

FOOD 7160 FOOD CARBOHYDRATES

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

Description:

The major purpose of this course is to study the structure, physicochemical properties and functionality of food carbohydrates. Discussions will focus on behaviour of carbohydrates in heterogeneous food systems including serving as functional ingredients and bases of many foods, that is, sweeteners, thickeners, structural elements and nutrients. Nutritional classification, physiological effects and analysis of food carbohydrates will also be discussed. Concepts in these areas will be presented, discussed and integrated into new approaches and perspectives. Topics will also include engineering the functional properties of food polysaccharides by chemical and biochemical methods; carbohydrate polymers for intelligent and sustainable packaging; carbohydrate polymers in 3D printing; dietary fibers consumption and its influence on the gut microbiome.

Instructor:

Trust Beta

Office: Room 226 Ellis Building

Phone: 204-474-8214 | Email: Trust.Beta@umanitoba.ca

Classes:

Lectures and Discussions will take place every Tuesday from 10:00 a.m. to 12 noon, virtually beginning September 14 and ending December 7, 2021. Discussions will include identification of critical abstracts and term paper reports. Some notes, topics and links to articles for discussion will be posted on UM Learn.

ATTENTION STUDENTS RESIDING OUTSIDE WINNIPEG

As this is a remote learning course, all instructional activities and deadlines will be Winnipeg time (Central Time). Please make sure your calendars are adjusted to reflect any time changes. Please inform your Instructor as soon as possible if you are taking the course while residing outside of Winnipeg, specifically:

- If you are in a rural Canadian area affected by poor internet connections that may impact completing assessments and exams on time
- If you are in another time zone within or outside Canada, specify where you are, and if you foresee any challenges with attending classes and completing assessments and exams on time

NOTE: It is your responsibility to communicate with your instructors well in advance of tests/exams/assignment due dates, of any ongoing issues, OR immediately once an issue arises that *may* impact your ability to complete course work.

References:

Carbohydrate Chemistry for Food Scientists. 3rd edn. J.N. BeMiller. 2019 Elsevier. N. [Carbohydrate Chemistry for Food Scientists \(3rd Edition\) - Knovel \(oclc.org\)](#)

Nondigestible Carbohydrates and Digestive Health. T. M. Paeschke 2011. Wiley-Blackwell, Hoboken, NJ. QP 144 F52 2011 (Elizabeth Dafoe Library) [Nondigestible Carbohydrates and Digestive Health | Wiley Online Books \(oclc.org\)](#)

Advanced Dietary Fibre Technology. B. v. McCleary, and L. Prosky (eds.) 2000. Oxford Malden, MA Blackwell Science. QP 144 F52 A285 2001 (Sciences and Technology Library). [Advanced Dietary Fibre Technology | Wiley Online Books \(oclc.org\)](#)

Starch, Chemistry and Technology. J. N. BeMiller, R.L. Whistler, L. Lester (eds.), 3rd edn. 2009. San diego: Elsevier Science & Technology. [Starch | ScienceDirect \(oclc.org\)](#)

Food Carbohydrate Chemistry. R. E. Wrolstad 2012. Wiley-Blackwell, Hoboken, NJ, USA. QD 321.W88 2012 [Food Carbohydrate Chemistry | Wiley Online Books \(oclc.org\)](#)

Cereal Grain-based Functional Foods: Carbohydrate and Phytochemical Components. T. Beta and M. E. Camire (ed.) 2019. Royal Society of Chemistry, London, England, UK. [Cereal Grain-Based Functional Foods - Carbohydrate and Phytochemical Components - Knovel \(oclc.org\)](#)

Food Carbohydrates: Chemistry, Physical Properties, and Applications. S. W. Cui (ed.) 2005. CRC Press, Boca Raton, FL. TX 553 C28 F64 2005 (Sciences and Technology Library). [on loan till 16/12/2021]

Dietary Fibre: Bio-active Carbohydrates for Food and Feed. N.-G. Asp, J. Miller Jones, G. Schaafsma, and J. W. van der Kamp (eds.) 2004. AACC, St. Paul, MN. QP 144 F52 D54 2004 (Sciences and Technology Library)

Essentials of Carbohydrate Chemistry. J. F. Robyt. 1998. Springer, New York. QD 321 R667 1998 (Sciences and Technology Library)

Other resources:

Technological innovation for food and nutrition security, and sustainability: A food biopolymer perspective. M. N. Emmambux 2021. Abstract: [Prof Naushad Emmambux Abstract \(greenvelope.com\)](#). Oral presentation: <https://youtu.be/Jg-V6fJDCjs>

Current literature from research papers or review articles will also be suggested as reading materials throughout the course. Log on to UM Learn & check for posted items.

