

# Enhancing food operator intention on specialty café using 3R waste management approach for eco-enzyme production as an implementation of SDGs 12 (Study on Akkar Specialty Cafés)

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## Abstract

Handling café business waste is essential for environmental protection, especially for organic food waste. After all, organic food waste decomposes quickly and produces methane gas, which has a pungent odor if not appropriately managed. This research analyzes and describes the waste management activities of specialty café businesses, starting with showing the development potential for managing by-product waste to increase added value and increase customer awareness. The research method used is descriptive qualitative analysis based on literature study, observation, interviews, and analysis of other supporting documents. The practice of waste management can positively impact the amount of waste generated from the café business because the amount of waste that must be submitted to the landfill can be reduced and provide by-products to increase income and café aesthetics. Waste management can be implemented by collecting and sorting waste and then processing it into by-products, one of which is by making eco-enzymes. The impact of this activity is that café businesses can educate employees and consumers to care more about the environment through simple waste management. The limitation of this study is that the research was conducted without a waste treatment trial process. Although this research is locally focused and qualitative, the results and methods of this research can be used to guide the implementation of wiser and more sustainable café business waste management.

**Keywords** *Eco-enzyme, Reduce-Reuse-Recycle, SDGs 12, Specialty café, Waste management*

## 1. Introduction

Indonesia is one of the influential contributors to the world's food waste. Indonesia, in 2021, is ranked third as the country with the highest amount of food waste in the world after China and India, with a total of 20.9 million tons/year of food waste [1]. DI. Yogyakarta Province also experiences much waste and accumulation, precisely at the Piyungan Integrated Waste Management Site (in Bahasa: *Tempat Pembuangan Sampah Terpadu/TPST*), where in mid-2023 DI. Yogyakarta is experiencing a waste emergency because the amount of waste continues to increase until it exceeds the capacity of TPST. The amount of waste must be further reduced to prevent various environmental, social, and economic impacts that will arise. The accumulation of food waste, especially food waste, can impact the environment by producing methane gas from the decomposition of organic waste, as much as 8.2% of greenhouse gas emissions in the atmosphere and almost comparable to 10% of greenhouse gas emissions from the transportation sector [2]. Managing food waste has a positive social impact, allowing more people access to

food [3]. Food waste has an energy content of 618-989 kcal/capita/day, equivalent to the needs of 29-47% of Indonesia's population that can be supplied from wasted food [4]. Food waste also has an economic impact; if consumers can reduce food waste, it can reduce the need for food, and the costs incurred to process the food are also wasted. The freed-up economic resources can be used for commodities other than food or indirectly have high economic growth effects [5]. Details of the effects of unmanaged food waste on environmental, social, and economic aspects are depicted in Fig 1.

The waste emergency problem experienced by DI. Yogyakarta requires the community to start processing waste independently. Therefore, it aligns with the Circular Letter of the Regional Secretariat of DI. Yogyakarta number 658/8312 related to the temporary closure of TPST Piyungan for 45 days due to the overcrowded condition of TPST, which requires each region in Bantul, Sleman, and Yogyakarta City to handle waste independently in each region. Efforts that the government can make to overcome the problem of waste accumulation have started since the beginning of 2023 by issuing Yogyakarta Mayor

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Circular Letter number 660/6123/SE/2022 concerning the zero inorganic waste movement. This policy asks people to reduce, utilize, and eliminate inorganic waste in the city. This policy can increase public awareness about the need to process waste

independently, including business actors, so that they play an active role in disseminating waste management and processing, one of which is for café businesses.

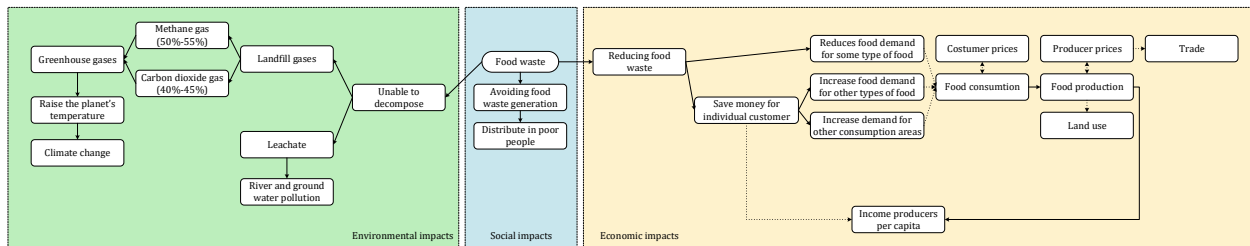


Fig 1. Schematic of the environmental, social, and economic impacts of food waste [6][7]

