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# Utilization Of Organic Banana Peel Waste As An Alternative Material For Making Environmentally Friendly Ice Cream

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**ABSTRACT**

*Banana peels are an abundant organic household waste that has not been optimally utilized. This community service activity aims to empower community groups through training in making banana peel-based ice cream as a functional food product that is environmentally friendly and has economic value. The implementation method includes socialization, technical training in processing banana peels into flour, ice cream formulation, packaging, and mentoring for household-scale businesses. The activity was carried out in Tanjung Selor, Bulungan Regency, targeting students of the University Kaltara. The results of the implementation showed an increase in participants' skills in processing waste into products with sales value, as well as the emergence of interest in developing local food-based businesses. This program also supports the implementation of a circular economy and the reduction of organic waste through an innovative community-based approach.*

Kulit pisang merupakan limbah organik rumah tangga yang melimpah dan sering terbuang sia-sia, padahal memiliki kandungan serat dan senyawa bioaktif yang potensial untuk dimanfaatkan sebagai bahan tambahan pangan. Kegiatan pengabdian ini bertujuan untuk meningkatkan kapasitas mahasiswa dalam mengolah kulit pisang menjadi es krim fungsional sebagai bentuk inovasi wirausaha berbasis limbah ramah lingkungan. Pelaksanaan kegiatan meliputi sosialisasi, pelatihan teknis pembuatan tepung kulit pisang, formulasi es krim, pengemasan, serta edukasi kewirausahaan. Sebanyak 25 mahasiswa terlibat dalam kegiatan ini dan menunjukkan peningkatan skor pemahaman dari rata-rata 58,4 (pre-test) menjadi 85,4 (post-test). Produk es krim dengan penambahan 8% tepung kulit pisang mendapat penilaian terbaik dalam uji rasa oleh panelis. Lebih dari 70% peserta menyatakan minat mengembangkan produk ini sebagai usaha. Hasil kegiatan menunjukkan bahwa pendekatan edukatif dan aplikatif mampu menumbuhkan jiwa wirausaha sekaligus kesadaran lingkungan. Program ini mendorong pemanfaatan sumber daya lokal, pengurangan limbah organik, dan penerapan ekonomi sirkular yang berkelanjutan di kalangan mahasiswa.

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## A. INTRODUCTION

North Kalimantan is known as one of the regions that has the potential for natural resources, one of which is banana trees. Bananas are not only a daily consumption fruit, but are also a superior agricultural commodity in the region. The natural resources of a region can be said to be superior if they have special characteristics that are different from other regions, so that they have characteristics and are not found in other regions (Budiarti *et al*., 2024). This potential is not yet widely known by the public, especially micro, small and medium enterprises (UMKM), so that direct empowerment and education efforts are needed.

However, banana peel waste produced from household consumption and small industries is often not utilized and is simply thrown away, thus increasing the volume of organic waste in the environment (Mohapatra *et al*., 2010). Banana peels actually have great potential as an alternative raw material, because it contains nutritional compounds such as dietary fiber, polyphenols, and natural antioxidants. Based on research results, the crude fiber content of banana peels reaches 3–4%, and has quite high antioxidant activity
(Happi *et al*., 2008)

On the other hand, current consumer trends show an increase in healthy and functional food products, including low-fat and high-fiber ice cream. Ice cream is a popular frozen food product and has great potential to be developed using local plant ingredients. The use of banana peel flour in making ice cream not only provides added economic value but also supports a healthy lifestyle (El-Ghandour et al., 2020).

This activity is a form of implementation of the conceptcircular economy(circular economy) on a household and MSME scale. The circular economy encourages the utilization of waste into new, useful products, thereby reducing dependence on primary raw materials and extending the product life cycle (Nascimento *et al*., 2022)

This concept is very relevant in the context of sustainable development and reducing household waste emissions. In addition, through the development of waste-based food products, communities are trained to innovate in food processing, improve nutritional literacy, and encourage the growth of local entrepreneurial spirit. This activity also opens up new job opportunities, especially for women's groups, housewives, and the younger generation of the village, who have not been touched by simple food technology-based entrepreneurship training (Wijayanti *et al*., 2021).

