Food Science Text Series

Third Edition

For other titles published in this series, go to
www.springer.com/series/5999

Series editor:

Dennis R. Heldman
Heldman Associates
Mason, Ohio, USA

The Food Science Text Series provides faculty with the leading teaching tools. The Editorial Board has outlined the most appropriate and complete content for each food science course in a typical food science program and has identified textbooks of the highest quality, written by the leading food science educators. Series Editor Dennis R. Heldman, Professor, Department of Food, Agricultural, and Biological Engineering, The Ohio State University. Editorial Board; John Coupland, Professor of Food Science, Department of Food Science, Penn State University, David A. Golden, Ph.D., Professor of Food Microbiology, Department of Food Science and Technology, University of Tennessee, Mario Ferruzzi, Professor, Food, Bioprocessing and Nutrition Sciences, North Carolina State University, Richard W. Hartel, Professor of Food Engineering, Department of Food Science, University of Wisconsin, Joseph H. Hotchkiss, Professor and Director of the School of Packaging and Center for Packaging Innovation and Sustainability, Michigan State University, S. Suzanne Nielsen, Professor, Department of Food Science, Purdue University, Juan L. Silva, Professor, Department of Food Science, Nutrition and Health Promotion, Mississippi State University, Martin Wiedmann, Professor, Department of Food Science, Cornell University, Kit Keith L. Yam, Professor of Food Science, Department of Food Science, Rutgers University

Food Analysis Laboratory Manual

Third Edition

edited by

S. Suzanne Nielsen
Purdue University
West Lafayette, IN, USA

S. Suzanne Nielsen
Department of Food Science
Purdue University
West Lafayette
Indiana
USA

ISSN 1572-0330 ISSN 2214-7799 (electronic)
Food Science Text Series
ISBN 978-3-319-44125-2 ISBN 978-3-319-44127-6 (eBook)
DOI 10.1007/978-3-319-44127-6

Library of Congress Control Number: 2017942968

Printed on acid-free paper

This Springer imprint is published by Springer Nature
The registered company is Springer International Publishing AG
The registered company address is: Gewerbestrasse 11, 6330 Cham, Switzerland

Preface and Acknowledgments

This laboratory manual was written to accompany the textbook, *Food Analysis*, fifth edition. The laboratory exercises are tied closely to the text and cover 21 of the 35 chapters in the textbook. Compared to the second edition of this laboratory manual, this third edition contains four introductory chapters with basic information that compliments both the textbook chapters and the laboratory exercises (as described below). Three of the introductory chapters include example problems and their solutions, plus additional practice problems at the end of the chapter (with answers at the end of the laboratory manual). This third edition also contains three new laboratory exercises, and previous experiments have been updated and corrected as appropriate. Most of the laboratory exercises include the following: background, reading assignment, objective, principle of method, chemicals (with CAS number and hazards), reagents, precautions and waste disposal, supplies, equipment, procedure, data and calculations, questions, and resource materials.

Instructors using these laboratory exercises should note the following:

1. Use of Introductory Chapters:
   - Chap. 1, "Laboratory Standard Operating Procedures" – recommended for students prior to starting any food analysis laboratory exercises
   - Chap. 2, "Preparation of Reagents and Buffers" – includes definition of units of concentrations, to assist in making chemical solutions
   - Chap. 3, "Dilution and Concentration Calculations" – relevant for calculations in many laboratory exercises
   - Chap. 4, "Use of Statistics in Food Analysis" – relevant to data analysis
2. Order of Laboratory Exercises: The order of laboratory exercises has been changed to be fairly consistent with the reordering of chapters in the textbook, *Food Analysis*, fifth edition (i.e., chromatography and spectroscopy near the front of the book). However, each laboratory exercise stands alone, so they can be covered in any order.
3. Customizing Laboratory Procedures: It is recognized that the time and equipment available for teaching food analysis laboratory sessions vary considerably between schools, as do student numbers and their level in school. Therefore, instructors may need to modify the laboratory procedures (e.g., number of samples analyzed, replicates) to fit their needs and situation. Some experiments include numerous parts/methods, and it is not assumed that an instructor uses all parts of the experiment as written. It may be logical to have students work in pairs to make things go faster. Also, it may be logical to have some students do one part of the experiment/one type of sample and other students to another part of the experiment/type of sample.
4. Use of Chemicals: The information on hazards and precautions in the use of the chemicals for each experiment is not comprehensive but should make students and a laboratory assistant aware of major concerns in handling and disposing of the chemicals.
5. Reagent Preparation: It is recommended in the text of the experiments that a laboratory assistant prepare many of the reagents, because of the time limitations for students in a laboratory session. The lists of supplies and equipment for experiments do not necessarily include those needed by the laboratory assistant in preparing reagents for the laboratory session.
6. Data and Calculations: The laboratory exercises provide details on recording data and doing calculations. In requesting laboratory reports from students, instructors will need to specify if they require just sample calculations or all calculations.