Café business waste is waste generated during daily operations. Of the various types of café businesses, there are juice café businesses that sell fruit and vegetable-based products. The types of waste generated consist of organic waste in the form of decaying raw materials to food waste, decaying waste of materials that have passed the date of use or are

damaged, and inorganic waste in the form of packaging waste, waste of damaged production equipment, and waste due to excessive production. The percentage comparison of the amount of organic and inorganic waste of cafés in Indonesia and AKKAR's organic and inorganic waste is depicted in Fig 2.

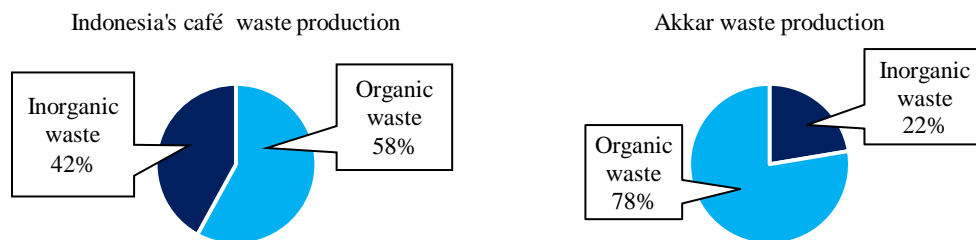


Fig 2. Percentage of café waste in Indonesia and Akkar juice bar [8]

The most straightforward juice café waste management is through the application of the 3R approach (Reduce, Reuse, and Recycle). The 3R approach is carried out by separating each type of waste based on the processing process that will then be carried out so that each waste can be managed appropriately and does not hinder the decomposition process. The advantages of the 3R approach over other waste management approaches are that it is more environmentally friendly because it helps reduce the creation of waste, saves resources, and is cost-effective [9][10]. Reduce action is an activity to minimize waste production by reducing or limiting the amount for the production process. Reuse is a management activity by reusing production equipment and product packaging. Reducing and reusing products can impact reducing new products, so resources and costs must be reduced [9][10]. Recycle activities are carried out by recycling organic waste into compost and inorganic waste handed over to waste processing companies for recycling. Thus, the 3R approach is a sustainable and low-cost waste management method compared to other methods.

Akkar juice bar is a café that provides processed fruits and vegetables from cold-pressed juice,

smoothies, and salads produced with two production models. The made-for-stock production model is

applied for cold-pressed juice products, while smoothies and salads are produced using the made-by-order model. Akkar Juice Bar is a café supporting healthy living by serving quality food and beverages with fresh and natural ingredients. Following its vision and mission, Akkar is present in the world of food and beverage in Yogyakarta with three values to create a healthy, belonging, and positive environment, namely:

- Mindful, Akkar is aware that all production actions will impact all aspects of life, including human health and environmental responsibility.
- Fruitful, Akkar always provides positive intentions for ourselves and others to grow together.
- Impactful, Akkar ensures that its products come from the best ingredients to be easily digested, function optimally, and are sustainable.

To always realize these values, Akkar has made efforts to manage café waste by implementing the 5Rs, consisting of:

- Refuse: AKKAR rejects using plastic packaging, replacing it with reusable bottles.
- Reduce: AKKAR reduces plastic bag use and switches to reusable bags or containers.

- c. Reuse: AKKAR provides cashback for reusing every bottle exchange after sterilization.
- d. Recycle: AKKAR works with local waste management services to sort inorganic waste.
- e. Rot: AKKAR works with local farmers to process residual production waste into compost from organic waste.

Overall, Akkar already has a reasonably good waste management system through the application of the 3Rs to demonstrate an attitude of responsibility to the environment in sustainable production and consumption so that any residual production waste has been separated for processing and not directly disposed of in landfills by Sustainable Development Goals (SDGs) 12.5 even though the waste treatment still depends on third parties. Therefore, this research analyzes and describes the activities carried out by Akkar juice bar to increase the behavioral intention of business actors in waste management for sustainable businesses.

