FOOD 3003A for Fall 2025

Food Packaging and Shelf Life

Course Instructor: Yaxi Hu

How to address me: Dr. Hu

Gender Pronouns: (she/her/hers)

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Note: Feel free to send me an email for anything you want to tell and/or ask me and I will try my best to respond within 48 h. If you would like to talk to me in person outside the office hours, please email to make an appointment

Best Ways to be in Touch: in class, via email, or during student hours

Student Hours: Tuesday, 11 am-noon, Steacie Buildling 229

Office Location: Steacie Buildling 229

Class Location: Please check Carleton Central for the room location.

Class Times: Tuesday and Thursday, 1:05 – 2:25 pm

Prerequisites: Undergraduate level FOOD 2002 Minimum Grade of D-

Preclusions: N/A

Department/Unit: Food Science/Chemistry

Topics Covered and Learning Outcomes

Course Description

Food packaging is an indispensable portion of food products and can takes up 8-10% of the overall product costs. Being an interdisciplinary subject, food packaging involves material science, food chemistry, food microbiology, food processing and engineering. This course focuses on introducing the fundamental information needed to select packaging materials for specific food products, design packaging with particular functions and assess the performance of packaging, with a brief introduction of the manufacturing process for different types of materials. The nexus between packaging and shelf life of food products will also be discussed since one of the major functions of food packaging is to protect foods and extend shelf life.

This course contains 5 modules. Module 1 is the background and introduction of food packaging, including its history, functional properties and regulation. Module 2 is about the properties and functions of packaging materials that have been commonly used for packaging food products. Module 3 focuses on some innovative techniques in food packaging. Module 4 explains the methods commonly used to evaluate the performance and sustainability of food packaging. Lastly, module 5 introduces the concepts of shelf life and the evaluating methods, as well as uses a few types of common food commodities to demonstrate the nexus between food packaging and shelf life.

Course level learning outcomes:

Learning Outcomes	This includes the ability to:
LO1. Explain the functions, properties and regulations of food packaging	• Outline the history of food packaging • Explain major functions of food packaging • Define critical physical and chemical properties considered for food packaging materials • Describe basic regulatory framework for food packaging materials
LO2. Describe and compare conventional packaging materials	• Describe the sources of major conventional food packaging materials • Compare physical and chemical properties of different packaging materials • Explain basic manufacturing processes of packaging materials • Identify applications for each major packaging materials in different food sectors
LO3. Explain advancements and trends in food packaging materials and technologies	• Recognize innovations and trends in food packaging materials and techniques through searching credible sources • Describe and explain advanced food packaging materials and techniques • Describe physical and chemical properties of advanced packaging materials (*e.g.*, edible and biodegradable) • Describe and explain principles of advanced packaging techniques (*e.g.*, active and intelligent packaging) • Compare the functional and economical performance of advanced materials and technologies with conventional materials.
LO4. Evaluate the performance and sustainability of food packaging	• Identify and explain tools used to evaluate the physical, chemical, mechanical, and optical properties of packaging materials • Recognize the importance of life cycle analysis for food packaging • Explain and apply the principle of life cycle analysis for food packaging
LO5. Propose packaging solutions to minimize deteriorative reactions in specific foods	• Describe mechanisms by which intrinsic and extrinsic factors influence deteriorative reactions in food • Identify appropriate indices of failure in specific food commodities • Design shelf life testing experiments and calculate shelf life of food based on known limiting quality index • Presume how such reactions are occurring in standard food packaging • Propose packaging solutions to overcome these deteriorative reactions
LO6. Effectively interpret and communicate findings in food packaging	• Interpret and present food packaging advancements to a scientific audience of peers • Interpret primary literature which assesses the effectiveness of food packaging

