

Polyphenols in Plants

Isolation, Purification and Extract Preparation

Edited by Ronald Ross Watson

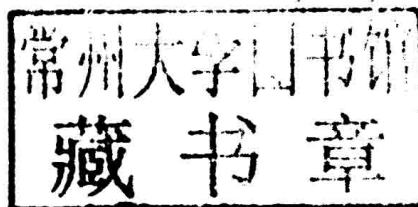


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Edited by

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Preface

Polyphenols are a unique group of phytochemicals present in fruits, vegetables and other plants. Their activity is based upon functional groups capable of accepting a free radical's negative charge. Polyphenols are being studied extensively for their health promoting and disease treating activities. This leads to substantial interest in environmental factors that change their concentration in plant sources as well as methods to isolate, describe and identify them. The latter is the primary focus of this book.

Two chapters review external factors that also produce different amounts in the plant. One describes phenolic compounds and saponins whose levels and relative composition change under different irrigation regimens and thus soil salt levels. Lichens, a very old type of plant that is used to investigate changes in the environment is described for such studies. Events in the plants' growth, stage of maturity and cultivar type change their relative amounts as reviewed in the book. Such factors are important for reproducible production of bioactive polyphenols that are consumed as part of the plant or isolated for use as a dietary supplement. Other writers describe plant polyphenol profiles as a method to trace and support biodiversity through characterization of these key compounds and their plant sources. The role of these compounds in controlling various activities of plants are reviewed, as their primary function is to benefit the producing plants, distinct from human's interest in their biomedical actions.

Plant systems modify and change polyphenols structure and concentration. Classification is based upon their chemical structure which contains multiple linked phenol groups. Such diverse chemical structures are the background and cause of polyphenols' many functions. The compounds' molecular weight ranges show small compounds in the molecular weight range of 3000 to very large compounds of 20,000. The latter are susceptible to biomodification by human as well as microbial enzymes providing challenges to identify bioactive compounds.

This knowledge is vital for other studies of biomedical benefits, to be able to identify various biologically important polyphenols. A major identification tool is gas chromatography-mass spectrometry and recent advances are reviewed. Improvements in this approach are described along with tools and methods for rapid, non-destructive measurements in fruits and vegetables. Finally novel techniques for identification are reviewed.

Methods to recover, purify, fractionate and finally isolate desired polyphenols are vital including specific examples of purification procedures to obtain biological activity. Of course not all polyphenols are isolatable from plants. Those that are extractable are the primary focus of researchers. The more novel and less well studied non-extractable polyphenols in foods need new methods of isolation, analysis and composition which are reviewed for future biomedical research.

Because of their structure polyphenols lend themselves to absorption to various resins and ion exchange chromatography with subsequent removal to purify and fractionate them. Chapters by those doing such studies, combined with a specific example

of characterization of isolated polyphenols from *Hibiscus* flowers, are provided. Finally, in the commercial production of vegetables the effects of water combined with heat is described in hydrothermal processing of polyphenols.

Examples of polyphenol characterization techniques as well as occurrence in various plant materials are reviewed. Improved characterization of polyphenols using liquid chromatography with specific chapters using fruit polyphenols is included in the book as methods and examples. Different plant parts have distinct needs for varying amounts and quantities of polyphenols, thus offering researchers special raw material sources. The book ends with a determination of polyphenols and their related flavonoids' antioxidant activities in seeds whereas most chapters have focused on polyphenol composition in the leaf and fruit parts of plants.

Ronald Ross Watson

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