## 2. Impact of waste management on the sustainability of the café business

Waste management and treatment are crucial to achieving sustainable goals and actively contributing to the environment. Through waste management and treatment efforts by café business actors, café business actors become agents of change in achieving the 12th SDGs related to responsible consumption and production to encourage sustainable and efficient consumption and production patterns to reduce negative impacts on the environment. The impacts of handling the sustainability of café waste based on the application of the 3Rs include:

- a. Reduce
  - 1) Waste accumulation: The disposal of food waste without processing leads to the accumulation of waste in landfills. The accumulation of food waste in landfills will increase the ambient temperature and cause an unpleasant odor because the bottom layer of the waste pile undergoes an anaerobic decay process [11].
  - 2) Ecosystem damage: Food waste deposited in landfills produces leachate from the decomposition of waste that can damage the soil. The accumulated waste also produces methane gas that contributes to greenhouse gas emissions, and food waste disposal is also the same as wasting 25% of the water needed in the manufacturing process [12]. Waste management activities to reduce potential damage to ecosystems are by SDGs 12.5 regarding reducing waste production by implementing the 3Rs.
- b. Reuse
  - 1) Economic loss: Food waste behavior can cause economic losses for businesses because the costs incurred to produce food are wasted when the food is thrown away. The costs include raw

material costs, labor costs, energy costs, transportation costs, processing costs, and the cost of disposing of food waste [13]. So, it is not in line with SDG 12.2, which targets sustainable management and efficient utilization of resources by 2030.

- 2) Decreased human health: Hunger is still a global problem due to the lack of access to quality and nutritious food, which can impact health. Good food waste management can be done by distributing food that is almost expired but still suitable for consumption to people in need, or businesses can sell these products at a 50% discount.
- c. Recycle
  - Decrease in business sustainability: People realize the importance of protecting the environment. Over time, people have a preference for products and services that are environmentally friendly. Café business with the concept of green practice is a competitive advantage to improve customer relationships in the long term [14]. The closer relationship with customers makes it easier for cafés to involve customers in waste management so that awareness of a lifestyle that is in harmony with nature can be formed by SDG 12.8.

## 3. Methodology

The research method used is a descriptive qualitative analysis based on literature study, observation, interviews, and analysis of other supporting documents in the context of café waste management and treatment. The research steps are depicted in Fig 3.

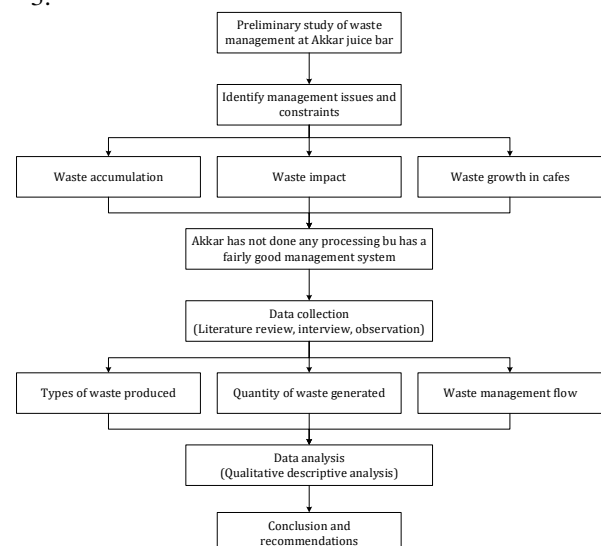


Fig 3. Research flow chart

## 4. Result and findings

### 4.1 Strategy for implementing the 3R concept of Akkar juice bar waste management

In order to support creating a healthy, sustainable environment and provide a sense of comfort for consumers. Akkar has a policy in managing café waste by implementing 3R (Reduce, Reuse, Recycle) as a realization of Akkar juice bar's commitment to grow together with the environment because Akkar realizes the importance of protecting the environment for natural balance. Therefore, Akkar implements a waste management system during café operations through activities described in Fig 4 with the following details:

