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Preliminary Study Of Rejected Coffee Bean Waste In Kopi Meneer Hargobinangun Yogyakarta

Eka Rachmawati [1*], Helmia Cipta Rohmawati[2], Lina Mufidah[3], Aziz Fitri Profita Aznam[4]

[1,2]Akademi Kesejahteraan Keluarga AKK Yogyakarta, 55162, Indonesia
[3,4]Dharma Nusantara Sakti Tourism Academy, Indonesia

*Corresponding Author
* eckha.rachma@gmail.com

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ABSTRACT

Kopi Meneer, located in Hargobinangun Village on the slopes of Mount Merapi, Yogyakarta, is a coffee business with significant potential, but faces challenges in managing rejected coffee bean waste. This preliminary study aims to identify the characteristics and potential utilization of coffee bean waste that does not meet quality standards at Kopi Meneer. This research used a case study method with observation, interviews, and literature analysis to examine the types, causes of rejection, physical-chemical characteristics, and potential waste processing. The study results indicate that rejected coffee bean waste results from the quality sorting process, with a percentage reaching 5-10% of the total beans received, caused by physical defects, pest infestation, abnormal color, and inadequate moisture content. This waste still contains organic compounds that have the potential to be used as raw material for biomass briquettes, compost, and functional cascara drinks. The study also identified management constraints such as limited knowledge, equipment, land, and market access. Similar activities in the Hargobinangun area showed that training interventions were able to reduce waste volume by 20% and increase community understanding of environmentally friendly coffee waste processing by 80%. This study recommends the need for waste processing trials and partnership development to support sustainable and economically valuable coffee bean waste management.

Keywords:
Coffee beans, waste, sorting, utilization, Meener Coffee

Kopi Meneer, yang terletak di Desa Hargobinangun di lereng Gunung Merapi, Yogyakarta, adalah bisnis kopi dengan potensi besar, namun menghadapi tantangan dalam mengelola limbah biji kopi yang ditolak. Studi awal ini bertujuan untuk mengidentifikasi karakteristik dan potensi pemanfaatan limbah biji kopi yang tidak memenuhi standar kualitas di Kopi Meneer. Penelitian ini menggunakan metode studi kasus dengan observasi, wawancara, dan analisis literatur untuk memeriksa jenis, penyebab penolakan, karakteristik fisik-kimia, dan potensi pengolahan limbah. Hasil studi menunjukkan bahwa limbah biji kopi yang ditolak berasal dari proses penyortiran berkualitas, dengan persentase mencapai 5-10% dari total biji kopi yang diterima, disebabkan oleh cacat fisik, infestasi hama, warna abnormal, dan kadar air yang tidak memadai. Limbah ini masih mengandung senyawa organik yang berpotensi digunakan sebagai bahan baku untuk briket biomassa, kompos, dan minuman cascara fungsional. Studi ini juga mengidentifikasi kendala manajemen seperti keterbatasan pengetahuan, peralatan, lahan, dan akses pasar. Kegiatan serupa di wilayah Hargobinangun menunjukkan bahwa intervensi pelatihan mampu mengurangi volume limbah sebesar 20% dan meningkatkan pemahaman masyarakat tentang pengolahan limbah kopi yang ramah lingkungan sebesar 80%. Studi ini merekomendasikan perlunya uji coba pengolahan limbah dan pengembangan kemitraan untuk mendukung pengelolaan limbah biji kopi yang berkelanjutan dan bernilai ekonomi.

1. Introduction

Indonesia is the world's fourth-largest coffee producer, with production reaching over 700,000 tons per year [1]. In the ground coffee production process, the bean sorting stage plays a crucial role in ensuring the quality of the final product. Coffee beans with physical defects (broken, hollow, moldy), uneven size, or abnormal color are separated and categorized as rejects, or damaged coffee beans. This waste is not sold as a primary product and is often used as animal feed, compost, or even simply discarded, thus not being optimally utilized [2]. However, in terms of chemical composition, reject coffee beans have potential that is not significantly different from primary coffee beans. Coffee beans generally contain bioactive compounds such as chlorogenic acid, caffeine, tannins, and other natural antioxidants [3].

Furthermore, coffee beans are also rich in lignin, cellulose, and hemicellulose, which have potential as biomass raw materials. However, the specific characteristics of rejected coffee bean waste have not been comprehensively studied. For example, whether these defect processes (e.g., pest infestation or excessive fermentation) significantly alter the bioactive compound profile, antioxidant levels, or physicochemical properties remains an open question.