Topics to be Covered

Date	Lecture Content	Related Textbook Chapters	Important Dates
Module 1. Background and Introduction			
Sep 4	Introduction and History of Food Packaging	Textbook 3: Chapter 1 Textbook 1: Chapter 1 https://www.hindawi.com/journals/ijps/2012/302029/	
Sep 9	Functional Properties		
Sep 11	Food Packaging Regulation	Textbook 1: Chapter 22; https://laws-lois.justice.gc.ca/eng/regulations/c.r.c.,_c._870/index.html	
Module 2. Conventional Packaging Materials			
Sep 16	Paper-based Packaging Materials	Textbook 1: Chapter 6	List of 10 products due at 11:59 pm, Sep 13th
Sep 18	Glass-based Packaging Materials	Textbook 1: Chapter 8	List of 10 products due at 11:59 pm, Sep 15th
Sep 23	Metal-based Packaging Materials	Textbook 1: Chapter 7	List of 10 products due at 11:59 pm, Sep 20th
Sep 25	Plastic-based Packaging Materials (Part 1)	Textbook 1: Chapter 2, 4 & 5	List of 10 products due at 11:59 pm, Sep 22nd
Sep 30	Midterm Exam 1		
Oct 3	Plastic-based Packaging Materials (Part 2)	Textbook 1: Chapter 2, 4 & 5	
Module 3. Advanced Packaging Materials and Technologies			
Oct 7	Bio-based and Biodegradable Packaging Materials & Exam debrief	Textbook 1: Chapter 3	
Oct 9	Active and Intelligent Packaging	Textbook 1: Chapter 15 & 16	
Module 4. Evaluation of Packaging			
Oct 14	Testing and Quality Evaluation of Packaging	Textbook 3: Chapter 8	

	Materials		
Oct 16	Life Cycle Assessment of Packaging Materials	Textbook 3: Chapter 10	
Oct 21	Fall Break		
Oct 23	Fall Break		
Module 5. Shelf Life			
Oct 28	Deteriorative Reactions in Foods	Textbook 1: Chapter 11; Textbook 2: Chapter 2	
Oct 30	Shelf Life and Shelf-Life Testing	Textbook 1: Chapter 12; Textbook 2: Chapter 3	
Nov 4	Midterm Exam 2		
Nov 6	Packaging and Shelf Life of Dairy Products	Textbook 2: Chapter 5-8	
Nov 11	Paper Review - Dairy & Exam Debrief		Due at 11:59 pm, Nov 11th
Nov 13	Packaging and Shelf Life of Fresh Produce	Textbook 2: Chapter 9 & 10	
Nov 18	Packaging and Shelf Life of Fish and Seafoods	Textbook 2: Chapter 15	
Nov 20	Paper Review - Fish		Due at 11:59 pm, Nov 20th
Nov 25	Packaging and Shelf Life of Cereals and Snack Foods	Textbook 2: Chapter 18	
Nov 26	Paper Review - Cereals		Due at 11:59 pm, Nov 26th
Dec 2	Packaging and Shelf Life of Vegetable Oil	Textbook 2: Chapter 17	
Dec 4	Paper Review - Vegetable Oil		Due at 11:59 pm, Dec 4th

Assessments

Grade Breakdown

Component	Grade Value	Date
In-class activities	7 %	
News Report Presentations	6 % (2 x 3%)	See details in the Table for Topics to Cover above
Mid-term exam 1	25 %	
Mid-term exam 2	30 %	
Field Trip Observation	12 % (4 x 3%)	
Paper Review	20 % (4 x 5%)	

This grading distribution is non-negotiable

Details of Assessment Activities

In-class activities (7%):

In-class activities will be included in every lecture to practice concepts that are taught and to obtain feedback. Participation for in-class tasks will also serve as attendance. Each lecture, in-class tasks will be graded as SAT/UNSAT. 20 out of 23 in-class tasks must be completed for full grades.

News Report Presentations (6%, for LO3 and 6)

Each student will be responsible for reading, summarizing and explaining **two brief news reports (2 x 3%) published within the past 6 months** in the field of food packaging and/or shelf life through out the term. Students are encouraged to sign up to the *Packaging Digest* (https://www.packagingdigest.com/), *FoodSafety Magazine* (https://www.food-safety.com/), or other credible online sources for inspiration. The presentation focus is on content and students may need to look for additional literacy to have a clear understanding of the stories described in the news of selection. Presentation delivery will be informal and should last ~5 minutes.

Presentation will be arranged at the beginning of lecture hours and **timeslot are reserved on a first-come-first-serve basis**. The topics are chosen by students with the approval of the instructor at least three days before the presentation date.