- a. Scheduling raw material orders. Akkar juice bar applies the FIFO (First In, First Out) system to all raw materials. According to the production schedule, the raw materials at Akkar are ordered from suppliers about two to three days before being processed. It is done to reduce the possibility of raw materials being damaged due to long storage.
- b. Preparing raw materials. Newly arrived raw materials are prepared first by washing, peeling, and cutting some raw materials into smaller sizes, such as carrots, jicama, pineapple, and beets. The raw material preparation process is done carefully and thoroughly to minimize the amount of waste generated. Low-temperature storage is carried out using a chiller at 6°C and a freezer at -18°C for raw materials not in the production schedule. This activity is carried out to extend the shelf life of raw materials so that they do not quickly rot and are wasted.
- c. Reusing packaging bottles. Akkar realizes that product packaging waste plays a role in the accumulation of waste. Therefore, Akkar

applies the reusable concept to the packaging of its cold-pressed juice products to consumers who help return the bottle packaging to Akkar and are rewarded with cashback on their next purchase.

- d. Separating organic and inorganic waste. Waste from production is sorted to produce two types of waste: organic and inorganic. Organic waste is derived from fruit peels, vegetable stalks, pulp from juicing, and rotting fruits and vegetables. In contrast, inorganic waste comprises clear glass packaging, colored glass, metal, tetrapack, cardboard, plastic bottles, duplex, white-blowing HDPE, PVC sheets, and non-aluminum foil plastic sheets. The two sources of waste are separated into different places to be processed through different processes. For inorganic waste, separate containers are provided to separate waste based on its type, while organic waste is placed in containers with a capacity of 20 kg per container.
- e. Establishing cooperation with third parties for waste treatment. Organic waste collected is then handed over to local farmers to be processed into compost, with collection times every two times/week. At the same time, inorganic waste is channeled to a waste recycling company once, with a collection period in the first ten days of each month. These services can help reduce the volume of waste disposed to landfills and provide material benefits to business actors.

