Antioxidant-rich phytochemicals in plants and agricultural food products have become an attractive subject for food, biomedical and nutrition scientists, as well as for food producers. Unlike synthetic food antioxidants, antioxidants from natural sources are generally recognized as safe for food applications and most have been confirmed as having health-promoting functions in relation to various human epidemiological diseases such as cardiovascular diseases, cancers, obesity and diabetes. In addition to their antioxidant function, many phytochemicals have been found to alter cell signaling pathways and gene expression, and thus have the ability to regulate numerous physiological functions involved in the pathogenesis of various chronic diseases.

Natural antioxidant phytochemicals usually exist at a very low level, and differ from proteins, carbohydrates, and lipids, which are macro-nutrients and abundant in food products. They are microconstituents in plants and agricultural food products. Furthermore, the type and quantity of antioxidant phytochemicals vary significantly from source to source. Different types of antioxidants may have different antioxidant activity and bioavailability. Although most antioxidants have UV absorption, using the traditional spectrophotometric method to quantify the antioxidants is not practical because they could be significantly masked or interfered with by many other compounds in the sources. Thus, the analysis methods for antioxidant phytochemicals are more complicated and sophisticated than those employed for macro-nutrient compounds.

This is the first book to focus on the sample preparation procedures and methods developed for identifying and quantifying natural antioxidants in plants and food products. The principle of quantification methods for natural antioxidant-rich phytochemicals is introduced, and current methods used in the determination of antioxidants in different sources are reviewed and summarized by experts in the field. As a handbook of analysis of natural antioxidant-rich phytochemicals, the volume provides practical information enabling researchers to identify the appropriate analysis methods for specific antioxidants. This book may also serve as a lecture resource for courses relating to food analysis, functional foods and nutrition.

About the Editors
Dr Zhimin Xu, Department of Food Science, Louisiana State University, Baton Rouge, Louisiana, USA
Dr Luke R. Howard, Department of Food Science, University of Arkansas, Fayetteville, Arkansas, USA

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Analysis of Antioxidant-Rich Phytochemicals
Analysis of Antioxidant-Rich Phytochemicals

Edited by
Zhimin Xu and Luke R. Howard
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Antioxidant-rich phytochemicals in plants and agricultural food products have recently become an attractive subject for food, biomedical and nutrition scientists, and food producers. Thousands of articles in this area are published each year and numerous related research projects are being carried out in institutes and companies. Compared to synthetic food antioxidants, the antioxidants in natural sources are generally recognized as safe for food applications. Also, most of the phytochemicals have been confirmed to have health-promoting functions in preventing various human epidemiological diseases, such as cardiovascular diseases, cancers, obesity, and diabetes. In addition to antioxidant function, many phytochemicals have been found to alter cell signalling pathways and gene expression, and thus have the ability to regulate numerous physiological functions involved in the pathogenesis of various chronic diseases.

Antioxidant-rich phytochemicals are micro-constituents in plants and agricultural food products. They differ from proteins, carbohydrates, and lipids, which are macro-nutrients that are abundant in plants and food products. The type and quantity of antioxidant-rich phytochemicals vary significantly from source to source. Different types of the antioxidant-rich phytochemicals may have different antioxidant and other biological activities and bioavailability. Although most phytochemicals have UV absorption, using traditional spectrophotometric methods to quantify the antioxidants is not practical as they could be significantly masked or interfered with by many other compounds in the sources. Thus, the analysis methods for antioxidant-rich phytochemicals are more complicated and sophisticated than the methods used for macro-nutrient compounds.
Chromatography techniques with different detectors followed by skillful sample preparation are usually applied to quantify these antioxidants in natural sources. These techniques offer sensitive and specific analysis methods for most of the antioxidants. This is the first book that particularly covers and summarizes the details of sample preparation procedures and methods developed to identify and quantify various types of natural antioxidants in plants and food products. In the book, the principle of quantification methods for natural antioxidant-rich phytochemicals is introduced and current methods used in the determination of antioxidants in different sources are reviewed and summarized by experts in the field. As a handbook of analysis of natural antioxidant-rich phytochemicals, the book provides useful information for many researchers in this area to learn ideal analysis methods for the antioxidants they are examining. The book may also serve as a lecture resource for courses in food analysis, functional foods, and nutrition.

