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**OIL EXTRACTION FROM SPENT COFFEE
GROUNDS (SCG) USING SOXHLET
EXTRACTION EMPLOYING METHANOL
AS SOLVENT**

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ABSTRACT

The roasted and ground seeds of the tropical evergreen coffee plant are used to make the beverage known as coffee. Along with water and tea, coffee is one of the three most consumed beverages worldwide due to its composition that contain caffeine that will enhances nerve system and brain activity of human. Due to it large consuming, it will produce around 50% of coffee production and producing around 6 to 10 million tonnes of coffee waste which is spent coffee grounds (SCG) annually. These large production of SCG will lead to the increasing of landfill waste thus, will contribute to the environmental pollution. Therefore, an experiment were conducted to extract the oil from SCG using Soxhlet extraction method employing methanol as a solvent at different cycles. The purpose of this experiment is to determined the optimum percentage yield of the extracted oil. The highest percentage yield obtained is 9.903% at extraction time 95 min in cycle 5.

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CHAPTER ONE

BACKGROUND

Introduction

Coffee is one of the most consumed and admired drinks due to its refreshing qualities, defined by green beans' composition and changes during roasting. Along with water and tea, coffee is one of the three most consumed beverages worldwide and one of the most lucrative international commodities (Ramanathan & Ali, 2021). Due to this enormous market, the coffee business is in charge of producing a lot of residues, with used coffee grounds being the most significantly generated. Spent coffee grounds (SCG) are the by-product produced when the coffee powder is heated with steam or hot water to prepare instant coffee or the organic residues from brewed coffee. The processing of coffee for soluble coffee preparation accounts for over 50% of global coffee production, producing around 6 or 10 million tonnes of SCG annually (Ramanathan & Ali, 2021; Tian et al., 2021; Yeoh & Ng, 2022) Large concentrations of organic substances, such as fatty acids, amino acids, polyphenols, minerals, and polysaccharides, in spent coffee grounds (SCG) support its valuation.

Table 1 shows the chemical composition of SCG that contains 10-15 wt% of oil content, depending on coffee varieties. The soxhlet extraction method is a process that was used to extract this oil from the SCG. A Soxhlet extraction method is somewhat opposite to filtration, as opposed to the total solubility of an organic component in a sample, which is suited for simple filtration. The sample extraction is for an insoluble organic component in a solvent. A Soxhlet extraction process extracts a substance from insoluble material using a chemical solvent.

Table 1; Chemical Composition of Spent Coffee Grounds (SCG) (Le et al., 2017))

Property	Spent Coffee Grounds (g/100g dry weight)
Protein	110
Nitrogen	223
Fat	197
Carbohydrate	134
Cellulose	202
Hemicellulose	24
Lignin	43
Ash	3
Total	53

For the potential application, coffee oil has been identified as a suitable raw material for biodiesel production (Goh et al., 2020) (Tian et al., 2021). However, its high amount of free fatty acids could harm the process of biodiesel production. The term "biodiesel" refers to fuels produced by esterifying renewable oils, fats, and fatty acids. Unmodified diesel engines can run on biodiesel as a fuel. Compared to gasoline, biodiesel is still not economically viable. Using less valuable feedstock, such as the oil from the coffee, could lessen these problems while enabling coffee growers to manufacture and use their fuel. Therefore, the purpose of the current study was to assess the viability of employing the oil from spent coffee grounds.

We must note that SCG from the coffee industry is typically utilized as a renewable energy resource. This waste is collected by specialist organizations and sold for various uses, including composting, gardening, the creation of bioenergy, and the cultivation of mushrooms to save the environment (Matrapazi & Zabaniotou, 2020). On top of that, SCG has its uses and advantages if it can be applied correctly. Therefore, the objective of this study was to extract the oil from the spent coffee grounds (SCG) using methanol at different extraction cycles to find the optimum oil yield for each experiment.