Previous studies have focused primarily on the utilization of post-brewing solid waste (spent coffee grounds) or coffee cherry skins (cascara). Meanwhile, in-depth studies on the characterization and utilization opportunities of rejected coffee bean waste from the primary processing industry are still very limited. This waste volume is significant and continuous throughout

the year, following the production cycle. If not managed properly, this waste can cause environmental problems due to the accumulation of organic material.

Therefore, this preliminary study is crucial as a foundation for promoting the utilization of rejected coffee bean waste with greater added value, in accordance with circular economy principles. This research aims to conduct initial characterization of rejected coffee bean waste, including proximate analysis (moisture, ash, protein, and fat content), identification of bioactive compounds, and antioxidant activity. The results of this preliminary study are expected to provide accurate baseline data on the chemical and functional potential of this waste, which can then serve as a reference for further research. Potential uses that can be explored include as a source of natural antioxidants, a raw material for food supplements, a substrate for fermentation, or a raw material for biocomposites.

2. Method

This research uses a qualitative approach with an exploratory case study. This approach was chosen to deeply understand the phenomenon of reject coffee bean waste utilization from an emic (actor) perspective, exploring meanings, processes, and constraints that cannot be measured quantitatively [4]. This research focuses on exploring the knowledge, perceptions, management practices, and potential innovations in the utilization of reject coffee bean waste as experienced and interpreted by key actors in coffee production centers.

This research was conducted from November to December 2025. The research subjects were at Kopi Meneer Hargobinnangun, Sleman, Yogyakarta. The location was selected using purposive sampling based on the following criteria: (1) it is an area with intensive post-harvest coffee processing activities (drying, hulling, sorting), and (2) it produces an identifiable volume of reject coffee bean waste.

The research subjects (informants) were selected using a purposive sampling technique [5]. Key informants included: a) one coffee plantation owner in the Hargobinangun area, b) two coffee bean collectors, and c) one farmer group leader.

Data collection was conducted using in-depth semi-structured interviews. Questions developed through the interviews included: a) the identification process and volume of damaged coffee bean waste, b) waste management practices and utilization, c) constraints and challenges in waste management. Interviews lasted between 40 and 60 minutes.

In addition to interviews, direct observations were conducted to observe the sorting process and the physical form of damaged coffee bean waste in the field. Observations focused on the socio-cultural and technical context of waste management [6]. Observations were documented in the form of field notes and photographs (with permission).

The data analysis in this study used thematic analysis techniques to process the interview and observation data. According to [7], which consists of six stages: a) reading transcripts and field notes, b) marking interesting pieces of data, c) grouping related codes, d) reviewing and checking the relevance of themes, e) articulating the essence of each theme formed, f) presenting the analysis in a narrative. To ensure the credibility of the findings, triangulation of sources and methods was carried out [8]: a) Comparing information obtained from farmers, middlemen, b) Comparing data from interviews with data from direct observations in the field.

3. Results and Discussion

3.1. **Results**

Based on observations and initial interviews with the management, the rejected coffee bean waste originates from the quality sorting process before the beans are further processed. Kopi Meneer, located in the Hargobinangun area of Pakem, Sleman, is situated on the slopes of Mount Merapi, a coffee-producing region known for its fertile volcanic soil.

1. Characteristics of Rejected Bean Waste

Coffee beans are rejected at Kopi Meneer based on physical quality criteria that do not meet standards. Rejection criteria include:

a. Physically defective coffee beans: Beans that are broken, have holes, or are misshapen (double beans or underdeveloped beans).
b. Pest-infested coffee beans: Beans showing signs of coffee smut (Hypothenemus hampei) infestation.
c. Abnormally colored coffee beans: Beans that are blackened or have an uneven color due to excessive fermentation or improper drying.
d. Coffee beans with inappropriate moisture content: Beans that are still wet or whose moisture content exceeds the standard (12-13%).

Based on preliminary data, rejected coffee bean waste is estimated to reach 5-10% of the total coffee beans received, depending on the harvest season and weather conditions. This waste has not been optimally utilized and is simply discarded or piled up in areas around business locations.

2. Physical and Chemical Characteristics of Waste

Based on the characteristics of Robusta coffee beans generally processed in the Yogyakarta region, rejected coffee beans have distinctive physical characteristics. In general, Robusta coffee beans have a higher yield than Arabica coffee, with a slightly rounder bean shape and thicker curves.

Initial analysis of rejected coffee bean waste indicates that, although physically not meeting quality standards for consumption, this waste still contains organic compounds with potential for utilization. Coffee beans contain carbohydrates, proteins, fats, minerals, and bioactive compounds such as caffeine and chlorogenic acid.

