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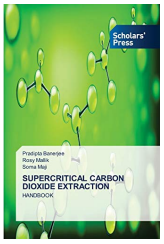

Pradipta Banerjee and 2 more

SUPERCRITICAL CARBON DIOXIDE EXTRACTION: HANDBOOK

CHAPTER 1

INTRODUCTION

Any material at a temperature and pressure above its critical point, where distinct liquid and gas phases do not exist, is a supercritical fluid (SCF) but below the pressure needed to compress it into a solid. It can be effused by porous solids such as a gas, overcoming the limitations of mass transfer that slow liquid transport through such materials. In their ability to dissolve materials such as liquids or solids, SCFs are far superior to gases. Furthermore, minor variations in pressure or temperature near the critical point result in significant changes in density, allowing several "fine- tuned" properties of a supercritical fluid. In the atmospheres of the gas giants Jupiter and Saturn, and possibly in those of the ice giants Uranus and Neptune, super critical fluids exist. Supercritical water, such as water coming from black smokers, a form of hydrothermal underwater vent, is found on earth. In a range of industrial and laboratory processes, they are used as a substitute for organic solvents. Carbon dioxide and water are the most commonly used supercritical fluids, being used for decaffeination and power generation, respectively.

Different methods of extraction have been assessed for the extraction of bioactive compounds such as antioxidants from plants. Four main steps are typically involved in the processing of antioxidants: pre-treatment, extraction, concentration and stabilisation. During the subsequent milling and homogenization processes, the feedstock is dried and allowed for rapid cell wall degradation during the pre-treatment step, reducing the enzymatic degradation of the fruits and antioxidant compounds (Dávila et al., 2014). Air drying, freeze drying or lyophilisation and vacuum drying are the most commonly used technologies in the pre-treatment stage for the extraction of antioxidants. In second stage, various extraction technologies, such as conventional solvent extraction (CSE), supercritical fluids (SFE) and ultrasonic and microwave assisted extraction, are used to extract antioxidant rich extracts. Vacuum distillation (Chumsri et al., 2008), ultrafiltration and nano-filtration (Dávila et al., 2014) are commonly used in the laboratory at the concentration stage. Low oxygen presence, low temperatures and low residence time are required in the concentration process to preserve the extract's high quality. The last stage involves the stabilisation of the concentrated extracts, since the bioactive compounds and antioxidants extracted from