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*Book Review*

# CURRENT TRENDS OF SUPERCRITICAL FLUID TECHNOLOGY IN PHARMACEUTICAL, NUTRACEUTICAL AND FOOD PROCESSING INDUSTRIES

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The book "Current Trends of Supercritical Fluid Technology in Pharmaceutical, Nutraceutical and Food Processing Industries" provides an overview of basic principles of Supercritical Fluid Extraction (SFE) and potential application in pharmaceutical and food industries.

Because of their unique properties and relatively low environmental impact, supercritical fluids have proven highly useful in the extraction and separation of organic compounds, in particle production, as reaction media, and for the destruction of toxic waste. During the last decades, more attention was focused on the extraction of organic compounds using supercritical fluids. In "Current Trends of Supercritical Fluid Technology in Pharmaceutical, Nutraceutical and Food Processing Industries", experienced practitioners present detailed accounts of a wide variety of techniques using supercritical fluids.

The book is divided in 4 parts and it comprises 10 chapters. Compiling contributions from international experts in the field, the book presents the state-of-the-science in the application of innovative technologies using supercritical fluids.

In the first chapter, *Introduction to Supercritical Fluids: Basic Principles and Applications* (by M. Nunes da Ponte) a concise and understandable scientific presentation of the basic principles, proprieties and potential application of supercritical fluids is related.

In the second chapter, *Applications of Supercritical Expansion Processes for Particle Formation* (by Ana Rita and C. Duarte) an overview of the supercritical expansion processes applied to pharmaceutical purposes is presented. The principles of these technologies and the advantages and disadvantages of the methods are clearly discussed. Because supercritical processes are often referred and classified as "green" and "environmental friendly" processes, a number of applications and some examples of the use of supercritical fluid technology for the preparation of controlled release systems are reported.

In chapter 3, *Supercritical Anti-Solvent Micronization: Control of Morphology and Particle Size* (by Ernesto Reverchon and Iolanda De Marco), SAS precipitation used to micronize different kinds of materials is approached considering that AntiSolvent (SAS) precipitation has been largely used in many distinct research areas such as: pharmaceuticals, superconductors, coloring matters, explosives, polymers, biopolymers etc. Furthermore, SAS experimental apparatus, several procedures and the optimal operating parameters are described along with details of the morphologies of the expanded microparticles.

Chapter 4, *Particles from Gas-Saturated Solutions and Related Methods for Particle Engineering* (by A.R. Sampaio de Sousa and Catarina M.M. Duarte) provides information on one of the most promising methods for particle engineering using supercritical fluids– Particles from gas saturated solutions (PGSS) and derived methods. The authors clearly described the basic principles, the modeling process, related methods and their application in pharmaceutical, cosmetic and nutraceutical field. This chapter presents an overview of the basic principles of the method, several developments that were further undertaken, and a compilation of different examples and systems.

Chapter 5. *Fundamentals and Modeling of Supercritical Precipitation Processes* (by Ángel Martín and María José Cocero) deals with important informations on the fundamental investigation and modeling of supercritical fluid precipitation processes. These aspects are extremely important in the development of a systematic procedure for the design and scale-up of these processes. Different approaches for the modeling of SCF precipitation processes have been also presented along with solubility and other phase equilibrium calculations.

Chapter 6, *Supercritical Fluid Impregnation for the Preparation of Controlled Delivery Systems* (by Ana Rita C. Duarte and Catarina M. M. Duarte) is focused on the impregnation using supercritical fluid technology, in the preparation of controlled release systems. The development of different successful controlled release systems is presented with the aim to obtain high purity products, free of residual solvents, since no organic solvents are involved in the impregnation process.

Chapter 7, *Ionic Liquids and Carbon Dioxide as Combined Solvents for Reactions and Separations: The Miscibility Switch* (by E. Kühne, G.J. Witkamp and C.J. Peters) refers to the use of Ionic liquids (ILs) and carbon dioxide (CO2) to replace volatile organic solvents in synthesis and extraction processes. When ILs are used simultaneously with carbon dioxide for reactions and extractions, the process will be based on non-toxic, non-flammable solvents and will be applicable for a wide variety of compounds.

Chapter 8, *Supercritical Antisolvent Fractionation of Plant Extracts* (by O.J. Catchpole, N.E. Durling, J.B. Grey, W. Eltringham and S.J. Tallon) contains valuable information regarding the fractionation of plant extract solutions using near-critical fluids to give two or more fractions containing bioactives with widely differing polarities. In particular the authors describe the use of the SAFT process in detail for the solvent extraction and subsequent supercritical antisolvent fractionation of sage and onion.

In chapter 9, *Mathematical Modelling of Supercritical Fluid Extraction* (by H. Sovová) are discussed two of the most frequent types of models for supercritical extraction from plants and the factors influencing scale-up of the process. Considering that different mathematical models for supercritical fluid extraction have been developed in the last decades and it is difficult to choose the most suitable model for particular extraction this study presents concisely, a simple criteria based on time constants of mass transfer and characteristic time of equilibrium extraction.

In chapter 10, *Supercritical Fluid Processing in Food and Pharmaceutical Industries: Scale-Up Issues* (by Fabrice Leboeuf and Frantz Deschamps) the keys for the scale-up of extraction and fractionation processes, together with examples of applications are discussed briefly. Also, the scale-up issues of the particle engineering processes for industrial applications, the design of SFF Full Scale Plants and the cost estimations, are given. The accurate knowledge of mass transfer and nucleation processes will form the basis for efficient scale-up.

Versatile and comprehensive, the book "Current Trends of Supercritical Fluid Technology in Pharmaceutical, Nutraceutical and Food Processing Industries" combines basic fundamentals with industrial applications.

Enhanced concern for the quality and safety of food products, increased preference for natural products, and stricter regulations on the residual level of solvents, all contribute to the growing use of supercritical fluid technology as a primary alternative for the extraction, fractionation, impregnation and particle expansion, and this technology is the key in pharmaceutical, cosmetic, food and nutraceutical field.

Considering the scientific advancements, the improved technology and increased utilization of supercritical fluids it was required a comprehensive, single-source review of current and future trends in supercritical fluid technology.

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