Even though this is the third edition of this laboratory manual, there are sure to be inadvertent omissions and mistakes. I will very much appreciate receiving suggestions for revisions from instructors, including input from lab assistants and students.

I maintain a website with additional teaching materials related to both the *Food Analysis* textbook and laboratory manual. Instructors are welcome to contact me for access to this website. To compliment the laboratory manual, the website contains more detailed versions of select introductory chapters and Excel sheets related to numerous laboratory exercises.

I am grateful to the food analysis instructors identified in the text who provided complete laboratory experiments or the materials to develop the experiments. For this edition, I especially want to thank the authors of the new introductory chapters who used their experience from teaching food analysis to develop what I hope will be very valuable chapters for students and instructors alike. The input I received from other food analysis instructors, their students, and mine who reviewed these new introductory chapters was extremely valuable and very much appreciated. Special thanks go to Baraem (Pam) Ismail and Andrew Neilson for their input and major contributions toward this edition of the laboratory manual. My last acknowledgment goes to my former graduate students, with thanks for their help in working out and testing all experimental procedures written for the initial edition of the laboratory manual.

West Lafayette, IN, USA S. Suzanne Nielsen

The original version of this book was revised.
The correction to this book can be found at DOI 10.1007/978-3-319-44127-6_32

Contents

Contributors

Charles E. Carpenter Department of Nutrition, Dietetics and Food Sciences, Utah State University, Logan, UT, USA

Young-Hee Cho Department of Food Science, Purdue University, West Lafayette, IN, USA

M. Monica Giusti Department of Food Science and Technology, The Ohio State University, Columbus, OH, USA

Y.H. Peggy Hsieh Department of Nutrition, Food and Exercise Sciences, Florida State University, Tallahassee, FL, USA

Baraem P. Ismail Department of Food Science and Nutrition, University of Minnesota, St. Paul, MN, USA

Helen S. Joyner School of Food Science, University of Idaho, Moscow, ID, USA

Dennis A. Lonergan The Vista Institute, Eden Prairie, MN, USA

Lloyd E. Metzger Department of Dairy Science, University of South Dakota, Brookings, SD, USA

Andrew P. Neilson Department of Food Science and Technology, Virginia Polytechnic Institute and State University, Blacksburg, VA, USA

S. Suzanne Nielsen Department of Food Science, Purdue University, West Lafayette, IN, USA

Sean F. O'Keefe Department of Food Science and Technology, Virginia Tech, Blacksburg, VA, USA

Oscar A. Pike Department of Nutrition, Dietetics, and Food Science, Brigham Young University, Provo, UT, USA

Michael C. Qian Department of Food Science and Technology, Oregon State University, Corvallis, OR, USA

Qinchun Rao Department of Nutrition, Food and Exercise Sciences, Florida State University, Tallahassee, FL, USA

Ann M. Roland Owl Software, Columbia, MO, USA

Daniel E. Smith Department of Food Science and Technology, Oregon State University, Corvallis, OR, USA

Denise M. Smith School of Food Science, Washington State University, Pullman, WA, USA

Stephen T. Talcott Department of Nutrition and Food Science, Texas A&M University, College Station, TX, USA

Catrin Tyl Department of Food Science and Nutrition, University of Minnesota, St. Paul, MN, USA

Robert E. Ward Department of Nutrition, Dietetics and Food Sciences, Utah State University, Logan, UT, USA

Ronald E. Wrolstad Department of Food Science and Technology, Oregon State University, Corvallis, OR, USA