Field Trip Observation (12%, LO2 and 3)

Each student is expected to visit one or a few grocery stores to observe different food packaging materials and identify the types of food packaged in different materials. Four lists **(4 x 3%)** of at least 10 different types of food products *(e.g., milk of different brands or flavors count as one type of product)* for each major type of packaging materials (*i.e.*, paper-based, glass-based, metal-based and polymer-based) should be submitted three days before the corresponding lecture time (see details of the deadline in table for Topics to Cover above). Remember to take pictures of the 10 types of food of your choice. Please use the template provided on Brightspace. This activity is to help students build the

connections between the knowledge learned in class and the real-world applications.

Midterm exam 1 & 2 (25% for exam 1 and 30% for exam 2, LO1-4):

The two midterm exams will be closed-book exams with a letter size (8.5"x11") or smaller hand-written "cheat sheet". The "cheat sheet" for Midterm Exam 1 is single-sided, while for Midterm Exam 2 can be double-sided. These closed-book exams are to ensure that you have a comprehensive understanding of the content covered during the lectures. You do not need to memorize everything, but are expected to identify important information when you are asked to select/design a food packaging for a specific food product or with a specific function, which is why a "cheat sheet" is allowed. The preparation of the "cheat sheet" is also a great way to help you review and summarize the content of lectures.

Remember to bring your calculator. Midterm exam 1 will focus on content during Sep 4th to Sep 25th, and Midterm exam 2 will focus on content during Sep 4th to Oct 30th.

Paper Reviews or Case Study (20%, LO5 and 6):

There will be 4 paper review activities during the last module about shelf life. Students will work in pairs to interpret food packaging primary literature selected by the instructor. To demonstrate accurate interpretation of the literature, students will read the selected literature prior to class and work together in-class to answer a series of questions. Students will submit their work by 11:59 pm on the day of the class (see details of the deadline in the table for Topics to Cover above).

DO NOT USE AI tools if you don't want yourself to be replaced by AI too fast.

Late and Missed Work Policies

- News Report Presentations: no late penalties, but failure to present two news reports before the end of term will result in a grade of zero for this activity.
- Late submission of each list of 10 products (for the Field Trip Observation assignment) will result in a grade of zero for each assignment.
- Late submission of each the paper review will result in losing 1.5% a day out of the 5% total marks for each paper-review assignment.

Learning Material(s) and Other Course/Lab-Related Resources

Resources (all free to access)

Textbook (required):

1. "Food Packaging: Principles and Practice", 2012, 3rd edition. Gordon L. Robertson. Taylor & Francis Group, Boca Raton (ISBN 9781439862414). Available as eBook from Carleton Library (https://ocul-

crl.primo.exlibrisgroup.com/permalink/01OCUL_CRL/1ortgfo/cdi_elibro_books_ELB141151)

2. "Food Packaging and Shelf Life: A Practical Guide", 2010. Gordon L. Robertson. Taylor & Francis Group, Boca Raton (ISBN 9781439862414). Available as eBook from Carleton Library (https://ocul-crl.primo.exlibrisgroup.com/permalink/01OCUL_CRL/hgdufh/alma991022680501905153)
3. "Food Packaging: Materials, Techniques and Environmental Issues", 2022. N.C. Saha *et al.* Springer, Singapore, (ISBN 978-981-16-4235-7). Available as eBook from Carleton Library (https://ocul-crl.primo.exlibrisgroup.com/permalink/01OCUL_CRL/hgdufh/alma991022988390505153)

Optional references:

1. "Food and Beverage Stability and Shelf Life", 2011. Daivd Kilcast, Persis Subramaniam. Woodhead Publishing Series in Food Science, Technology and Nutrition (ISBN 978-1-84569-701-3). Available as eBook from Carleton Library (https://ocul-crl.primo.exlibrisgroup.com/permalink/01OCUL_CRL/1ortgfo/cdi_proquest_ebookcentralchapters_1584459_2_4)

Useful websites on food packaging and shelf-life news and innovations:

https://www.packagingdigest.com/
https://www.food-safety.com/
https://www.newfoodmagazine.com/?s=shelf+life
https://www.ift.org/news-and-publications

Academic Accommodations and Regulations

Carleton is committed to providing academic accessibility for all individuals. You may need special arrangements to meet your academic obligations during the term. The accommodation request processes are outlined on the Academic Accommodations website (https://students.carleton.ca/course-outline/).

