FOOD 2500 FOOD CHEMISTRY / HNSC 2150 COMPOSITION, FUNCTIONAL AND NUTRITIONAL PROPERTIES OF FOODS

Credits: (3-L:0-0)3

Description:

Structure and chemistry of food components. Physical and chemical changes in food commodities.

Prerequisites:

CHEM 2770 or MBIO 2770 or CHEM 2360 or MBIO 2360

HNSC 1200, HNSC 1210 and CHEM 1300

Instructor: Dr. Trust Beta
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Teaching assistant: Nancy Asen

Grader / Marker: Nilakshi Abeysinghe

Classes: Cisco WebEx (Tuesdays & Thursdays 10:00 –11:15 am)

FOOD 2500 Labs: Virtual & 241 Ellis Building (Thursdays & Fridays 2:30 - 5:25 pm)

Consultations:

You can e-mail me or post discussion questions on UM Learn.
Cisco WebEx consultation meetings are scheduled on Tuesdays 2:30 pm to 3:30 pm as needed.

Recommended textbooks/ References:

Y. H. Hui. 2012. Food Chemistry: Principles and Applications, 3rd edition. Science Technology System, West Sacramento, CA. TX 545 F591 2012

S. Damodaran, K. L. Parkin, 2017. Fennema's Food Chemistry, 5th edition, CRC, Boca Raton, FL. TX 541 F65 2017
Online access: Fennema's Food Chemistry (5th Edition) - Knovel (oclc.org)

J. M. deMan, J. W. Finley, W. J. Hurst, C. Y. Lee. 2018. Principles of Food Chemistry, 4th edition. Springer. TX 531 D43 2018
Online access: Principles of Food Chemistry | SpringerLink (oclc.org)

H. D. Belitz. 2009. Food Chemistry, 4th edition, Springer Verlag, Berlin, Heidelberg.
Online access: http://dx.doi.org/10.1007/978-3-540-69934-7

T. P. Coultate. 2016. Food: the chemistry of its components, 6th edition, Royal Society of Chemistry, Cambridge. TX 531 C68 2016

T. P. Coultate. 2009. Food: the chemistry of its components, 5th edition, Royal Society of Chemistry, Cambridge. TX 531 C68 2009
Online access: Food - The Chemistry of its Components (5th Edition) - Knovel

M. Eskin, F. Shahidi 2012. Biochemistry of Foods, 3rd Edition
Online access: Biochemistry of Foods (3rd Edition) - Knovel (oclc.org)

AOAC International. 2005. Official Methods of Analysis of the Association of Official Analytical Chemists (AOAC) International, 18th ed., W. Horwits (ed), AOAC International), Gaithersburg, Maryland.

Subject outline

Introduction: an overview of food chemistry.

Water, acids, bases and buffers: water structure, water activity, sorption isotherms; food acidity.

Lipids: nomenclature, structure, classification of lipids and fatty acids; functional properties of lipids; production of edible oils and fats including refining, hydrogenation, interesterification; rancidity in fats; emulsions.

Carbohydrates: nomenclature, structures, conformations, projections; monosaccharides, disaccharides, oligosaccharides, starch, glycogen, cellulose, modified starches, gums; functional properties of mono- and disaccharides, polysaccharides, gums.

Proteins: amino acids, protein structure; functional properties of proteins; animal and plant proteins.

Enzymes: nomenclature, kinetics; enzymes in the food and beverage industry.

Vitamins and minerals: fat soluble and water soluble vitamins; common elements in foods.

Additives: types of additives and their functions.

Colorants: food colours, food pigments; general measurement of food colour.

Flavours: taste, odour, classes, flavour enhancers.

Overview of food composition and food composition databases.

