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Utilization of Unprocessed Sugarcane Bagasse and Coffee Waste into Soap Products

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ABSTRACT

The increasing by-products from sugarcane and coffee consumption have resulted in a greater volume of sugarcane bagasse and coffee waste with potential environmental impacts. Physically and chemically, coffee and sugarcane waste can be processed into soap products without further processing. This community service activity aimed to provide education and practical skills in utilising coffee and sugarcane waste as raw materials for hand soap production. The activity was conducted at the Baitussalam Mosque in Gadut, Padang City, with 20 participants. The implementation methods included material presentation, demonstrations, and hands-on practice in liquid soap formulation. The soap formula used sugarcane and coffee waste as the main ingredients with additional components including Texapon as a surfactant, EDTA as a chelating agent, salt as a viscosity regulator, warm water, and fragrance. The findings indicated that participants comprehended the potential of utilising sugarcane and coffee waste, allowing them to produce a basic liquid soap product for daily usage. Soap made from sugarcane and coffee waste has the potential to become an organic product with antioxidant and antimicrobial benefits for the skin. This activity aims to increase public awareness of the importance of waste management and promote the development of environmentally friendly, nature-based creative enterprises.

Keywords: sugarcane bagasse, coffee waste, liquid soap

INTRODUCTION

Sexually Sugarcane bagasse is a fibrous solid residue generated by milling the sugarcane plant (*Saccharum officinarum*) after complete juice extraction. Sugarcane has been reported to possess antidiabetic, antioxidant, and antimicrobial activities (Andila et al., 2021). The plant can be found in almost all regions of Indonesia, making bagasse readily available. The industrial use of sugarcane has primarily focused on extracting its juice for sugar production, while the bagasse is typically utilised as an alternative energy source, serving as industrial fuel that produces sugarcane bagasse ash (SCBA) or is disposed of as waste (Tarigan & Dukabain, 2023). Sugarcane stalk bagasse consists of three primary components: cellulose, hemicellulose, and lignin, with the remainder consisting of other extractives soluble in hot water (Novia et al., 2022; September et al., 2023).

Coffee is a highly valued beverage crop recognised for its unique and enjoyable flavour as well as its organoleptic characteristics. The studies report more than 1,000 distinct volatile and non-volatile compounds in coffee which confer various activities including antioxidant, antihypertensive, antimicrobial, and anti-inflammatory effects

(Carvalho Neto et al., 2021). In Indonesia, coffee serves as a major agricultural commodity with a significant impact on international trade. According to Indonesia's 2023 statistical data, national coffee production reached 794.8 thousand tonnes in 2022, an increase of 1.1% compared with the previous year (Ningrum & Prayitno, 2023). Coffee consumption has become a habit or lifestyle for much of the population contributing to the rapid growth of Cafe across the country. This surge in Cafe culture and the growing demand for coffee have resulted in substantial quantities of spent coffee grounds with only about 10% currently being reused, while the remaining portion is discarded as waste (Adrin et al., 2022).

Waste management is a significant environmental concern for many countries worldwide. The problem of waste is not only connected to the amount that continues to expand in tandem with population growth and community consumption, but also related to the inefficient management system (Pamuji et al., 2023; Ramang et al., 2023). In recent decades, the concept of community-based waste management has emerged as an alternative approach to enhancing the efficacy and efficiency of waste management (Andayani et al., 2023). This strategy emphasises the active participation of local communities in trash management, from segregation to collection to converting garbage into something of more value. This strategy is projected to not only reduce the volume of garbage disposed of but also enhance community knowledge and environmental responsibility (Jauhariyah et al., 2023).

Soap is a cleansing agent, also known as a surfactant, made up of two distinct parts: a non-polar (hydrophobic hydrocarbon tail that attaches to oils and dirt) and a polar (hydrophilic head that dissolves in water). This unique structure enables soap to effectively clean on both skin and clothing (Abera et al., 2023). According to the National Socioeconomic Survey, bath soap ranks 169th out of 248 types of non-food household needs in Indonesia. Soap is typically produced using either vegetable oils or animal fats which are processed with a base such as caustic soda. Various soap formulations incorporating herbal additives have been developed to provide additional benefits; examples include *Centella asiatica* and bitter melon leaf extracts which exhibit antibacterial activity (Rahayu et al., 2020). The importance of exploring waste utilization as a community-accessible means to mitigate environmental degradation motivates this community service initiative to produce soap from sugarcane bagasse and coffee waste.

METHOD

This activity was conducted on Saturday, 27 September 2025, at Baitussalam Mosque, Unand Housing Complex, Block D Bandar Buat, Lubuk Kilangan Subdistrict, Padang City. The program consisted of the following components:

1. Material presentation

The event began with a presentation by the team on the benefits of soap made from sugarcane bagasse and coffee waste, as well as the method of producing hand soap from these materials. The sugar cane and coffee waste to be used is dried and ground into a smooth consistency. The presentation was delivered using PowerPoint slides and brochures that had been distributed beforehand. This was followed by a discussion and question-and-answer session, allowing participants to gain further clarification on topics that were not yet fully understood.

