

*FOOD PRESERVATION TECHNOLOGY SERIES*



# Osmotic Dehydration & Vacuum Impregnation

Applications in Food Industries

EDITED BY

Pedro Fito  
Amparo Chiralt  
Jose M. Barat  
Walter E. L. Spiess  
Diana Behsnlian

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# Osmotic Dehydration and Vacuum Impregnation

a **TECHNOMIC**<sup>®</sup> publication

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## Series Preface

WE welcome *Osmotic Dehydration and Vacuum Impregnation: Applications in Food Industries*, edited by Pedro Fito, Amparo Chiralt, Jose M. Barat, Walter E.L. Speiss and Diana Behnlian to our fast growing Food Preservation Technology Series. This valuable addition to the Series covers an important topic never before treated in such a well-organized and comprehensive manner. This carefully edited reference addresses the fundamental and applied aspects of osmotic dehydration and vacuum impregnation and includes the work of highly renowned research centers from Europe, Israel, and Canada. I am particularly impressed with the depth of each chapter and the immense contribution of new knowledge this work brings to the scientific community and practitioners in food technology.

Those of us who have done work in this field are aware of the limitations to fully implementing this technology. There is no question that this book answers many of the previously unresolved issues and greatly facilitates the understanding and the scale-up of osmotic dehydration and vacuum impregnation.

I congratulate the editors and authors for a job well done. This is in an area in which a good book is long overdue. I hope all interested readers will experience as much enthusiasm and fun as I did going through the pages of this excellent and well thought out book.

GUSTAVO V. BARBOSA-CÁNOVAS  
*Series Editor*

## Preface

**T**HE principle of osmosis has been known as a means of water removal for some time. However, controlled application of osmotic treatments (OT) to food can be considered among the newest of improved techniques. Food products obtained for final consumption through OT are intermediate moisture products of improved quality, compared to conventionally dried materials. The treatment involves immersing foods in aqueous solutions of sufficiently high concentration at moderate temperatures. Consequently, water drains from the tissue into the solution and the solute transfers from the solution into the tissue. However, a leaching process of the tissue's own solutes into the solution is also observed.

OT is applied with the aim of modifying the composition of food material through partial water removal and impregnation, without affecting the material's integrity. A wide range of applications is possible through the appropriate choice and control of operating conditions, such as processing temperature, pressure and time, composition of solution, geometry of the food pieces, weight ratio solution, and contact between the food pieces and solution. The extent of water removal and solute impregnation is dependent on the additional processing techniques applied, and on the desired nutritional and sensory characteristics of the products.

The recent increase in interest in OT arises primarily from the need for quality improved food products. Quality improvement is related not only to water removal without thermal stress, but also to impregnated solutes. With the correct choice of solutes and a controlled and equilibrated ratio of water removal and impregnation, it is possible to enhance natural flavour and colour retention in fruit products, so that the addition of food additives such as antioxi-

dants can be avoided; softer textures in partially dehydrated products can be obtained; and each food ingredient can be targeted for a particular use.

Due to the relatively simple equipment needed for batch operations, applications of OT have frequently neglected process optimisation; however, the development of industrial applications on a large scale demands a controlled process. There is much practical experience gained from OT alone, but to fulfil consumer, industrial, and environmental expectations, some problems remain to be solved.

For successful process control and optimisation, efforts must be made in the following key areas: (a) improvement in the understanding of the mechanisms of mass transport responsible for water removal and solute uptake, and achievement of a better insight into structural changes, so that the relationship between osmotic process variables and modifications achieved in the material can be used to develop predictive models; (b) prediction of the behavior of modified materials during further processing and storage; (c) response to environmental and economical questions for the management of osmotic solutions.

Adequate predictive models are needed to implement necessary process control and to achieve progress in the design of industrial equipment working in a continuous fashion. Consumers are interested in a wide range of safe products with excellent sensory and nutritional characteristics. Application of OT improves the overall quality of existing products and makes the development of new ones possible. However, optimization of the combined processing of foods, where osmotic dehydration is a step is still necessary. At the same time, management of osmotic solutions remains one of the most critical points on an industrial scale to be resolved.

This book includes edited and expanded versions of the papers presented at the "3rd Industrial Seminar on Osmotic Dehydration and Vacuum Impregnation: Applications of New Technologies to Traditional Food Industry", which took place March 15th, 1999 in Valencia, Spain at the Universidad Politécnica de Valencia. This Seminar Series was part of a European Union Concerted Action funded by the Directorate General XII (research grant FAIR 96-1118). Prior Seminars, part of this Series, were held in Porto, Portugal (October 1997) and Bertinoro, Italy (April 1998).

This EU Concerted Action involved 13 Research Centers and Universities in Europe (9 countries), Israel, and Canada, including: Federal Research Centre for Nutrition and University of Karlsruhe, Germany; CIRAD-AMIS, France; The Robert Gordon University, Scotland; Aristotelean University of Thessaloniki, Greece; University of Udine and I.V.P.T.A., Italy; ATO-DLO Institute, The Netherlands, Israel Institute of Technology, Israel; and University of Guelph, Canada. Two other European Institutions were associated with the group: Warsaw Agricultural University, Poland and The National Food Centre, Ireland.



The main objectives of this action were to create and improve the links between the different groups working on applications of osmotic treatments to food material, improve scientific knowledge for the evaluation and control of modifications of food processed through osmotic treatments, and provide necessary scientific and technological tools for industrial application of OT on a larger scale.

We hope this book will fill a wide gap in the understanding and utilization of osmotic dehydration and vacuum impregnation in food processing. We thank all scientists, institutions, and sponsors for making this work possible.

THE EDITORS

## Acknowledgement

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