FOOD 2500 Laboratory exercises
Basic techniques
Acid content of foods
Lipid properties
Sugar and starch properties
Protein properties
Enzymatic browning
Basic tastes

HNSC 2150 Assignments
Proximate analyses and food composition tables
Sensory evaluation

Objectives:
At the end of the course, students should be able to:

1. Discuss the relationship between chemical and physical composition and function of major and minor components in food
2. Describe physicochemical changes that food components undergo during processing and storage
3. Apply basic principles of food chemistry to discuss the effects of processing and storage on food composition and quality

Evaluation Tool	Points	% of Grade	Date
FOOD Labs || HNSC Assignments	100	20	1 wk after lab || 03/11 & 04/01
Class participation (bonus points)*	100	5	In Lectures
Mid-term Exam	100	40	March 2
Final Exam	100	40	April 19 to May 1

*Note that 105% can be achieved.

Grades:

A+ 90 - 100%
A 80 - 89%
B+ 75 - 79%
B 67 - 74%
C+ 61 - 66%
C 56 - 60%
D 50 - 55%
F Under 50%

Policy on Plagiarism and Cheating (quote from university calendar):

"To plagiarize is to take ideas or words of another person and pass them off as one's own. Obviously, it is not necessary to state the source of well known or easily verifiable facts, but students are expected to acknowledge the source of ideas and expressions they use in their written work, whether quoted directly or paraphrased. This applies to diagrams, statistical tables and the like, as well as written material.

It will also be considered plagiarism and/or cheating if a student submits a term paper written in whole or in part by someone other than himself or herself, or copies the answer or answers of a fellow student in any test, examinations or take-home assignments. Plagiarism or any other form of cheating in examinations or term tests is subject to serious academic penalty."

Course Policies on Missed Labs, Missed Exams, Missed Assignments, Late Assignments & Class Participation

Missed Labs, Missed Exams or Missed Assignments: No marks will be earned. Accommodation will only be provided for medical reasons or other emergency upon submission of satisfactory documentation. Whenever possible, give prior notification.

Late Assignments: Late assignments attract a penalty of 5% of total marks per business day.

*Class participation: Bonus points of up to 5% can be earned through participation in discussions and bringing up questions or suggestions relevant to enhancement of understanding of food chemistry concepts.

Instructional objectives

1. On **Water and acids**, student

- Discusses how the chemical structure of water explains water's unique properties
- Explains the phase changes water undergoes as related to chemical structure
- States the effects of solutes on boiling point, melting point, osmotic pressure, and surface tension
- Differentiates the characteristics of bound water versus free water in a food
- Relates the different types of water in foods to water activity
- Describes the effect of storage condition, temperature, and ingredient interaction on water activity, and moisture sorption isotherm
- Identifies whether compound is acid or base based on Bronsted and Lowry definition
- Differentiates between the titration curves of strong acids versus weak acids
- States the functions of acids, bases and buffers in foods
- Describes composition of buffer systems and how the composition is affected by the addition of acid or base

2. On **Lipids**, student

- Distinguishes among the classes of lipid molecules
- Identifies the major fatty acids present in food lipids
- Explains the physical and chemical properties of fatty acids
- Describes the physical and chemical properties of lipids
- States the major functional properties of lipids that are important in foods
- Discusses the relationship between lipid type, processing and functionality
- Describes how oil is processed and refined

3. On **Carbohydrates**, student

- Distinguishes the different classes of food carbohydrates and explains the basis of classification
- Describes the structures of important monosaccharides and disaccharides and the reactions they undergo
- States the major functional properties of monosaccharides and disaccharides
- Describes the structures of important polysaccharides and gums and the reactions they undergo
- States the major functional properties of polysaccharides and gums
- Discusses the effects of pH, heat, and salts on functional properties of carbohydrates

4. On **Proteins**, student

- Describes how the structure and properties of amino acids affect the structure and functional properties of proteins
- Explains the role of different types of bonds in stabilizing the four levels of protein structure
- Discusses the effects of processing treatments on protein structure
- States the major functional properties of proteins that are important in foods
- Discusses the relationship between protein structure, processing and functionality of proteins
- Discusses the effects of pH, heat, and salts on functional properties of proteins