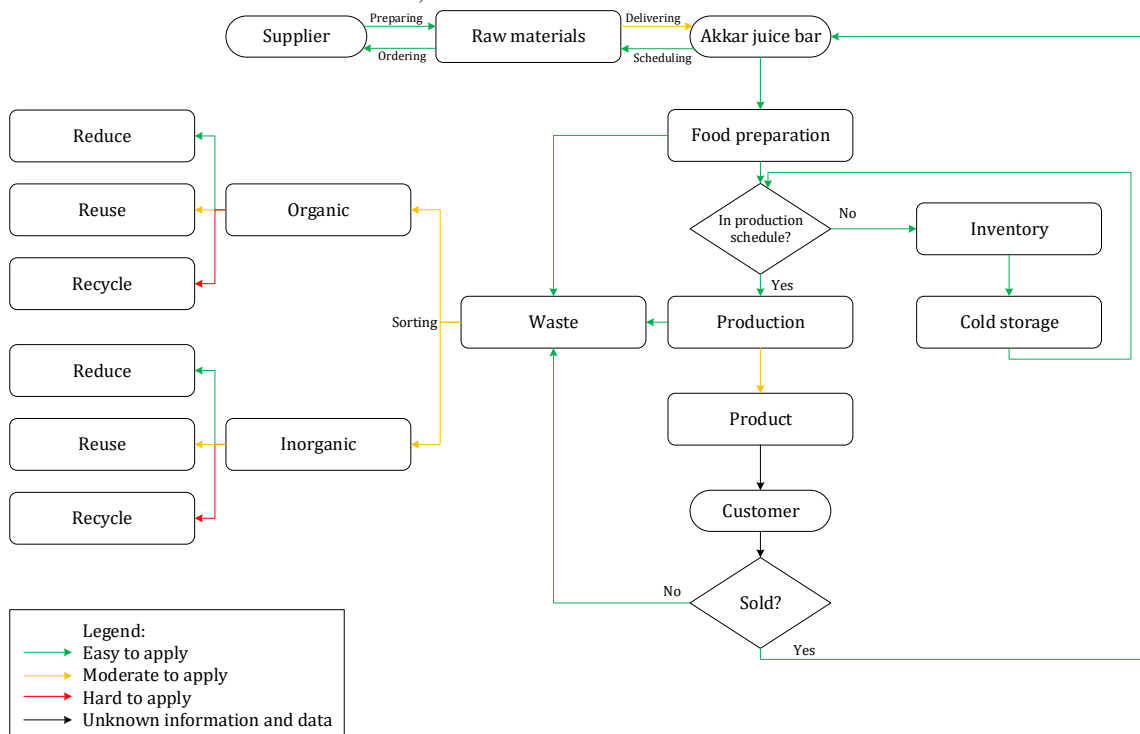


Fig 4. Production flow at Akkar juice bar

Akkar has 3 product variants: cold-pressed juice, smoothies, and salads. Based on these three products, cold-pressed juice is Akkar's flagship product, produced daily, although only for some variants. The amount of cold-pressed juice production waste measurements were taken using a mass balance with repetition three times for seven observations so that the average organic waste result is 10.5 kg/day. These results can be influenced by the composition of the raw materials used, the number of production batches, and the production period with details of each variant, as in Fig 5. Of the seven observations, the average total waste was dominated by the red-colored juice variant consisting of the summer crush, hangover doctor, root boost, and sweet punch variants, with the most waste coming from the summer crush variant. The summer crush variant has ingredients from watermelon, pineapple, and lime. Based on the nature of the raw materials, the high water content causes the waste generated to be higher because the pulp from juicing still has a high water content. The organic waste is collected and then handed over to local farmers to be processed into compost.

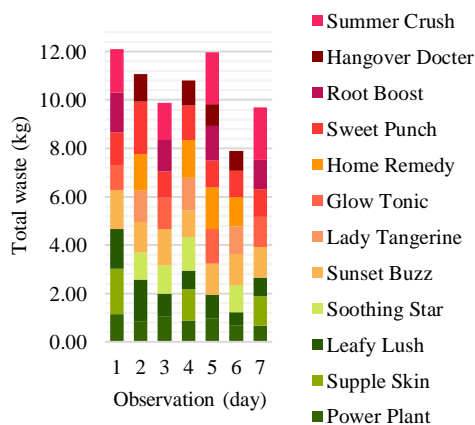


Fig 5. Amount of organic waste of cold-pressed juice Akkar juice bar

In addition to organic waste, the café business also produces inorganic waste derived from packaging raw materials for products in Akkar, as described in Fig 6. The inorganic waste produced consists of cardboard fruit packaging, metal on the lid of cold-pressed juice packaging, tetrapack for making smoothies, transparent polypropylene, white blowing HDPE, and colored glass from salad dressing bottle packaging, clear glass fragments from cold-pressed juice packaging bottles that cannot be reused, PVC sheets from berry packaging, plastic sheets from date packaging as an additional ingredient in making almond milk, and duplexes from take away packaging of salad and smoothies products.

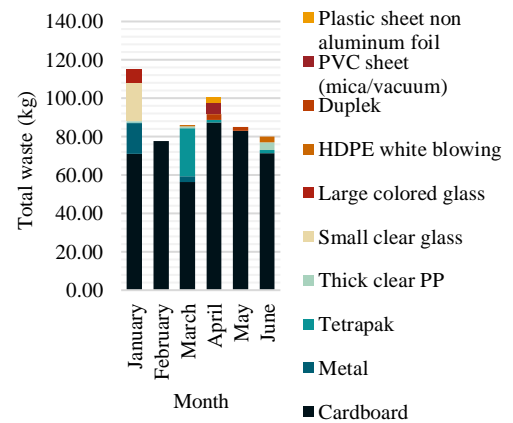


Fig 6. Amount of inorganic waste of Akkar juice bar

Based on the types of inorganic waste, the total waste is measured using a monthly mass balance; the calculated mass is the total mass of waste submitted to the recycling company. Through the results of inorganic waste measurements, it is known that the amount of inorganic waste is dominated by cardboard waste, with an average amount of waste of 74.5 kg/month. The large amount of cardboard is because cardboard is the packaging waste of raw materials supplied daily for the production of all Akkar products. All inorganic waste is recycled by a sustainable waste processing company that picks up waste at Akkar regularly once a month.

The processing of Akkar's production waste is mostly through waste recycling for both organic and inorganic waste, while in recycling waste, Akkar still relies on third parties for waste processing. This condition will be better if Akkar can independently process waste through simple and sustainable processing.

