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# OIL EXTRACTION FROM SPENT COFFEE GROUNDS (SCG) USING SOXHLET EXTRACTION METHOD EMPLOYING HEXANE AS SOLVENT

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**2023**

# ABSTRACT

Coffee is the most popular beverage worldwide, with its regular consumption increasing. The production of coffee as a drink generates an average of 6 million tons of spent coffee grounds (SCG) per year globally. These yearly wastes are often burned, combined with animal feed, or dumped in landfills in bulk. Due to their high content of tannins and caffeine, coffee wastes can degrade soil quality and induce carcinogenicity when mixed with animal fodder. The nature of SCGs allows for a wide range of uses. Therefore, several studies have been conducted on how to turn them into valuable products. SCG could be helpful as a promising source of antioxidative materials and it principally consists of lignin, cellulose, and hemicellulose and various bioactive molecules . In this study, the experiments of oil extraction from spent coffee ground SCG) employing hexane as solvent were conducted. The method involved in this research was Soxhlet Extraction (SE). Under the ideal circumstances of a four-cycle SE, the DSCG may generate around 14.03 wt% oil. To establish the best method for extracting oil and the amount of free fatty acids (FFA) in the oil, the extracted coffee oil from up to seven sequential extractions was examined using Fourier Transform Infrared Spectroscopy (FTIR). The findings revealed similarities between the information gained from earlier studies. This study aimed to identify the optimum percentage of oil from extracted dried SCG that involved the drying process of spent coffee grounds (SCG), extraction process using Soxhlet Extractor, and separation process via the rotary evaporator.

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# BACKGROUND

## 1.1 Introduction

Coffee is one of the most famous and popular beverages, alongside tea and water. Production of coffee as a drink generates an average of 6 million tons of spent coffee grounds (SCG) per year globally (Leal Vieira Cubas et al., 2020). Spent coffee grounds, known as SCG, are leftovers or residue obtained after the coffee is brewed. It is also a vital waste product of the coffee industry as it can make up around 10 to 15 wt.% of coffee oil, depending on the coffee variety (Somnuk et al., 2017). Figure 1 shows the chemical compositions (g/100g) of the SCG (Arya et al., 2022). The Soxhlet Extraction method can be applied to extract the coffee oil from the SCG. This method is widely used as it reduces the consumption amount of the solvent we used in the procedure as the solvent is continuously cycled through the process.

At the end of the process, the extracted oil can obtain from the SCG. One of the potential applications of that extracted oil is biodiesel. It is because the SCG is a good substance or feedstock for fuels due to its high calorific value (Najdanovic-Visak et al., 2017). Calorific value can be defined as the amount of heat energy produced on a complete combustion. It is expressed in a unit called kilojoule per kg (kJ/kg). Therefore, the higher the calorific value of a fuel, the more heat energy can be produced, leading to better fuel efficiency. Also, antioxidants are naturally abundant in coffee oil. This makes the oil very stable as the oil does not decompose very quickly because of the low levels of saponified matter, which makes the oil remains viscous and does not congeal quickly (Goh & Hoe, 2019, Al-Hamamre et al., 2012). As a result, coffee oil is expected to be ideal for use in biodiesel. In addition, SCG is a nuisance material for the environment as the organic waste from SCG will decompose partly to methane which can contribute to climate change (Somnuk et al., 2017). So, recycling, reusing, or converting SCG into a usable material will help us to prevent it from becoming more harmful to the environment. SCG from the brewed coffee process has been used as a renewable fuel resource.

In contrast, the dried spent coffee ground known as DSCG from the coffee industry are used as renewable energy resources after removing the moisture in the SCG

through the drying process. Moreover, some specialized agencies will collect the SCG and then sell it for various purposes, such as composting, gardening, bioenergy production, and mushroom growing (Goh & Hoe, 2019, Al-Hamamre et al., 2012). The objective of this study is to extract oil from the spent coffee ground (SCG) using Soxhlet extraction employing hexane as a solvent, using parameters- the cycle of Soxhlet extraction and FTIR to characterize the chemical compound in the extracted coffee oil.

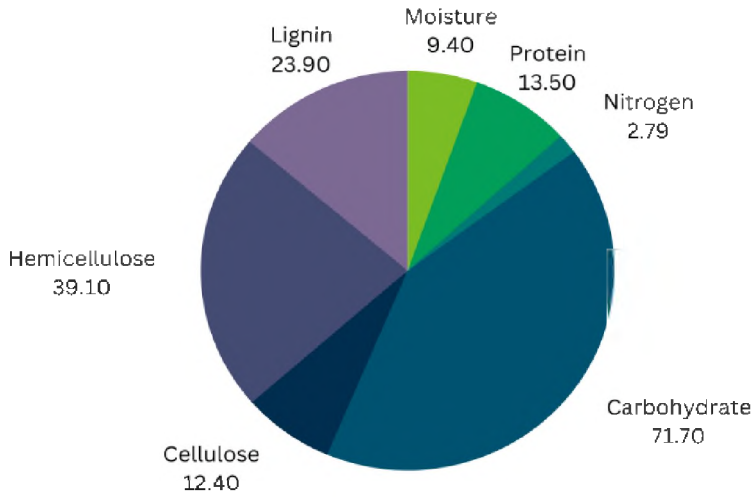


Figure 1 Chemical Compositions (g/100g) of SCG