Addis Ababa University
School of Chemical and Bio-Engineering
Food Engineering Graduate Program

ChEg 6224 Food Preservation and Packaging (3Cr. Hrs; 7ECTS)

Course Description: Food Preservation and Packaging course description includes: Overview on principles of food preservation; Post-harvest handling and management of agricultural produces; Post-harvest food value chain losses identification and prevention/management principles using various techniques of food preservation; Crucial food preservation unit operations and reaction kinetics including food preservation by removal of heat; thermal treatments, freeze drying/lyophilization; spray drying engineering; and preservation by the use of food additives; Novel methods of food preservation techniques (Emerging food preservation techniques); Understanding and measuring the shelf-life of foods, predicting the shelf-life of food and shelf-life testing using stability chamber. The course also comprise Packaging as means food preservation; Types and function of packaging used for foods; Reasons for growing packaging needs in economic emerging countries; Selection of packing materials; Active and intelligent packaging, Mechanical and optical properties and Permeability of thermoplastic polymers; Edible and biodegradable polymeric materials for food packaging; Interaction of package and food materials; Filling and sealing of containers, Package and seal integrity tests.
Finally, the course includes individual/ group term paper with presentation and educational industry visit.

Expected output: Fundamental understanding on food preservation engineering concepts, and major unit operations; principles of packaging of high value agricultural produces; food preservation technologies with their engineering concepts of processed and packaged food products; shelf stability impressions on empirical and instrumental prediction of food products conveyed.

Course Outline *Instructor: Dr.Eng. Shimelis Admassu*

1. Fundamentals of Food Preservation

2. Preservation of Food by Heat, Natural Antioxidants and Antimicrobial

- 2.1 Thermal Processing
  - 2.1.1 Process parameters for the reduction in the microbial population
  - 2.1.2 Spoilage probability of thermal process
- 2.2 Antioxidants in Food Preservation
- 2.3 Microbial Fermentation and Natural Antimicrobial for Food Preservation

Set by: Shimelis Admassu (Dr.Eng.) / Professor (Associate) /

3. Spray Drying Technology

3.1 Thermal Spray Process
3.2 Process Control Equipment in Thermal Spray Technology
  3.2.1 Process Parameters
  3.2.2 Material Feed
  3.2.3 Thermal Spray Controls
  3.2.4 Powder Pulsing and Characteristics
  3.2.5 Thermal Spray Controls
3.3 Applications for Thermal Spray Processing

4. Food Preservation by the Removal of Heat

4.1 Food Chilling
4.2 Food freezing

5. Food Packaging Systems

5.1 Function of post-processing operations
5.2 Types and selection criteria of food packaging materials
5.3 Active and intelligent packaging
5.4 Antimicrobial food packaging
5.5 Package and seal integrity tests
5.6 Packaging machinery, filling and plant operations
5.7 Food safety and legislative aspects of packaging

6. Food Additives

References

Asseghedech Woldelul. (1998). Successful packaging for International market. Artistic printing press, Ethiopia.

Dong Sun Lee, Kit L.Yan.(2008). Food Packaging Science and Technology.

FAO. (1985). Prevention of post-harvest food losses: A practical manual, Rome, Italy.

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Heldman, D.R.,& Hartel, R.W.(1997). Principles of food processing. Chapman & Hall, ITP Publishing Ltd. New York.

Ibarz A., & Barbosa-Cánovas, V.G. (2003). Unit operation in food engineering. Food preservation technology series, CRC Press LLC, Washington, D.C.

Kordylas, J.M. (1990). Processing and preservation of tropical and subtropical foods. Macmillan publishing Ltd, London.

Kyzlink, V.(1990). Principles of food preservation. Development in food science 22. Elsevier publisher. New York.

Raija, A.(2005). Novel food packaging techniques. CRC Press Book. Woodhead Publishing in Food Science and Technology.

Robertson, G.L.(2006). Food Packaging Principles and Practice. 2nd edition, CRC Press Book, Taylor & Francis Group.550pp.

Scott A. Morris.(2011). Food and Package Engineering.

Shafiur Rahman, M..(2007). Hand Book of Food Preservation. 2nd edition, CRC press,pp.1088.

