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Bioactive peptides from spent coffee grounds defatted by supercritical carbon dioxide extraction

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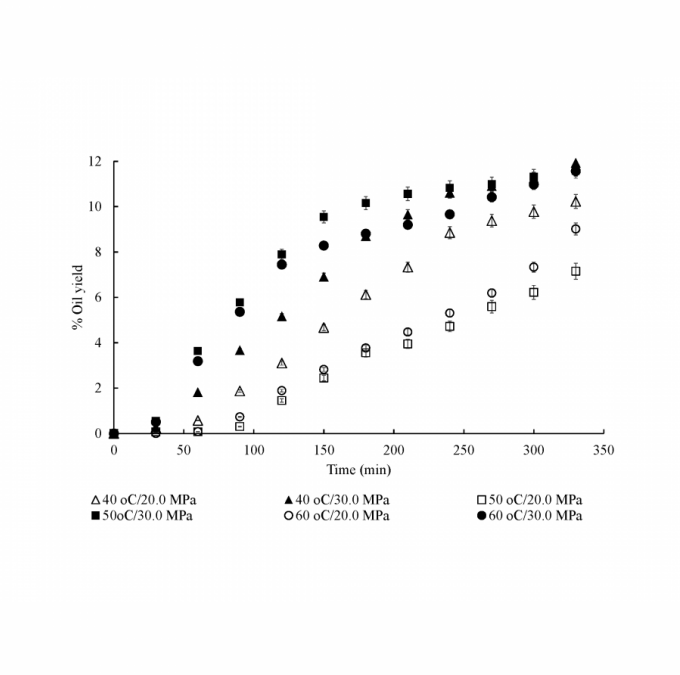
PURPOSE OF THE ABSTRACT

The coffee brewing generates waste known as spent coffee grounds (SCGs), at approximately 0.65 kg of dried SCGs per 1 kg of coffee beans. Although prior research has shown that beneficial remains components exist, SCGs were presently ignored and dumped in landfills. To utilize SCGs through the circular economy concept which is the interested topic nowadays, the supercritical carbon dioxide (SCCO2) extraction could be applied for recovering some active compounds in SCGs. The hypothesis of this work was the SCCO2 is able to simultaneously extract lipids from DSCGs' porous matrix, enhance enzymatic accessibility, and improve the antioxidant activity of protein hydrolysate. The proximate analysis shown that the particles size of SCGs are in range of 250 ? 500 µm, moisture content of ~12.76%wt., and protein content of ~14.29%wt. The n-hexane extraction showed the maximum extractable % oil yield at ~15.67%wt. The oil yield of 11.93%wt. was observed from SCCO2 extraction at 30 MPa, 40 °C and 10 g/min of CO2 flow rate. The major fatty acids in SCGs were palmitic (C16:0) and linoleic (C18:2) acids. The detectable major compounds in volatile oil were aldehydes and flavor compounds classified as furans. For bioactive peptide production, the defatted SCGs (DFSCGs) samples were hydrolyzed with papain at a final ratio of 0.3% E/S for 180 minutes. The degree of hydrolysis of the SCGs and DFSCGs were not significantly difference, whereas the soluble protein of DFSCGs was higher than that of SCGs. The electrophoretic profile (SDS-PAGE) of SCGs and DFSCGs comprises of polypeptide bands at around 130, 67, 24, and <20 kDa mainly derived from the 11S globulin subunits. After hydrolysis, molecular masses of 4-20 and 24 kDa were virtually eliminated, causing the release of polypeptides with molecular masses of <4 kDa. The hydrolysates DFSCGs showed higher antioxidant capacities (DPPH and ABTS). It could be realized that the coffee oil extracted from SCGs can be used as feedstock for 3 products being biodiesel, bioplastic, and antioxidants. Pretreatment with SCCO2 enhances enzymatic accessibility and improves the quality of protein hydrolysate. It can also be potentially included as a supplement in functional foods and high nutraceutical products.

FIGURES



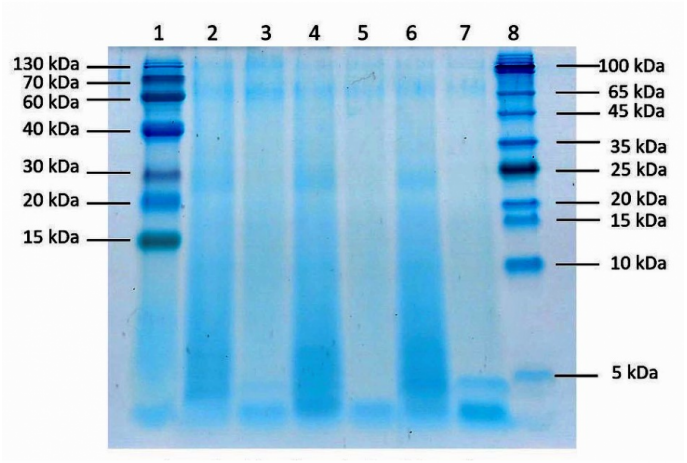


FIGURE 1

Extraction of SCG by SCCO2

The SCCO2 extraction curves at various temperature and pressure

FIGURE 2

The electrophoretic profile (SDS-PAGE) of SCG and DFSCG obtained from various conditions

1 is Iris-9 Prestained Protein Ladder.

2 is non-hydrolyzed SCG

3 is protein hydrolysate of SCG

4 is non-hydrolyzed defatted SCG

5 is 2 is protein hydrolysate of defatted SCG by SCCO2

6 is non-hydrolyzed defatted coffee ground

7 is protein hydrolysate of d

KEYWORDS

Antioxidant activity | Bioactive peptides | Enzymatic hydrolysates | Supercritical carbon dioxide

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