With a training-based approach and direct practice (learning by doing), participants are expected to not only gain theoretical knowledge but also applied skills that are relevant to market needs. This community service aims to simultaneously address two main issues, namely organic waste management and community economic empowerment based on food innovation. Through training in making ice cream from banana peels, it is hoped that the community can utilize local resources creatively while producing high-value products. Therefore, this program is a concrete step in supporting wiser waste management and making the community the main actor in the development of environmentally friendly food innovation. It is hoped that this activity will not only create new products, but also form a productive and creative mindset in utilizing local potential.

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## B. METHODS

1. Socialization and Education
   Presentation of material on the economic potential of organic waste (banana peels), nutritional content and added value of banana peels, principles of circular economy and functional foods.
2. Product Manufacturing Training
   Banana Peel Processing Techniques Sorting and washing of banana peels Banana peel grinding

**Making Ice Cream:**

Introduction of additional ingredients (milk, cream, sugar, etc.) The process of making ice cream dough Simple freezing techniques with a household freezer

## C. RESULTS AND DISCUSSION

### 1. Improving Students' Knowledge and Skills

Community service activities have succeeded in increasing students' understanding of the potential of banana peel waste as an alternative raw material for economically valuable food products. Through counseling and training sessions, students gain knowledge about the nutritional content of banana peels, processing techniques into flour, and the process of formulating functional ice cream. Before the training, only 18% of participants knew that banana peels contain high dietary fiber; after the training, this figure increased to 92% based on the results of the pre-test and post-test. In addition, students are trained to process waste into processed products that have marketability. They learn to carry out the process, cleaning materials, grinding, to become simple ice cream products with local ingredients, in addition to being practical provisions for developing products independently to be provisions for students after graduating from college.

### 2. Strengthening the Entrepreneurial Spirit

One of the important achievements of this program is the growth of interest in entrepreneurship among students. As many as 75% of participants expressed interest in developing banana skin ice cream as a business product after attending the training. Students were also invited to prepare a simple business plan that includes: raw material analysis, production cost calculations, marketing strategies, and profit projections. Group discussions produced several development ideas, such as: Ice cream with local flavor variants (bananavanilla, banana chocolate).

### 3. Environmentally Friendly and Valuable Products

The ice cream products produced from the training showed quality that was fit for consumption and liked. Taste tests by 25 respondents showed that 85% stated that they "liked" the taste, texture, and aroma of the product. The addition of 8% banana peel flour produced ice cream that had a soft texture, was not bitter, and had a distinctive color that was acceptable to consumers. From the production costs, making 20 cups of ice cream only costs around Rp55,000 for material costs, and operational costs of Rp55,000, and can be resold in the form of mini cups for Rp8,000.

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4. **Social Innovation and Circular Economy Approach**
   This activity also instills sustainability values through the utilization of waste and the application of concepts.circular economy. Students are introduced to a new paradigm that waste is not garbage, but a resource, through this activity, students are invited to think critically and creatively to create innovations based on local potential in overcoming waste reduction. waste. Thus, it is expected that students will not only become job seekers, but also job creators who contribute to sustainable development.

**Figure 1. Ice Cream Making Process**

**Figure 2. Training Participants**

**Figure 3. Processed Ice Cream Products from Banana Pee**

**Table 1. Feedback Recapitulation Feedback Training Activities**

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| No | Assessment Aspect | Average Score | Category |
|---|---|---|---|
| 1 | Relevance of the material to participants' needs | 4.72 | Very Good |
| 2 | Clarity of material delivery | 4.60 | Very Good |
| 3 | Quality of the resource person | 4.64 | Very Good |
| 4 | Benefits of the training for entrepreneurship | 4.76 | Very Good |
| 5 | Participant involvement in practical activities | 4.68 | Very Good |
| 6 | Availability of tools and materials | 4.32 | Good |
| 7 | Training duration | 4.28 | Good |
| 8 | Atmosphere of the activity | 4.56 | Very Good |
| 9 | Participants' expectations for continuity | 4.80 | Very Good |

