

FOOD 2500 FOOD CHEMISTRY

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

Instructor: Dr. Trust Beta
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Teaching assistant: Nancy Asen

Grader / Marker: Vanessa Alexander

Classes: Tuesdays & Thursdays 10:00 –11:15 am

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

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

Texts/References:

Recommended textbooks

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; 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

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	100	20	1 wk after lab
Class participation quizzes	100	5	During lectures (bonus points)
Mid-term Exam	100	35	March 8
Term Paper Assignment	100	10	April 13
Final Exam	100	35	April 26 to May 3

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 quizzes given in class as part of discussions relevant to enhancement of understanding of food chemistry concepts.

Students - UM COVID-19 - Syllabus Insert – January 19, 2022.

The University of Manitoba (the “UM”) is committed to maintaining a safe learning environment for all students, faculty, and staff. Should campus operations change because of health concerns related to the COVID-19 pandemic or other campus-wide emergency, it is possible that this course will move to a fully remote delivery format. Should the instructor be required to stay at home for an extended period and an alternate instructor not be available, the course may move temporarily to a remote delivery format. In that instance, you may be provided with an asynchronous option to minimize the impact the change may have on your schedule.

PPE and Mask Wearing

In a face-to-face environment, our commitment to safety requires students to observe all physical distancing (2m) and personal protective equipment (PPE) guidelines set by the University (<https://umanitoba.ca/coronavirus>)

While on campus and in class, you must wear PPE (Personal Protective Equipment) as stipulated in current [University policies, procedures, and guidelines](#). Students who fail

to comply are subject to disciplinary action in accordance with the [Student Discipline Bylaw](#) and the [Non-Academic Misconduct and Concerning Behaviour Procedure](#).

Medical-grade 3-ply masks are available at many locations on campus, including specific classroom locations, designated by your unit, the Elizabeth Dafoe Library (Fort Garry Campus) and the Brodie Centre main doors (Bannatyne Campus). Additional PPE, if necessary for a specific learning environment, will be provided to you by the teaching unit.

If you do not follow masking and other requirements you will be asked to leave the learning space and may only return to the class already in progress when you have complied with these requirements. Repeated issues will result in disciplinary action as previously noted.

Students should not eat or drink during class time.

Illness

Remember: **STAY HOME IF YOU HAVE SYMPTOMS OR ARE ILL.** If you become sick or are required to self-isolate you should notify your instructor by email so you can develop a plan to complete the course learning outcomes while you are absent.

If you have symptoms, do not come to campus or any UM facilities. Complete the [self-assessment](#) on the Manitoba Public Health site and follow the guidelines, which may include booking a COVID-19 test.

What to do if you become ill while at UM:

1. Leave the classroom, lab or workspace immediately. Continue to wear your mask while leaving the premises and/or while waiting for transportation.
2. Perform hand hygiene (soap and water or hand sanitizer) and avoid contact with others, and minimize contact with the physical environment.
3. Once at home, complete the [MB self-assessment](#) and follow the directions that are provided.
4. Inform your supervisor(s), instructor(s) or, if in residence, the appropriate individual.
5. You must remain off campus and all UM facilities until cleared to return in accordance with self-assessment, testing results, or MB Health requirements.

Recommended transportation options (in order):

1. Drive yourself home.
2. Pick-up by family or friend – remember to keep your mask on and to distance as much as possible, and where possible, open a window to improve ventilation.
3. Pickup by taxi/Uber:

- Remain masked and perform hand hygiene before entering the vehicle.
 - Avoid touching the inside of the vehicle
 - Keep your mask on for the duration of the ride
 - Where possible, open a window to improve ventilation.

4. Winnipeg Transit buses - Winnipeg Transit has indicated that individuals that are ill **must not use Transit.**

Instructional objectives

1. Concerning **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. Concerning **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. Concerning **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. Concerning **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. Concerning **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. Concerning **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. Concerning **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. Concerning **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. Concerning **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

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 27 (28)
Food acidity (virtual)	Feb 03 (04)
Lipid characterization	Feb 10 (11)
Carbohydrate properties	Feb 17/Mar 3 (Feb 18/Mar 4)
Protein chemistry	Mar 10/17 (11/18)
Enzymatic browning	Mar 24/31 (Mar 25/April 1)

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.

(Note: Winter term is from January 24 to April 25, 2022)

(Note: Winter term exam period is from April 26 to May 3, 2022)

FOOD 2500 Calendar

Month	Day	Lecture #	Topic	Hui Chapter #
January	25	1	What is Food Chemistry?	1
	27	2	Water	2 & 3
February	01	3	Water	2 & 3
	03	4	Acid Base pH TA	
	08	5	Lipids	6 & 7
	10	6	Lipids	6 & 7
	15	7	Carbohydrates	4 & 5
	17	8	Carbohydrates	4 & 5
	22-25		READING WEEK	
March	01	9	Carbohydrates	4 & 5
	03	10	Carbohydrates	4 & 5
	08		MID-TERM EXAM: L1-10	L1-10
	10	11	Proteins	8 & 9
	15	12	Proteins	8 & 9
	17	13	Proteins	8 & 9
	22	14	Enzymes	13
	24	15	Enzymes	13
	29	16	Vitamins	10
	31	17	Minerals	11
April	05	18	Food Additives	17
	07	19	Flavors	14
	12	20	Colorants	15
	13		TERM PAPER ASSIGNMENT DUE	
	14	21	Food Composition (Term Papers)	
	19	22	Food Composition (Term Papers)	
	21	23	What I have learned in FOOD2500	
April to May	26		FINAL EXAMS: L11-22	
	03		FINAL EXAMS: L11-22	