3. Potential Environmental Impact

Improperly managed coffee bean waste can cause environmental problems. Coffee beans have a relatively high moisture content and are easily damaged, and they contain organic compounds that can pollute the environment if left to rot. Furthermore, the accumulation of solid waste in areas around business locations can produce unpleasant odors and become a breeding ground for pests.

In general, coffee processing waste from coffee cherries can account for up to 48.10% of fresh fruit production, consisting of the pulp (42.20%) and the seed coat (5.90%). Rejected coffee bean waste at Kopi Meneer falls into the solid waste category, requiring special handling to prevent negative environmental impacts.

Figure 1. Reject Coffee Waste

Figure 2. With the resource person for Meneer Coffee products

3.2. **Discussion**

Damaged coffee beans can be utilized in various new products. Previous research indicates that coffee beans have a relatively high carbon content and have potential as a raw material for alternative energy. Coffee grounds contain 47.8%–58.9% total carbon, 1.9%–2.3% total nitrogen, 0.4%–1.6% ash, and 8.6% cellulose. Rejected coffee bean waste also has a calorific value that makes it potential for use as a raw material for biomass briquettes.

Research on the use of coffee waste as briquettes shows that a composition of 70% coffee grounds and 30% adhesive can produce briquettes with the following characteristics: density 0.49 g/cm^3, moisture content 5.11%, volatile matter content 78.33%, bound carbon content 17.31%, ash content 0.62%, and a calorific value of 4656 cal/g. This potential demonstrates the potential for processing rejected coffee bean waste into an environmentally friendly alternative fuel.

Besides being used as a raw material for biomass briquettes, damaged coffee beans can be used as compost. Coffee bean waste is rich in nutrients that can be used as raw material for organic fertilizer. Indonesia produces significant amounts of coffee hull waste, accounting for 50-60% of the total coffee bean harvest. Processing coffee hull waste into compost can improve soil fertility and support sustainable agriculture.

Besides damaged beans, coffee hulls are also produced as waste, which can be made into tea. Besides being used as fertilizer, coffee hull waste can also be processed into cascara, a tea drink made from dried coffee bean hulls [9]. The process for making cascara is relatively simple: the harvested coffee beans are washed, the hulls are removed, and dried.

Based on a preliminary study, there are several obstacles in managing rejected coffee bean waste at Kopi Meneer:

a. Limited knowledge: Management does not yet have adequate knowledge about the potential utilization of coffee bean waste.
b. Limited equipment: Equipment is not available to process waste into value-added products.
c. Limited land: Limited land available for processing or storing waste.
d. Limited market access: There is no market access for processed coffee waste products.

4. Conclusions

Based on the results of a preliminary study on rejected coffee bean waste at Kopi Meneer Hargobinangun Yogyakarta, the following conclusions can be drawn:

a. Waste Characteristics: Rejected coffee bean waste at Kopi Meneer originates from the quality sorting process, accounting for 5-10% of the total coffee beans received. Causes of rejection include physical defects (broken, hollow, or misshapen beans), coffee bean pest infestation (Hypothenemus hampei), abnormal color due to excessive fermentation or improper drying, and substandard moisture content (above 12-13%).
b. Potential Utilization: Rejected coffee bean waste still contains organic compounds that have the potential to be utilized as value-added products, including: (a) raw material for biomass briquettes with a calorific value of 4,656 cal/g, (b) nutrient-rich compost to support sustainable agriculture, and (c) raw material for the economically valuable functional cascara beverage.
c. Management Constraints: Currently, coffee bean waste management at Kopi Meneer faces various constraints, including limited management knowledge about the potential for waste utilization, limited processing equipment, limited land for storage and processing, and the lack of market access for processed waste products.
d. Development Opportunities: Based on the results of similar activities in the Hargobinangun area, coffee waste management has shown positive results, with a 20% reduction in waste volume, an 80% increase in community understanding of environmentally friendly waste management, and 60% of participants being able to practice waste processing independently. This opens up opportunities for Kopi Meneer to develop sustainable waste management.
e. Follow-up Recommendations: Strategic steps are needed, such as detailed identification of the chemical composition of waste, trials of waste processing into various products, training for managers, developing partnerships with research institutions or universities, and evaluating the economic feasibility of various waste utilization alternatives.

Overall, rejected coffee bean waste at Kopi Meneer has significant potential to be processed into value-added products. With proper management, this waste can not only reduce its negative impact on the environment but can also become a source of additional income, supporting the future sustainability of Kopi Meneer's business.

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