**Tabel 2. Post-Test** Values

| No | Inisial Peserta | Skor (%) |
|---|---|---|
| 1 | AP | 90 |
| 2 | BT | 85 |
| 3 | CR | 88 |
| 4 | DA | 92 |
| 5 | ES | 86 |
| 6 | FH | 91 |
| 7 | GA | 84 |
| 8 | HR | 80 |
| 9 | IF | 78 |
| 10 | JN | 89 |
| 11 | KA | 82 |
| 12 | LM | 87 |
| 13 | MN | 93 |
| 14 | NR | 81 |
| 15 | OP | 77 |
| 16 | PQ | 90 |
| 17 | QR | 85 |
| 18 | RS | 84 |
| 19 | SN | 88 |
| 20 | TM | 86 |
| 21 | UA | 91 |
| 22 | VI | 83 |
| 23 | WR | 87 |
| 24 | XS | 80 |
| 25 | YT | 89 |

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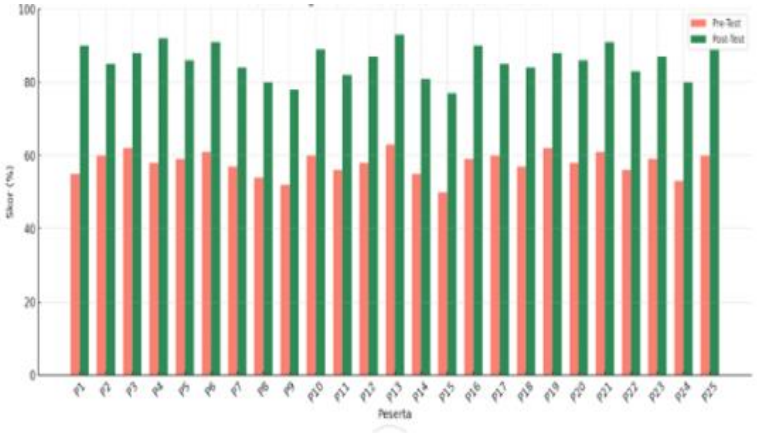


**Figure 4. Comparison of Pre-Test and Post-Test Scores**

Based on the graph above,comparison of pre-test and post-test scoresof 25 participants, showed a significant increase in scores after training, indicating the effectiveness of the program in improving participants' understanding and skills. Thus, the motivation that grows within students to become entrepreneurs becomes a source of strength for them in carrying out activities related to entrepreneurship, especially in participating in entrepreneurship training (Aslan *et al.*, 2023).

## D. CONCLUSION

Community service activities focused on prospective student entrepreneurs in improving knowledge, technical skills, and entrepreneurial interests in the utilization of organic waste, especially banana peels. Thus, this program contributes to the development of local potential, reduction of organic waste, and empowering students as agents of change in the development of a creative and environmentally conscious economy. In the future, follow-up actions need to be carried out in the form of business incubation, business mentoring, and program integration with independent campus activities or other national entrepreneurship programs.

## E. ACKNOWLEDGEMENTS

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## F. AUTHOR CONTRIBUTIONS

Dewi Qomariah ImeldaPlay a role in formulating ideas for community service activities, and be responsible for compiling and discussing articles.Tati Hariyaticoordination of implementation of activities in the field of training module development, as well as writing and editing articles as a whole.Resky Ayu Ningsih, Responsible for implementing technical training in the field, collecting participant evaluation data, documenting activities (photos, videos, logbooks).Prism Nugroho, Conducting recapitulation and analysis of pre-test and

post-test data, evaluating participant satisfaction, and creating data visualization in the form of tables and graphs. Playing a role in simple statistical processing and interpretation of results.Reny Respita and Dwi Alya Amanda Sariprovide critical input on the implementation of activities and assist in the preparation of reports

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