REKAYASA 20 (1) (2022): 10-19

REKAYASA

Jurnal Penerapan Teknologi dan Pembelajaran

http://journal.unnes.ac.id/nju/index.php/rekayasa

Production of Persimmon Juice with Technology Ultrafiltration of Membrane to Improve People's Skills

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DOI: http://dx.doi.org/10.15294/rekayasa.v20i1.44764
Submit: 4 June 2023; Revisi: 15 August 2023; Accepted: 17 August 2023

Abstract

COVID-19 impacted the Grabag Village community's economic instability, resulting in the termination of employment. Grabag Village has the potential for persimmons as fresh fruit consumption, which lasts only less than two weeks. It is the background for the community empowerment activities for three months. The program aims to utilize membrane ultrafiltration technology and introduce the use of chitosan preservatives to the community. The implementation method applied includes the preparation, implementation, and evaluation stages. The results of this activity program show an increase in the knowledge of the partner community regarding the basic introduction of persimmon fruit, diversification of persimmon fruit products, and understanding of the production process with an average value of above 80%. However, only 75% of all partners understand online marketing from a technological point of view. Community assistance is needed to face the challenges of digitizing business actors to expand market share and reach increasingly widespread smartphone users. The community knows the potential of persimmon fruit, which can be used to make many processed products into ready-to-drink drinks. The partner also knows chitosan as a natural preservative and practices adding it directly to fruit juice, packaging, and labelling. After the socialization stage, the community is more educated regarding the procedures for making ready-to-sell persimmon juice from persimmon fruit.

Keywords: community, membrane, filtration, persimmon, fruit juice

INTRODUCTION

The COVID-19 pandemic has impacted the economic instability of the people of Wiyono Hamlet, Grabag Village, and Magelang Regency. Many companies have gone bankrupt, so they have closed their businesses, which has impacted

the Termination of Employment. On the other hand, Grabag Village has one of the abundant rare fruit plants that have the potential to be developed, namely persimmon. Based on the priority problem analysis carried out using the Hanlon Quantitative Method with the calculation of the Basic Priority Value and Total Priority Value, the problem priority. Identification of the problem, namely the large number of people affected by layoffs, caused some people to lose their livelihoods. According to the Magelang Regency Disperinaker (2021), there were 769 workers affected by layoffs in Magelang Regency in 2021.

In addition, the age of persimmon fruit as a fresh consumption fruit can only last up to two weeks. This village's persimmon plant management system still applies the traditional method on a small scale, farming on hillsides and around the yards of people's houses, which produce fruit of varying quality and quantity. Based on the results of interviews with local farmers, persimmon production can reach 250 to 400 per tree or 1-2 quintals per tree, and the weight of persimmons distributed gets> 3 tons. The produce is then sold directly by farmers as consumption fruit with a selling price of only IDR 4,000.00 10,000.00/kg, where the shelf life of persimmon fruit is a maximum of 14 days after harvest, then the fruit starts to change its characteristics to become overripe. The distribution pattern of local fruit that could be more optimal makes marketing this persimmon deficient. It is also not recognized and in demand by the public because it is unavailable in all outlets or fruit shops (Nurchayati & Hikmah, 2014; Arhim & Ningsi, 2017).

Since persimmons are still inferior to other consumption fruits and have a short shelf life, it is necessary to diversify their processing and preservation technologies (Siringoringo et al., 2013; Niazi et al., 2021). Persimmon is a good source of nutrients and bioactive compounds, especially dietary fibre, carotenoids, and phenolic compounds, among other bioactive phytochemicals (Hosseininejad et al., 2022).

Persimmon contains high amounts of pectin, which increases viscosity, decreases colour brightness, and increases product hardness (Dipowaseso et al., 2018). Based on qualitative observations by Yulianti and Herawati (2020), drinks that look cloudy, pale in colour, and appear to have sediment cause a reduction in consumer interest, especially among young people. Therefore, filtration technology is needed to separate pectin to produce quality fruit juice (Urošević et al., 2017). Ultrafiltration membrane technology has a high-quality natural taste, can be carried out continuously, and is free of additional costs (Shi et al., 2019).

A large amount of pectin found in persimmon juice makes the juice quality colourless, and the yield is low because half-ripe persimmon meat tends to be chewy, which is one of the main problems in processing persimmon juice. In previous studies, pectinase was added to juice processing with an enzymatic hydrolysis process at a specified temperature. However, the main drawback of adding pectinase is that the formulation is suitable. If more, it will result in an unpleasant taste of the juice. Some have researched using pectinase to treat juice under optimal (Cerriti et al., 2017). When the ultrafiltration membrane technology is applied to persimmon juice, it can increase economic value and compete in the market.

In addition, using chitosan to preserve persimmon juice naturally can increase the profit value and financial income of the people affected by layoffs in Grabag Village.

The benefits of realizing the potential of local fruit to be further developed in their area, partners have the knowledge and skills to be able to process persimmon fruit into fruit juice

products that are economically valuable and can compete in the market by utilizing membrane ultrafiltration technology and natural preservative chitosan, partners have knowledge and skills on how to pack, distribute, calculate product selling prices, partner women have other more valuable activities, and open partners insights to continue to innovate and be entrepreneurial.

