 in trainee manual

Step 7: Ask trainees to perform the task provided in application of learning 3.5

Points to Remember

- Complexometric titration is a method used to determine the concentration of metal ions, including calcium and magnesium, in a sample. It involves the formation of a colored complex between the metal ion and a chelating agent.
- The procedures of determining calcium and magnesium content in food are sample preparation, buffer preparation, titration and calculation.



Application of learning 3.5.

Organize trainees' practice in food chemistry laboratory and ask trainees to determine calcium and magnesium content in food.

Check list:

SN	Criteria	Indicator	Score	
			Yes	No
1	Calcium and magnesium are well determined	1.1 Sample is prepared		
		1.2 Buffer is prepared		
		1.3 Titration is done		
		1.4 Calculation is done		
		1.5 Results are interpreted		

Learning outcome 3 end assessment

Written assessment

I. Read the following statement on testing chemical properties of food then circle th e letter corresponding to the correct answer.

1. What is the reagent used in Karl Fischer titration
   a) Iodine
   b) Potassium permanganate
   c) Sodium hydroxide
   d) Hydrochloric acid

Answer: a) Iodine

2.Which of the following is a gravimetric method for determining moisture content?
   a) Karl Fischer titration
   b) Capacitive moisture meter
   c) Oven drying
   d) Refractometry

Answer: c) Oven drying

3.Ash content in food refers to:
   a) The inorganic residue remaining after organic matter is removed
   b) The total amount of water in a food
   c) The amount of carbohydrates in a food
   d) The amount of protein in a food

Answer: a) The inorganic residue remaining after organic matter is remove

4.Which of the following is not a step involved in the Kjeldahl method?
   a) Digestion
   b) Neutralization and distillation
   c) Titration
   d) Precipitation

Answer: d) Precipitation

5. What is the most commonly solvent used for Soxhlet extraction in fat determination?
   a) Water
   b) Ethanol
   c) Petroleum ether
   d) Methanol

Answer: c) Petroleum ether

II. Read the statement related to test chemical properties of food, Answer by True if the statement is correct and False if the statement is wrong

1. Centrifugation is an important step in the Gerber method to separate fat from the liquid mixture. **True**
2. A pH indicator, such as phenolphthalein, is often used during titration to detect the endpoint of the reaction. **True**
3. The UV spectrophotometry method for vitamin A determination is non-destructive, meaning the sample can be reused after analysis. **False**
4. Iodometric titration can be used to determine both the oxidized and reduced forms of vitamin C in food. **False**
5. Refractometers can be used to measure the total soluble solids in beverages such as fruit juices, wines, and soft drinks**. True**

Practical assessment

AGAHOZO company export different food products including juices and pastries, the company requires to analyse chemical properties of those food. The quality management officer of the company asks trainees to assist AGAHOZO company to perform these tests. This task must be completed within 8 hours.

SN	Criteria	Indicator	Score	
			Yes	No
1	Proximate food composition is well determined	Moisture content is determined		
		Ash content is determined		
		Protein content is determined		
		Fat content is determined		
2	Acidity and brix are well tested	acidity is tested		
		brix is tested		
3	Vitamin content is well tested	Vitamin A is tested		
		Vitamin C is tested		
4	Minerals are well tested	Calcium and magnesium are determined		
5	Interpreting of the results is applied	3.1The Test Results are understood		
		3.2 Comparing Against Standards is done		
		3.3 Contextualizing Results is done		
		3.4 Assessing Quality Control Systems is done		
		3.5 Investigating Anomalies is done		
		3.6 Documenting Findings is done		
		3.7 Communicating Results is done		

END

Further information to the trainer

AOAC International. (2023). *Official methods of analysis of AOAC International* (22nd ed.). Method 925.40 - Moisture in dry foods - Method I: Vacuum oven drying at 70°C.

Lawless, H. T., & Heymann, H. (2010). *Sensory evaluation of food: Principles and practices* (2nd ed.). Springer.

Nielsen, S. S. (2010). *Food analysis* (4th ed.). Springer. (Chapter 5: Protein).

Rao, M. A. (2014). *Rheology of fluid and semi-solid foods: Principles and applications* (2nd ed.). Springer

Stone, H., & Sidel, J. (2004). *Sensory evaluation practices* (3rd ed.). Elsevier.

Steffe, J. F. (1996). *Rheological methods in food process engineering* (2nd ed.). Freeman Press.

RTB | RWANDA TVET BOARD

October 2024