Objectives:

At the end of the course, students should:

- Discuss the nutritional classification and analysis of food carbohydrates
- Describe the structural, physical, and chemical properties of carbohydrates
- Discuss the major functional properties of carbohydrates
- Explain the principles of the methods employed in characterizing carbohydrates
- Discuss the effects of environment on physicochemical and functional properties of carbohydrates

FOOD 7160 Topics:

Introductions; evaluation criteria; sources & classes of food carbohydrates; monosaccharides - configuration, nomenclature, conformation & projections, sugar alcohols

Oligosaccharides and Cyclodextrins

Starch

Starch physical chemistry, structure and biosynthesis
Fractionation of starch
Other components in starch
Physical properties of starch: gelatinization, pasting & retrogradation
Interaction between starch and other chemicals
Analyses of starch: DSC, X-ray, HPAEC, HPSEC, NMR, IR
Starch modification & starch degrading enzymes

Fibre | Nonstarch polysaccharides

Types and composition
Methodology
Functionality

Carbohydrate sweetness

Sweeteners, taste and functionality
Sweeteners from corn wet milling, cane and beets
Alternative sweeteners

Special topics

Critical abstracts
Presentation of research papers

2021Date || Course Schedule

14-Sep	Introduction & evaluation criteria Carbohydrate classification & nomenclature Monosaccharides, oligosaccharides, reducing and non-reducing sugars, cyclodextrins
21-Sep	Composition and functionality of sugars and oligosaccharides in foods

28-Sep	Starch physical chemistry, structure and biosynthesis Analyses of starch (Term paper topics selected 28-Sep)
05-Oct	Starch gelatinization, pasting & retrogradation Starch modification, starch degrading enzymes
12-Oct	Fibre classification and composition Fibre methodology
19-Oct	Fibre functionality in food and health Fibre physiological effects
26-Oct	Chemical characterization of arabinoxylans Finalize your compilation of critical abstracts due 02-Nov @ 12 noon
02-Nov	Sweeteners: sources, taste and functionality Preparation for comprehensive exam
09-Nov	Comprehensive Exam Monosaccharides, oligosaccharides, starch, fibre, sweeteners
16-Nov	Discussions - critical abstracts
↓↑	Provide handouts of your PPT presentation for posting on UM Learn
*23-Nov	Completion of term paper assignments - Library exercise Full papers due 26-Nov @ 12 noon
30-Nov	Presentations
07-Dec	Wrap up

***Note: November 23, 2021 is the last day for voluntary withdrawal.**

Term Paper Project including Critical Abstracts

Guidelines for Term Paper Project

The purpose of preparing **critical abstracts**, a **full paper** and **presentations** of one topic is for you to improve your communication skills and for you to learn more about one area of Food Carbohydrates. Any topic addressing the dynamic, interactive chemical and/or physical properties or health-related effects of carbohydrates or carbohydrate-based foods can be selected. Use your curiosity and areas of interest to choose a subject that intrigues you the most. Here are some examples of general topics for literature search to 1) select critical abstracts, 2) write a full paper, and 3) make presentations:

- Resistant oligosaccharides (definitions, formation, analytical & physiological aspects, functionality)
- Resistant starch (definitions, formation, analytical & physiological aspects, functionality)
- Functional dietary fibre ingredients (pectin, wheat bran, guar gum, alginate, oat fibre, psyllium, barley bran, rice bran, etc.)
- Beta-glucans or arabinoxylans (sources, isolation, analytical & physiological aspects, functionality)
- Starch-based fat replacers (chemistry and functionality, physiological aspects)

- Chemical modification of cereal carbohydrates to improve functionality
- Source, chemistry and functionality of raffinose family of oligosaccharides in foods
- Dietary fibre – associated compounds: chemistry, analysis, and nutritional effects of polyphenols
- Engineering the functional properties of food polysaccharides by chemical and biochemical methods
- Carbohydrate polymers for intelligent and sustainable packaging
- Carbohydrate polymers in 3D printing
- Dietary fibers consumption and its influence on the gut microbiome

