UNIVERSITI TEKNOLOGI MARA
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TITLE: OIL EXTRACTION FROM SPENT COFFEE GROUNDS (SCG) USING SOXHLET EXTRACTION UTILIZING ISOPROPANOL AS SOLVENT

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ABSTRACT

Coffee has the highest industrial production volumes of any beverage and is extremely popular worldwide. Spent coffee grounds (SCG), which are the by-products of the coffee brewing process, are a significant waste product. Hemicellulose, cellulose, lignin, polyphenols, proteins, lipids, and minerals were present in the SCG. The SCG is used in various industries, including cosmetics, fertilizer, biogas, power, food additives, and pharmaceuticals. Oil can be extracted from SCG using various techniques, including Soxhlet and two-phase extraction. The experiment aims to determine the yield of oil from SCG and to use FTIR to identify the component in the oil. The soxhlet extraction process used oil from spent coffee grounds using isopropanol as a polar solvent. Cycle 1 until 6 with a different time periods are used to record the oil yield. According to the data, it takes 39 minutes and 35 seconds to extract the most oil at a yield of 34%. The two distinct peaks at 2922.32 cm^{-1} and 2852.86 cm^{-1} that are present in the FTIR results confirm the presence of the methyl and methylene groups. We efficiently extracted oil from old coffee grounds, and we discovered that the oil included a significant number of fatty acids, making it acceptable for various uses.

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CHAPTER ONE
BACKGROUND

1.1 Introduction

The most consumed beverage in the world, coffee generates significant industrial production volumes. Estimates from the Food and Agriculture Organization Corporate Statitistic Database (FAOSTAT) indicate that roughly 10.2 million tonnes of coffee were produced worldwide in 2019. Over three billion cups of coffee are consumed everyday worldwide, according to the International Coffee Organization (ICO) (International Coffee Association, 2019). Additionally, processing such enormous quantities of coffee beans produces a tremendous quantity of waste. Spent coffee grounds (SCG), which are the byproducts of the coffee brewing process, are a significant waste product. SCG contains a wide variety of organic compounds, and the idea of transforming SCG into a variety of high-value-added products has drawn increasing interest in a number of industries, including agriculture, health care, medicine, food, and energy (such as charcoal and biodiesel) (Stylianou et al., 2018). The SCG contains minerals, 6.7–13.6% proteins, 8.6–13.3% cellulose, 25–33% lignin, 2.5% polyphenols, and 30–40% hemicellulose (Bhaturiwala & Modi, 2020). Another intriguing but underutilised strategy is the utilisation of SCG as a possible source of bioactive substances, particularly diterpenes (cafestol and kahweol). Numerous potential pharmacological effects of these substances, including anti-inflammatory, anti-cancer, anti-diabetic, hepatoprotective, and anti-osteoclastogenesis activities, have been recently emphasised in research (Ren et al., 2019).

1.2 Literature Review

1.2.1 Application of SCG and Oil

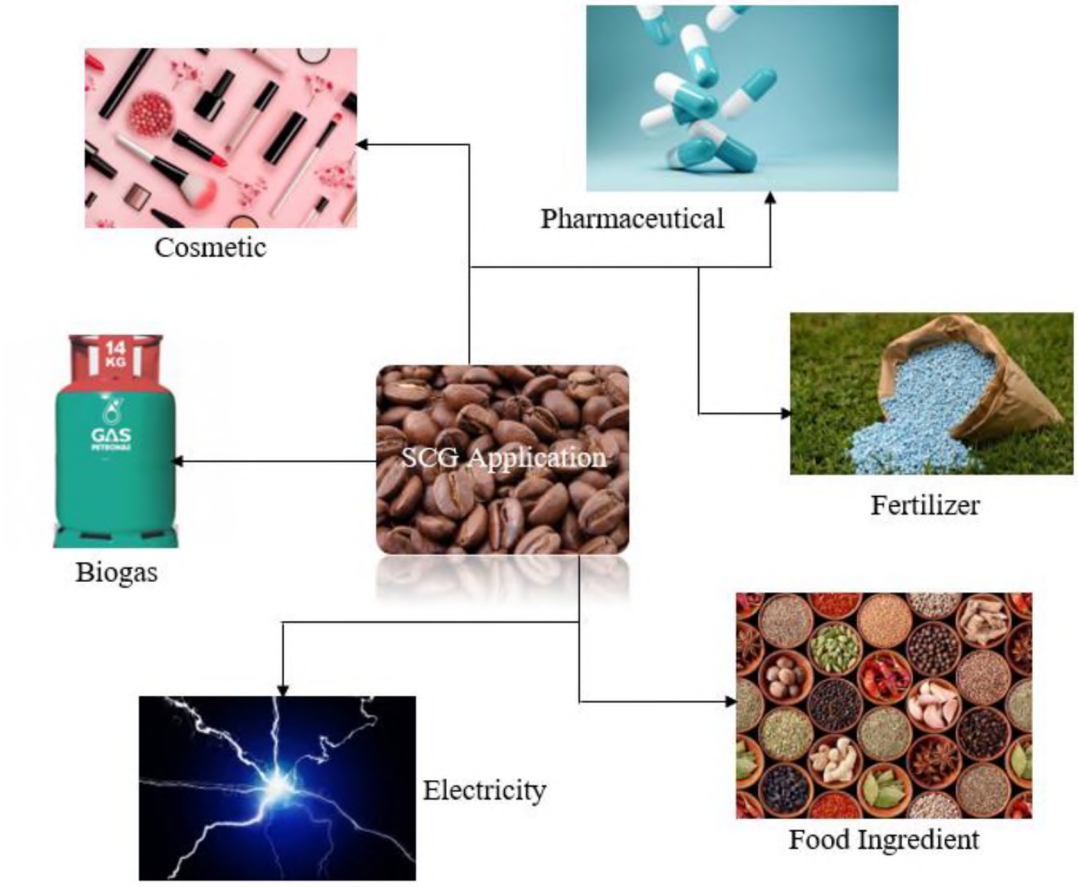

Figure 1

Based on figure 1, the applications for SCG and the extracted oil are numerous. We shall now talk about the uses of SCG and extracted oil. Biodiesel production is the first use of extracted oil. Wasted coffee grounds are rich in beneficial compounds such as polysaccharides, saturated and unsaturated fatty acids, and caffeine. This study investigated a cascade biorefinery to create biodiesel from coffee oils (Battista et al., 2021). Due to their high triglycerides and long fatty acid concentration, comparable to typical first-generation feedstocks, SCGs are desirable biodiesel substrates (Battista et al., 2021). Then, SCG is one of the feedstocks material considered for biodiesel manufacturing. With an average oil concentration of 15% wt, it is a high-quality feedstock comparable to common first-generation feedstocks like soybeans and palm oil. In the same vein, the enormous amount of SCG created every day might have a major impact on the creation of biodiesel on a global scale. There will be 9910.8 million