Zhimin Xu and Luke R. Howard
Contributors

Morgan J. Cichon
Department of Food Science & Technology
The Ohio State University
Columbus, Ohio, USA

Jessica L. Cooperstone
Department of Food Science & Technology
The Ohio State University
Columbus, Ohio, USA

Federico Ferreres
Research Group on Quality
Safety and Bioactivity of Plant Foods, CEBAS (CSIC)
Murcia, Spain

Liwei Gu
Department of Food Science and Human Nutrition
University of Florida
Gainesville, Florida, USA

Luke Howard
Department of Food Science
University of Arkansas
Fayetteville, Arkansas, USA
G.K. Jayaprakasha  
Vegetable and Fruit Improvement Center  
Department of Horticultural Sciences  
Texas A&M University  
College Station, Texas, USA

Rachel E. Kopec  
Department of Food Science & Technology  
The Ohio State University  
Columbus, Ohio, USA

Anna-Maija Lampi  
Department of Food and Environmental Sciences  
University of Helsinki  
Latokartanonkaari, Finland

Robert A. Moreau  
Eastern Regional Research Center  
USDA, ARS  
Wyndmoor, Pennsylvania, USA

Laura Nyström  
Institute of Food Nutrition and Health  
ETH Zurich, Switzerland

Bhimanagouda S Patil  
Vegetable and Fruit Improvement Center  
Department of Horticultural Sciences  
Texas A&M University  
College Station, Texas, USA

Ron Prior  
Department of Food Science  
University of Arkansas  
Fayetteville, Arkansas, USA

Lydia Rice  
Department of Food Science  
University of Arkansas  
Fayetteville, Arkansas, USA

Steve J. Schwartz  
Department of Food Science and Technology  
The Ohio State University  
Columbus, Ohio, USA
Contributors

Steve Talcott
Department of Nutrition and Food Science
Texas A&M University
College Station, Texas, USA

Francisco A. Tomas-Barberan
Research Group on Quality
Safety and Bioactivity of Plant Foods, CEBAS (CSIC)
Murcia, Spain

Amit Vikram
Vegetable and Fruit Improvement Center
Department of Horticultural Sciences
Texas A&M University
College Station, Texas, USA

Brittany White
Department of Food Science
University of Arkansas
Fayetteville, Arkansas, USA

Xianli Wu
Arkansas Children’s Nutrition Center
Little Rock, Arkansas, USA

Zhimin Xu
Department of Food Science
Louisiana State University
Baton Rouge, Louisiana, USA
Chapter 1

Important Antioxidant Phytochemicals in Agricultural Food Products

Zhimin Xu

Abstract

Antioxidant phytochemicals are secondary plant metabolites widely present in the plant kingdom. Most of the phytochemicals are phenolic derivatives with monohydric or polyhydric phenols. Numerous clinical studies have confirmed that antioxidant phytochemicals can prevent some cholesterol-related and oxidation-induced chronic diseases. The antioxidant properties and health benefits of phytochemicals in different agricultural food plants have been intensively studied in recent years. This chapter will discuss the phytochemicals in common fruits, vegetables, and grains and their potential to reduce the risk of epidemiological disease. As more and more consumers are becoming concerned about health functions of foods, the information of this chapter will be useful for scientists in the food, plant breeding and physiology, medicine, and epidemiology areas to understand and utilize natural antioxidant phytochemicals in health-promoting food and other products.

Keywords: antioxidant; phytochemical; phenolic; polyphenolic; antioxidation; plants

1.1 Introduction

Antioxidant phytochemicals generally possess one or more hydroxylated aromatic or phenolic rings, which contribute to their antioxidant