2. Demonstration

The next session was a demonstration and hands-on practice of hand soap production using waste from sugarcane bagasse and coffee waste. All chemicals used are safe and do not cause skin irritation. Participants were divided into three groups, each guided by an

assigned team member to ensure that they could clearly observe the process and actively participate in the practice.

3. Evaluation

The activity concluded with an evaluation consisting of questionnaire designed to assess participants' understanding of the presented material and training. Participants were expected to be able to produce hand soap from sugarcane bagasse and coffee waste independently.

RESULTS AND DISCUSSION

Waste management includes waste collection, transportation, treatment, and disposal. This approach focuses not only on waste and hazardous materials but also on resource management and environmental protection (Andayani et al., 2023). The objective is to minimise trash creation, boost recycling and recovery, and mitigate negative effects on the environment and human health. Modern waste management strategies include reducing trash at the source, segregating waste to facilitate recycling, and utilising technologies such as pharmaceutical formulation to convert waste into more valuable forms.

This community service activity was conducted at Baitussalam Mosque, Unand Housing Complex, Block D, Gadut, Lubuk Kilangan Subdistrict, Padang City, with 20 participants. The event was attended by several lecturers from the Faculty of Pharmacy, Andalas University. The activity was conducted in three stages: a presentation of the material, a demonstration of hand soap production using sugarcane bagasse and coffee waste, and an evaluation to assess the participants' understanding of the material presented.

The activity began with a presentation on the benefits of soap made from green sugarcane bagasse and coffee waste, as seen in Figure 1. Disposed sugarcane bagasse can pose an environmental hazard if not properly managed. The accumulation of this waste may attract a large number of insects, which can have a negative impact on public health and contribute to the spread of various diseases. The reutilization of agricultural waste offers a strategic approach to waste reduction and compliance with waste management system requirements, such as utilising this waste as a raw material for soap production (September et al., 2023).

With the increasing number of Cafes or coffee shops, the volume of spent coffee grounds is also rising. Greater coffee consumption correlates with increased spent coffee grounds waste, which has the potential to pollute the environment. When disposed of in landfill sites, spent coffee grounds decompose and release methane gas, a potent greenhouse gas that significantly contributes to global warming. One way to utilise sugarcane bagasse and spent coffee grounds in the cosmetics industry is as additives in soap production. Soap made from coffee grounds offers skin health benefits and can serve as a base material in organic soaps, thanks to its antioxidant and antimicrobial properties. Generally, there are two types of soap: solid soap and liquid soap. Solid soap is considered more economical and practical compared to liquid soap, as liquid soap typically requires more additives and preservatives to maintain its texture and stability due to its high water content (Neisya, 2024).



Figure 1. Presentation on the benefits of soap made from sugarcane bagasse and coffee waste

The next stage involved hands-on practice in producing hand soap from sugarcane bagasse and coffee waste using materials provided by the outreach team. The production process was conducted by dividing participants into three groups, each with several participant representatives conducting the soap production under the guidance of team members, as seen in Figure 2. Materials used included green sugarcane bagasse or spent coffee grounds, salt as a viscosity regulator for the liquid soap, EDTA (ethylene diamine tetraacetic acid) employed as a chelating agent to help extend shelf life (indirect preservative effect) (Jung A, 2002), and Texapon as the surfactant responsible for foaming, cleansing, and solubilising oils.



Figure 2. Participants performing the soap-making process

The procedure for making hand soap from sugarcane bagasse and spent coffee grounds involves preparing 1 liter of warm water in a container, then adding 5 g of EDTA and stirring until dissolved. Next, Texapon is gradually added while gently stirring until the mixture becomes homogeneous. Then, 3 tablespoons of sugarcane bagasse and coffee grounds are added and mixed thoroughly. Fragrance may be added optionally to enhance

the soap's scent, although the natural aroma of the sugarcane bagasse and coffee grounds is usually sufficient. Salt is then added gradually until the desired viscosity is achieved. Finally, the soap mixture is left to stand for a while until the foam subsides and the solution stabilises, making it ready to be poured into packaging bottles.

After the soaps were packaged and all processing steps were completed, they were distributed to each participant for personal use, as seen in Figure 3. Participants were encouraged to independently replicate the formulation to create income-generating opportunities and to help reduce environmental waste. In the evaluation 65% of participants successfully produced soap independently.



Figure 3. Group photo of participants and the finished soap products

CONCLUSION

The community service activity in the form of training on hand soap production from sugarcane bagasse and coffee grounds waste was successfully conducted, involving 20 participants. The participants gained an understanding of the environmental hazards posed by improperly managed waste and its potential utilization in cosmetics production. Through hands-on demonstration, the participants were able to comprehend the soap-making process from sugarcane bagasse and coffee grounds, which not only functions as a cleanser but also offers antioxidant and antimicrobial benefits. This activity is expected to raise public awareness of the importance of waste utilization while also creating opportunities for creative economic ventures based on environmentally friendly natural materials. In order to boost production and enhance the quality of soap preparations, small and medium-sized businesses can work together to produce soap from coffee and sugar cane waste for medium-term goals.

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