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OIL EXTRACTION FROM SPENT COFFEE GROUND (SCG) USING SOXHLET EXTRACTION UTILIZING ETHANOL AS SOLVENT

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ABSTRACT

This study investigates the use of Soxhlet extraction with ethanol as the solvent to extract oil from spent coffee grounds. The effects of altering the extraction time by using cycle on the extracted oil yield were examined. The dried spent coffee ground is constant in this experiment which is 10 gram.The maximum yield of oil was produced when the extraction time was at 5 cycle. The extracted oil's composition was determined to be rich in fatty acids, making it a possible source for biodiesel production.The use of spent coffee grounds as an oil source, as well as Soxhlet extraction using ethanol as the solvent, is a sustainable and ecologically beneficial way to oil production. The Soxhlet extraction method is a simple and efficient method for extracting oil from solid materials. It was discovered that the extraction duration which using a cycle are critical elements in the oil extraction process. This research demonstrates that ethanol is an efficient solvent for extracting oil from spent coffee grounds, and that the oil recovered from coffee grounds has a high potential for use as a biodiesel feedstock.

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BACKGROUND

1.1 Introduction

Coffee is the second most consumed beverage in the world after water, and the second largest commodity traded on the stock exchange after petroleum (Araújo et al., 2019a). According to the International Coffee Organization (ICO), 9.4 million tonnes of coffee were produced worldwide in 2018 (ICO, 2018). Huge amounts of waste, such as skins and spent coffee grounds (SCG), are generated during the coffee production and processing process. 1000 kg of processed green coffee beans yield approximately 650 kg of SCG (Karmee, 2018). Many organic compounds, such as fatty acids, amino acids, lignin, cellulose, hemicellulose, and other polysaccharides, are found in SCG and can be processed to add value to this waste (Campos-Vega et al., 2015). Aside from that, it contains bioactive compounds such as alkaloids and polyphenols, as well as caffeine (the major alkaloid), tannins, flavanols, flavones, and phenolic acids. As a result, recovering these compounds may be of interest for applications in the food, pharmaceutical, and cosmetic industries. Currently, however, SCG are incinerated, releasing greenhouse gases, and/or disposed of in landfills. As a result, SCG has been investigated as a source of value-added products in order to reduce its environmental impact (Mata et al., 2018). The crude oil from SCG is the most economically valuable and easily recovered compound. For example, there is growing interest in producing biodiesel from residual oil obtained from spent coffee grounds as a feedstock, as this is a sustainable waste reduction practise and a low-cost source of fatty acids. SCG has biodiesel production potential because its oil content ranges from 12 to 18.3.Oil extraction is usually done with organic solvents, but environmental regulations and increased public health risks are forcing the industry to look for alternative extraction methods (Araújo et al., 2019a).

1.2 Literature Review

1.2.1 Application of SCG and extracted oil

There are a lot of applications of SCG and extracted oil. So, here will discuss about the applications of SCG and extacted oil. The first application of extracted oil is to produce biodiesel. Spent coffee grounds are abundant in valuable chemicals including saturate and unsaturated fatty acids, as well as polysaccharides. As a result, this research looked at a cascade biorefinery to produce biodiesel derived from coffee oils (Battista et al., 2021b). SCGs are attractive biodiesel substrates due to their high content of triglycerids and long fatty acids, which is equivalent to that of standard first generation feedstocks (Battista et al., 2021b). Then , SCG is one of the promising feedstocks for biodiesel production that has been considered. It is a high-quality feedstock with an average oil concentration of 15% wt, equivalent to standard first-generation feedstocks such as soybeans and palm oil. Similarly, the massive volume of SCG produced per day might contribute significantly to global biodiesel production. In 2018, global coffee consumption was expected to be 9910.8 million t, of which only 20% was dissolved in water and ended up in coffee cups, with the remaining 80% ending up as trash. Assuming a conversion efficiency of 80% , 1034.17 billion L of SCG biodiesel may be generated yearly, accounting for 3% of total world biodiesel output in 2018. Furthermore, by 2020, this quantity of SCG biodiesel might account for more than 25% of total waste-based biodiesel production (Kamil et al., 2020).

After that , the application of SCG is cosmetics. Several research have been conducted to investigate the potential of the extracted oil in cosmetic applications. One of them is just aesthetic. Consumers' desire for natural, eco-friendly, and long-lasting cosmetics is growing (Lourith et al.,2022). Coffee residue chemical characterisation and usage as possible bioactive components for the creation of innovative functional goods emerge as a factor of environmental sustainability and economic recovery for coffee processing and roasting firms (S. Bessada, 2018). Because of customer desire for more natural and ecologically friendly products derived from sustainable resources that improve skin health and beauty, the cosmetic industry has been exploring for new active ingredients. Because of its strong antioxidant capacity, phenolic compounds, melanoidins, and caffeine concentration, silverskin has the potential to replace synthetic chemicals as active components in cosmetic compositions (S. Bessada, 2018). Caffeine is another naturally occurring CS molecule with UV-absorption capabilities. Lu and colleagues investigated the effect of caffeine topical treatment on the development of UVB-induced skin cancer in SKH-1 hairless mice. The mice were given caffeine topically once a day (five days a week) for 18 weeks, and the results revealed that caffeine topical treatments reduced the amount of nonmalignant and malignant skin tumours per mouse (44% and 72%, respectively). In another investigation, Koo and colleagues investigated the impact of topical caffeine treatment on the skin of SKH-1 hairless mice exposed to UVB (three times per week for 11 weeks). Caffeine administration increased the deletion of DNA-damaged keratinocytes, indicating that it may reduce photodamage and photocarcinogenesis (S. Bessada, 2018)

Furthermore , fertilizers or composting is also one of the applications of SCG. Sustainable agriculture throws additional demands on agricultural practises, namely plant protection and fertilisation. As a result, demand for high-quality organic fertilisers