5. On **Enzymes**, student

- Explains the functions of enzymes in foods and the effects of enzyme on food quality

- Applies enzyme kinetics to calculate the rates of enzyme reactions
- Describes how environmental and other factors (substrate and enzyme concentration, pH, temperature, water activity, inhibitors) affect enzyme reactions

6. On **Vitamins and minerals**, student

- Identifies the chemical structures and forms of fat-soluble and water-soluble vitamins found in foods
- States the functional roles of individual vitamins
- Explains the effects of processing on vitamin content and stability
- Distinguishes the terms element, mineral, salt, complex and ash
- Describes the chemical & physical properties of elements & their salts
- Discusses the multiple functions of elements and salts in food systems

7. On **Food flavours**, student

- Defines the terms flavour, taste, pungency and odour
- Explains the effects of food processing on flavour perception
- Differentiates the four basic tastes and identify compounds associated with each taste
- Identifies primary flavour contributors

8. On **Food colorants**, student

- Explains colour theory
- Describes methods of measuring colour using Munsell system, CIE system, and tristimulus colorimeters
- Identifies important natural pigments in foods
- Identifies certified colour additives used in foods

9. On FOOD2500 **Labs**, student

- Demonstrates skills/abilities for conducting lab experiments in a team environment
- Describes the principles involved in the analysis
- Identifies food samples analyzed
- Describes the experimental procedure used in the analysis
- Applies simple statistical methods of data evaluation
- Discusses results on food acidity, lipids, proteins, carbohydrates, and enzymes

10. On HNSC2150 **Assignments**, student

- Describes the principles and procedures involved in proximate analysis
- Discusses the need for Food Composition Tables and their usage
- Explains the term ‘sensory evaluation’ as it applies to food
- Describes methods used for conducting sensory evaluation of foods

FOOD 2500 Food Chemistry

Laboratory schedule
241 Ellis Building
Thursdays (B02) 2:30-5:30 pm & Fridays (B01) 2:30-5:30 pm (dates in brackets)

Title	**Date**
Introduction* (virtual) Safety review, lab reporting, basic techniques*	Jan 21 (22)
Food acidity (virtual)	Jan 28 (29)
Lipid characterization	Feb 04/11 (5/12)
Carbohydrate properties	Feb 25/Mar 4 (Feb 26/Mar 5)
Protein chemistry	Mar 11/18 (12/19)
Enzymatic browning**	Mar 25/Apr 1 (Mar 26)

Students will work in groups but each student submits his or her own independent report.

*The sessions familiarize students with lab safety features and basic techniques of weighing, pipetting, and good laboratory practices.
**Enzymatic browning: Options for second B01 group to complete lab in morning of Mar 25, 26 or April 1 since April 2 is Good Friday

FOOD 2500 / HNSC 2150 Calendar

Month	Day	Lecture #	Topic	Hui Chapter #
January	19	1	What is Food Chemistry?	1
	21	2	Water	2 & 3
	26	3	Water	2 & 3
	28	4	Acid Base pH TA	
February	02	5	Lipids	6 & 7
	04	6	Lipids	6 & 7
	09	7	Carbohydrates	4 & 5
	11	8	Carbohydrates	4 & 5
	15-19		READING WEEK	
	23	9	Carbohydrates	4 & 5
	25	10	Carbohydrates	4 & 5
March	02		MID-TERM EXAM: L1-10	L1-10
	04	11	Proteins	8 & 9
	09	12	Proteins	8 & 9
	11	13	Proteins	8 & 9
	16	14	Enzymes	13
	18	15	Enzymes	13
	23	16	Vitamins	10
	25	17	Minerals	11
	30	18	Food Additives	17
April	01	19	Flavors	14
	06	20	Colorants	15
	08	21	Food composition	
	13	22	Food composition	
	15		What I have learned in FOOD2500 /HNSC2150	
	19-30		FINAL EXAM: L11-22	