## 5. Discussion

### 5.1 Café business waste management-processing

Some of the steps that Akkar has implemented in waste management have shown that as a café business actor, Akkar is responsible for production and consumption by Sustainable Development Goals 12.3 regarding food waste handling. To increase the sense of environmental responsibility, Akkar can carry out the waste treatment process independently. One way is through composting. Akkar has managed the remaining organic waste from production into compost. However, the composting process is still carried out by a third party, with the composting results not returning to Akkar, and Akkar needs fees for the processing service. The improvement strategy can be applied is to process organic waste into eco-enzyme. Eco-enzyme is a versatile liquid from the synthesis of organisms by decomposing complex organic



matter into simpler, environmentally friendly ones [15]. Making eco-enzymes requires organic waste such as fruit peels or vegetable scraps, molasses, and water. Eco-enzyme can be used as a cleaning liquid, fertilizer mixture, mosquito repellent, and recycled as raw material for soap making. Manufacturing eco-enzymes as an organic waste treatment can help reduce the amount of waste entering the landfill. Enzymes have unique characteristics that allow them to work efficiently and effectively on different types of agricultural waste. Developing environmentally friendly and efficient enzymatic treatment methods is a priority in agricultural waste management [16]. Therefore, eco-enzyme is one of the sustainable solutions that Akkar can apply to recycle organic waste because it is a simple practice but can positively impact the environment..

### 5.2 Processing of citrus waste for eco-enzyme production

Akkar's cold-pressed juice products are juices with various fruits and vegetables. One of the raw materials used in all cold-pressed juice variants is citrus, which consists of limes, lemons, and oranges. Of the twelve cold-pressed juice variants, three do not use citrus in their ingredient composition: power plant, leafy lush, and sunset buzz. Using citrus plays a role in providing a refreshing sour taste to cold-pressed juice products. Its essential role in making cold-pressed juice is directly proportional to the amount of production and citrus waste produced. In one citrus fruit, only 45% can be consumed in the form of juice, and as much as 55% of the citrus must be discarded, consisting of skin (flavedo) as much as 27%, pulp (albedo and endocarp) as much as 26%, and seeds as much as 2% [17].

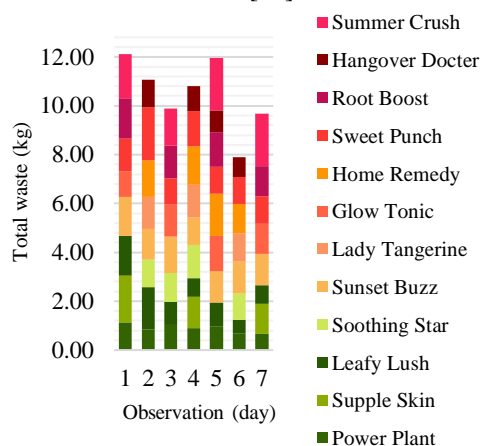


Fig 7. Amount of organic waste of cold-pressed juice Akkar juice bar without citrus waste

The practice of waste treatment by utilizing citrus waste as a base material for eco-enzyme is the most beneficial solution because it is the most economical and efficient method in terms of human and natural resources based on the short

lead team and low operational costs required. Through citrus waste treatment, Akkar can reduce the amount of waste generated by about 9% or as much as 9.56 kg/day, with details in Fig 7. In addition to the impact on reducing the amount of waste, the manufacture of eco-enzymes using citrus has several advantages, among others:

1. Citrus peels contain vitamin C and a high level of acidity that makes the eco-enzyme results potent disinfectants and insecticides and can provide a sharp fragrance [18].
2. Manufacturing eco-enzymes requires low costs and can be done on a small or large scale. The tools and materials needed consist of citrus waste, sugar, water, and containers. Organic waste and water can be obtained for free, so the costs incurred are only for the purchase of sugar and containers. The results of the eco-enzyme were obtained to meet the need for environmentally friendly sanitation for daily use so that Akkar does not need to buy sanitation equipment [19].
3. Eco-enzyme is made from organic materials so that its use does not have a destructive impact that can pollute the environment because it does not contain chemicals that are toxic to humans [19]. Eco-enzyme is a creative way of treating waste to reduce, reuse, and recycle waste [18].

Making eco-enzyme does not have to be in large quantities but can also be done on a home scale. Using simple tools and materials makes it possible to make a versatile eco-enzyme.