Vaclavik, V.A.(1999). Essentials of food science. A Chapman & Hall Food Science Book. An Aspen publication, Aspen publishers, Inc. Gaithersburg, Maryland.

Zeuthen,P. and Bøgh-Serensen,L.(2003). Food Preservation Techniques. CRC Press Wood Head Publishing Limited, England.pp581.

Any General Food Preservation and Food Packaging Textbooks will probably contain majority of the topics covered during lecture. Students are encouraged to narrow-down reference options based on the scope of the material covered in the lectures.

Exams: There shall be Mid and Final examinations. It contains 40% of the final course grade.

Term Papers and Presentation: Students are expected to submit home-take assignments on food preservation and packaging course topics. It includes 50% of the final course grade. Plagiarism will affect series problem on academic honesty. Hard works motivate achievers towards elevated academic excellence. To meet the objective of teaching-learning process **Habitual Attendance is worthwhile**.

Grading: The performance of students will be scaled as per the Addis Ababa University Graduate Program grading scale. Borderline cases will be considered on a case-by-case. Class participation, motivation and alertness might be the key tools for resolution.

Expectations: You should read the text from reference materials and work meticulously as we proceed through the course chapters.

School of Chemical and Bio-Engineering, AAU
Food Engineering Graduate Program

ChEg 6224: Food Preservation and Packaging
Course Director: Shimelis Admassu (Dr.Eng.)

Assignments by Group (Group work)

1. Advances in Food Preservation

1.1 Pulsed Electric Fields
1.2 High-Pressure Processing of Biomaterials
1.3 Biotechnology and reduced spoilage
1.4 Encapsulation and Controlled Release

Focal points to consider includes:

- Principles, equipment and processing technology
- Mechanisms of microbial inactivation
- Critical factors determining microbial inactivation
- Elaborate the specific preservation technology in combination with other food preservations technologies (conventional and emerging)
- Combinations with other preservation techniques
- Effects of the specific technology on enzymes, food proteins, vitamins and other quality attributes of foods
- Strengths and weaknesses as a preservation technology
- Applications and their future potentials/developments

2. Determination of Product Shelf-life (Group work) with Practical applications

Fundamental points to be included in the write up process:

- Main factors affecting shelf stability of packed foods
- Basic concepts shelf-life stability and prediction mechanisms
- Direct and indirect shelf-life predicting principles
- Modes of shelf-life and spoilage measuring
- Kinetics of Food Deterioration
- Accelerated shelf-life tests (ASLT)

- ☯ Predictive Mathematical Modelling or Shelf Life Prediction Models/Modeling using ASLT
- ☯ Exercise the shelf life determination using specific case study (Oil, Eggs, Bread, Peanuts butter and Pasta)
- ☯ Conclusion and Recommendation.

Also take account of:

- Characterization of water activity and its relation with shelf-life prediction;
- Interpretation and importance of water activity towards deterioration of bio-chemical reactions in foods;
- Effects of water activity on shelf-life of foods products and its major role;
- Instruments for measuring water activity/shelf life stability of agricultural produces;
- Modern measuring instrument for shelf-life stability of packaged food products;
- Shelf-life prediction procedure and its limitations;
- Approaches to shelf-life determination and factors influencing shelf-life analysis of biomaterials;
- Food safety and shelf-life;
- Shelf life prediction procedures for food products: Current status in Ethiopia;

(The case of Ethiopia, Africa and other developing countries: Provide typical case study)

Finally, you will present the findings on shelf-life testing procedures, data and obtained results using illustrations of the specific agricultural produces.

3. Food Packaging (Group Assessment Term-Paper)

- ♦ Active and Intelligent packaging
- ♦ Antimicrobial food packaging
- ♦ Controlled and modified atmosphere packaging
- ♦ Bio-based food packaging

- **For all group assignments rigorous presentation is utmost essential**

Remarks: Cut-off date for submission of 1st Assignment: April 27, 2020
Cut-off date for submission of 2nd Assignment: May 20, 2020
Cut-off date for submission of 3rd Assignment: June 12, 2020

Late submission is not advisable.

Final Examination June 2nd week, 2020