AI Use in this course: Minimal Use - Basic Assistance Only

Students may use AI tools for basic word processing and formatting functions, including:

- Grammar and spell checking (e.g., Grammarly, Microsoft Word Editor)
- Basic formatting and design suggestions (e.g., Microsoft Word's formatting tools, PowerPoint Design editor)

Documenting AI Use: It is not necessary to document the use of AI for the permitted purposes listed above. If you have questions about a specific use of AI that isn't listed above, please consult your instructor.

Why have I adopted this policy? This policy ensures that student voices and ideas are prioritized and authentically represented, maintaining the integrity of the work produced by students while allowing basic

support to enhance clarity, correctness, layout, and flow of ideas. The goal of adopting a limited use of AI is to help students develop foundational skills in writing and critical thinking by practicing substantive content creation without the support of AI.

Accommodation for Student Activities

Carleton University recognizes the substantial benefits, both to the individual student and for the university, that result from a student participating in activities beyond the classroom experience. Reasonable accommodation must be provided to students who compete or perform at the national or international level. Please contact me with any requests for academic accommodation during the first two weeks of class, or as soon as possible after the need for accommodation is known to exist. For more details, see the Senate Policy on Accommodation for Student Activities (PDF, 25KB).

Statement on Academic Integrity

Students are expected to uphold the values of academic integrity, which include fairness, honesty, trust, and responsibility. Examples of actions that that compromise these values include but are not limited to plagiarism, accessing unauthorized sites for assignments or tests, unauthorized collaboration on assignments or exams, and using artificial intelligence tools such as ChatGPT when your assessment instructions say it is not permitted.

Misconduct in scholarly activity will not be tolerated and will result in consequences as outlined in Carleton University's Academic Integrity Policy. A list of standard sanctions in the Faculty of Science can be found here.

Additional details about this process can be found on the Faculty of Science Academic Integrity website.

Students are expected to familiarize themselves with and abide by Carleton University's Academic Integrity Policy.

COURSE SHARING WEBSITES

Classroom teaching and learning activities, including lectures, discussions, presentations, etc., by both instructors and students, are copy protected and remain the intellectual property of their respective author(s). All course materials, including PowerPoint presentations, outlines, and other materials, are also protected by copyright and remain the intellectual property of their respective author(s).

Students registered in the course may take notes and make copies of course materials for their own educational use only. Students are not permitted to reproduce or distribute lecture notes and course materials publicly for commercial or non-commercial purposes without express written consent from the copyright holder(s).

University Policies

In accordance with the Carleton University Undergraduate Calendar Regulations, the letter grades assigned in this course will have the following percentage equivalents:

A+ = 90-100	B+ = 77-79	C+ = 67-69	D+ = 57-59
A = 85-89	B = 73-76	C = 63-66	D = 53-56
A- = 80-84	B- = 70-72	C- = 60-62	D- = 50-52

F = <50
WDN = Withdrawn from the course
ABS = Student absent from final exam
DEF = Deferred

Student Rights & Responsibilities

Students are expected to act responsibly and engage respectfully with other students and members of the Carleton and the broader community. See the 7 Rights and Responsibilities Policy for details regarding the expectations of non-academic behaviour of students. Those who participate with another student in the commission of an infraction of this Policy will also be held liable for their actions.

Student Concerns

If a concern arises regarding this course, **your first point of contact is me**: Email or drop in during student hours and I will do my best to address your concern. If I am unable to address your concern, the next points of contact are (in this order):

Note: You can also bring your concerns to Ombuds services.

Assistance for Students

Academic and Career Development Services: http://carleton.ca/sacds/
Writing Services: http://www.carleton.ca/csas/writing-services/
Peer Assisted Study Sessions (PASS): https://carleton.ca/csas/group-support/pass/
Math Tutorial Centre: https://carleton.ca/math/math-tutorial-centre/
Science Student Success Centre: https://sssc.carleton.ca/