Fig 8. Step to make eco-enzyme

The steps that must be taken to make eco-enzyme are depicted in Fig 8 with the details of the activities, as follows:

1. Citrus waste from cold-pressed juice production is collected and cut into small pieces to expand the fermentation surface area [20][21].
2. Sugar, citrus waste, and water are mixed in a ratio of 1:3:10 into a tightly closed container to prevent air from entering [18].

3. The eco-enzyme mixture was stirred once a week to ensure that the citrus waste was evenly fermented, and then the mixture was allowed to stand for three months [18].
4. After three months, the eco-enzyme was filtered to remove solid impurities. The solid impurities can be used as compost, and the liquid eco-enzyme can be used for environmentally friendly sanitary products [20].

Through the simple steps of making eco-enzyme, organic waste treatment is accessible for Akkar to implement. Besides positively impacting the environment, eco-enzymes also have a social and economic impact. Through the manufacture of eco-enzyme, Akkar also obtains by-products from waste treatment so that it has a selling value and can make the waste treatment process by making eco-enzyme as a means of educating consumers to be applied in treating household waste, as illustrated in Fig 9. A good waste management and treatment process can make Akkar a juice cafe business actor who cares more about the environment and is an example for other cafe business actors. Increasing Akkar's participation in management practices and disseminating information about food waste treatment proves the seriousness of the cafe business that is displayed to customers [6].

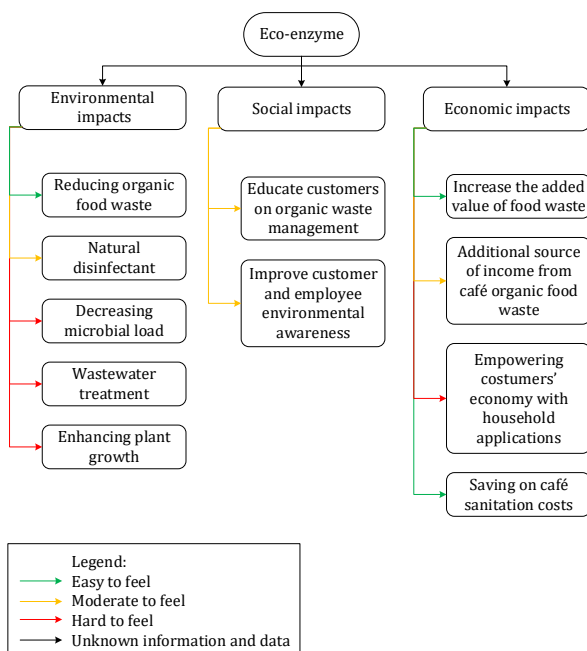


Fig 9. Environment, social, and economic impacts of *eco-enzyme* manufacturing [17]

## 6. Limitation and future research

In recent years, the development of the cafe business has continued to multiply. Not only coffee-based café businesses but juice café businesses have also begun to develop, which in production use fruits and vegetables as raw materials for the products sold. The remaining raw materials are a source of organic food

waste that can pollute the environment if waste management and processing are not done. Therefore, Akkar Juice Bar, as a juice cafe business, has managed waste to realize its responsibility to the environment. However, because the business is still in the medium category, there is no proper waste treatment. Therefore, in this study, Akkar is advised to treat waste by making eco-enzymes. Manufacturing eco-enzymes can benefit Akkar both environmentally, socially and economically favorably. The limitations of this study are that the research was only conducted at the Akkar juice bar production house because it has the most dense production activities, and the waste treatment suggestions have not been tested. Thus, waste treatment trials can be carried out for further research, and the percentage of changes that occur from applying organic waste treatment in the juice cafe business can be measured.

## 7. Conclusion

Implementing waste management at Akkar Juice Bar has been running quite well because it has implemented reduction, reuse, and recycling. However, in the recycling process, Akkar still involves a third party for the waste treatment process. Increasing Akkar's role in waste management can be done by starting to process waste independently, namely by utilizing citrus waste to make eco-enzymes. Through the manufacture of eco-enzyme, Akkar not only treats waste at a low cost and is environmentally friendly but also gets by-products that have selling value and enhance consumer awareness and employees to care for the environment by carrying out sustainable waste treatment.

## Acknowledgments

The authors thank Akkar Juice Bar for their support of the data collection, and all authors of this manuscript contributed equally to this research.

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