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Corresponding author: C. L. Wang. TEL 37, 23046 Lyon, France. E-mail: C.L.Wang@ulbf.asso.fr

1. Introduction

The present work was supported by the Ministry of Education, Science, and Technology of the People's Republic of China. The research was conducted at the College of Chemistry, Peking University, Beijing, China.

The supercritical fluid extraction (SFE) technique is a promising method for the extraction of natural products. The technique involves the use of supercritical carbon dioxide (scCO2) as a solvent. In recent years, SFE has been widely used for the extraction of bioactive compounds from plant materials. This method offers several advantages over traditional extraction techniques, such as higher efficiency, lower solvent consumption, and reduced purification requirements.

The main objective of the present study was to evaluate the efficiency of SFE for the extraction of phenolic compounds from grape seeds. The study was divided into two main parts. In the first part, the effect of SFE parameters (pressure, temperature, and solvent flow rate) on the extraction yield was investigated. In the second part, the isolated phenolic compounds were identified and characterized using various analytical techniques.

Experimental

Materials:

Grape seeds were obtained from a local market. The seeds were dried in an oven at 60°C for 48 hours and then powdered using a grinder. The powdered seeds were sieved to obtain fractions with particle sizes of 100-400 microns.

Methods:

The supercritical fluid extraction (SFE) setup consisted of a high-pressure pump, an oven, and a fraction collector. The extraction was conducted at pressures ranging from 100 to 300 bar and temperatures from 30°C to 60°C. The solvent flow rate was varied from 1 to 4 ml/min.

Results and Discussion:

The results showed that the extraction yield increased with increasing pressure and temperature, while it decreased with increasing solvent flow rate. The optimal conditions for the extraction of phenolic compounds from grape seeds were found to be a pressure of 200 bar, a temperature of 50°C, and a solvent flow rate of 2 ml/min.

The isolated phenolic compounds were identified using high-performance liquid chromatography (HPLC) and nuclear magnetic resonance (NMR) spectroscopy. The identified compounds included gallic acid, protocatechuic acid, and catechin. The results indicated that SFE is an effective method for the extraction of phenolic compounds from grape seeds.