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Spent ground coffee – awaking the sustainability prospects

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Abstract

This paper outlines the threat of spent coffee ground (SCG) towards environmental health and some promising remedial efforts carried out by the scientific community working against it. To maintain human and earth wellbeing, massive biowastes left behind by the rising popularity of coffee drinking and its processing must be properly addressed. The recent waste to wealth value engineering efforts carried out to repurpose these biowastes are first presented. Some promising applications of SCGs in various prospective civil engineering areas alongside their favorable findings are then summarized. Attributed to beneficial properties as reported in existing studies, silica fume is recommended as the potential constituent to mix with SCG for future construction materials exploration in overcoming both the biowaste and industrial waste issues.

Keywords :
Spent ground coffee; value engineering; waste; construction industry; silica fume

1 Introduction

Coffee, a drink brewed using the roasted and ground coffee beans of African origin, remains one of the three most consumed beverages worldwide along with tea and water. It ranks second only to fossil fuel in terms of the product traded around the globe (Murthy and Naidu, 2012a). Coffee is classified under the genus *Coffea* in the Rubiaceae family. As much as bringing huge economic impact to the coffee-producing countries, coffee drinking has deeply embedded in modern society and culture due to its long historical heritage. Accredited to health benefits of coffee consumption such as reduced risks of heart disease and some cancers, including favorable properties like anti-oxidant (Gómez-Ruiz et al., 2007), anti-bacterial (Meckelburg et al., 2014), remedial functions on type 2 diabetes (Akash et al., 2014), as well as anti-obesity and anti-inflammation (Jia et al., 2014) advantages as reported in scientific studies, the demand of the beverage is expectedly on the rise. Each ton of fresh coffee yields half as much mass of coffee pulp along with 0.18 ton of coffee husk from an estimated daily consumption of about 2.3 billion cups of coffee worldwide (Roussos et al., 1995), resulting in an annual amount of 6 million tons spent coffee grounds (SCG) (Mussatto et al., 2011). SCG comprises high quantities of organic compounds, including amino acids, polyphenols, fatty acids, minerals, and polysaccharides that enhance its recycling merit. Some recent innovations explored its uses as domestic agricultural fertilizer or landfill leachate absorbent (Ching et al., 2011; Gomes et al., 2014).

It is also potentially considered a secondary ingredient for the food and drink industry. Nonetheless, a huge SCG harvesting scheme for recycling or marketable purposes has yet to be reported. Although the drink is arguably harmless unless a large amount is consumed, it has been found that coffee production is not a completely green process. Mismanagement of its by-products could cause an extensive water quality deterioration, thereby posing detrimental effects on the water resources of major coffee producers around the globe while negatively impacting the revenue for manufacturers. The Specialty Coffee Association of America found that the wastewater resulted from the coffee processing pollutes 40 times more water vs. those from the typical municipal sewerage. Since coffee pulp in particular has not been well exploited practically or economically, this rate of biowaste production poses a challenge to the health of our environment, as rivers and lakes near the production areas can be potentially polluted. The disposal of coffee waste, which contain tannins, caffeine, and chlorogenic acid, into the environment can exert serious toxicity impacts on the surrounding ecology (Fernandes et al., 2017). The landfill may be one of the currently practiced removal techniques, intelligently repurposing these by-products in various applications can improve their worthiness by turning waste into wealth from the value engineering perspective. Moreover, there is a crucial necessity to adopt the economic SCG and explore its prospects in developing new construction materials to amplify the overall sustainability of the coffee agro-industry and to prevent it from ending in landfills and causing water pollution.

It is worth noting that in preparing this brief perspective note, references have been made from several good reviews (Murthy and Naidu, 2012a; Janissen and Huynh, 2018). Readers are welcomed to seek these reviews for insights into numerous discussions on coffee in its various forms. Hence, this article is not so much a review paper. Rather, it is a summarization of some major directions of SCG applications for progress advancement purposes. Naturally, no attempt is made to involve the expansive coverage of all studies

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