Plus other topics of your choice (diverse topics are encouraged as duplication of the same subject is not permitted)

CRITICAL ABSTRACTS

Find 4 recent **critical** articles in the area of your topic [dynamic, interactive chemical and/or physical properties of carbohydrates or carbohydrate-based foods]. Recent means within the last 10 years; for some topics this means within the last 15 to 25 years. **Critical** means the research presented in the paper is a major contribution to the field and hence, the paper is highly cited. These articles should provide the basis of your full paper; and therefore, you should be well on your way with your review paper by the time you compile the critical abstracts. Please TYPE (single space) the abstract on one side of a sheet of paper and insert tables / figures on the back of the sheet (total 10 pages) using this format:

[**Authors**] Beta, T.

[**Title**] Instructions to Prepare Critical Abstracts

[**Source**] Food Carbohydrates. 70: 198-204 (2021) {note full pagination}

[**Location of Research**] Food Carbohydrates Laboratory, Department of Food Science, University of Manitoba, Winnipeg, Manitoba, Canada R3T 2N2. Phone 204-474-8214

[**Abstract**] The abstract should provide enough detailed information about what was done that you do not need to go back to the original paper. (Avoid selecting a review article.)

- (1) Start with a summary statement of the general area and approach of the article.
- (2) Describe important materials and methods necessary to understand the data.
- (3) The results should include data, summary tables, and figures.
- (4) Summarize the significant contributions of the research article.
- (5) Evaluate / criticize what was done right and what was done wrong.
- (6) State how the research could have been improved and / or supplemented.
- (7) Suggest follow up experiments.

For class discussion, prepare a handout (about 1-2 pages) containing the key points from the four critical papers that you will use to lead the discussion. You can use PowerPoint slides for the discussion.

FULL TERM PAPER

The paper needs to present technical information about the dynamic, interactive chemical and/or physical properties or health-related effects of carbohydrates or carbohydrate-based foods. The paper should be organized and presented in a logical and orderly manner with an abstract, introduction, body, and conclusion. The paper should be subdivided to help focus the reader's attention. The typed paper should be no more than 25 pages in length [double-spaced lines, 1 inch margins]. Content of the paper is considerably more important than the length of the paper. Print the abstract on a separate page along with the title, author and address [of the author] (these do not count toward the 300 word limit of the abstract). The abstract of the paper should be 300 words providing a summary of what is in the paper.

Term paper format

Title

Abstract or Summary

Introduction or Background

Objectives

Body of the report (subdivided)

Conclusion

References (follow style of the journal **Critical Reviews in Food Science & Nutrition**)

Term paper presentation

Each person will present the topic of his or her paper in front of the class. Technical information from your review paper should be presented in an organized, logical manner. The presentation will be 20 - 25 minutes long and an additional 5-10 minutes for questions and answers. Your presentation will be evaluated for: content, organization, style, and mannerisms. Fellow students can provide constructive suggestions. Laptop and computer projection equipment will be available for your presentation which will preferably be completed using PowerPoint.

COURSE EVALUATION

	Marks	% of Final Grade
Class attendance & participation	100pts	5
Lab reports (Results & Discussion)	100pts	10
Exam	100pts	40
Critical abstracts & class handout	80pts	15
Oral discussion of critical abstracts (15 min)	20pts	5
Term paper	80pts	20
Oral report of term paper (20 min)	<u>20pts</u>	<u>5</u>
Total	500pts	100

<u>Grades:</u>	A+	90-100	C+	60-64
	A	80-89	C	55-59
	B+	75-79	D	50-54
	B	65-74	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 papers is subject to serious academic penalty.”

OTHER COURSE POLICIES

- Late submission of assignments will attract a 10-point deduction per day missed.
- Failure to write the examination on the scheduled date will result in a zero mark being recorded unless proof of extenuating circumstances is provided.
- Class attendance is encouraged while participation in laboratory exercises, discussions of critical abstracts and term paper presentations is mandatory.
- Students with disabilities are encouraged to immediately contact Student Accessibility Services to facilitate the implementation of accommodations that may be necessary.
- Meetings will be arranged with Students to discuss the accommodations recommended by Student Accessibility Services.

Background noise cancellation:

How to Mute Background Noise in Cisco Webex Meetings?

<https://krisp.ai/blog/webex-noise-cancellation/>