High-pressure processing is widely used in the food industry as a non-thermal technology, especially in fruit or vegetable products, but uses pressures below 400 MPa/1 min, although it has better performance, including against bacteria (Xu et al., 2021)

The use of membrane ultrafiltration technology was previously carried out in Malang Regency by processing star fruit into fruit juice. The machine used is a pressure vessel with the help of a compressor, requiring an electric power of 0.75 hp (Sulthon et al., 2015). The renewal of the tool that the team made uses a single without Reverse Osmosis with a lower electric power of 0.4 hp. Based on the research that has been done, the use of technology is more expansive than in certain areas. Human resources who use technology can be trained through various activities or outreach.

Human resources partners in the community that will be carried out are people affected by the termination of employment in Wiyono Hamlet, Grabag Village, Magelang Regency. Grabag Village is about 58 km from the main campus, with an area of 77.16 Ha in a hilly plateau with potential natural resources in the form of persimmons. The target is working mothers affected by Wiyono Hamlet layoffs. The basis for selecting participants for this partner is due to the limited job vacancies available for women.

Potentials that can develop if carried out sustainably are cooperation between the persimmon juice production team and persimmon farmers, branding local natural resources, diversification of fruit juice products by utilizing membrane ultrafiltration devices for starfruit, oranges, mangoes, and guavas, partners have the knowledge to develop Small and Medium Enterprises as a further movement of persimmon juice production, house organizations, partners can independently process and use ultrafiltration equipment to produce fruit juice, and partners have the knowledge to sell fruit juice online.

METHOD

The program is carried out for three months with 12 partners, namely the community in Wiyono Hamlet, which experienced layoffs due to COVID-19. The stages of the activity are preparation, implementation, and evaluation. The location of this implementation activity is Wiyono Hamlet, Grabag Village, Grabag District, Magelang Regency, Province Central Java.

The team carried out outreach through demonstrations of making and practising tools. This socialization was carried out for 120 minutes with form group small from layoff-affected communities comprising six members of each group done offline.

The membrane filter size refers to the standard size of ultrafiltration membranes with code 4040. The diameter of the membrane is 4 inches, and the length of the membrane is 40 inches. Membranes of this size are commonly used in various applications in water treatment, liquid purification, and the separation of micro-sized dissolved particles so that particles from 0.001 to 0.1 micrometres can be filtered.

The manufacturing process is described in Figure 1. Preparation of the primary raw materials for fruit persimmon washed until clean. Then, peel from the skin. The persimmon skin peeled can be utilized by extracting the skin, which is rich in carotenoid content as a nutraceutical ingredient. (Gea-Botella et al., 2021).

Stage furthermore as much 350 g of persimmon extracted with boiling to get the juice Fruit mixed with fibres The juice and fibre are blended with 1L of water and heated at a low temperature of 90 ^{o}C to speed up the liquid being released from the fruit fibres and dissolved by the water. Furthermore, the results of the decoction can be separated between the juice and the thread by using filtration with membrane ultrafiltration technology, which also aims to filter out pectin substances that affect the quality of the liquid.

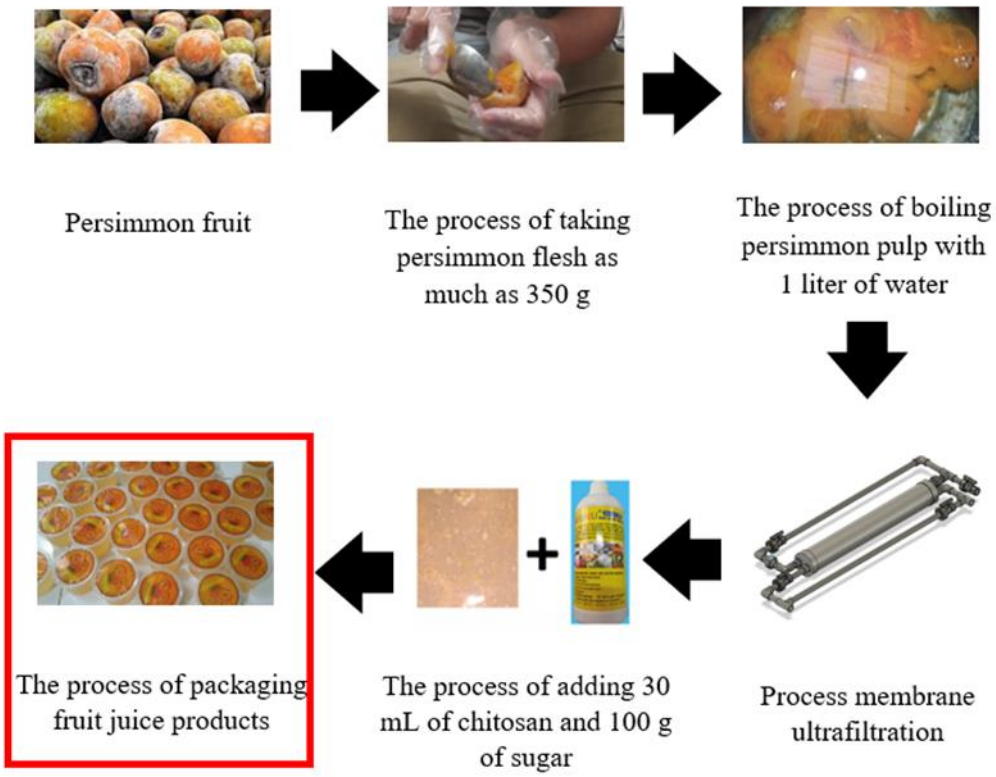

Figure 1. Process Diagram for Making Persimmon Juice

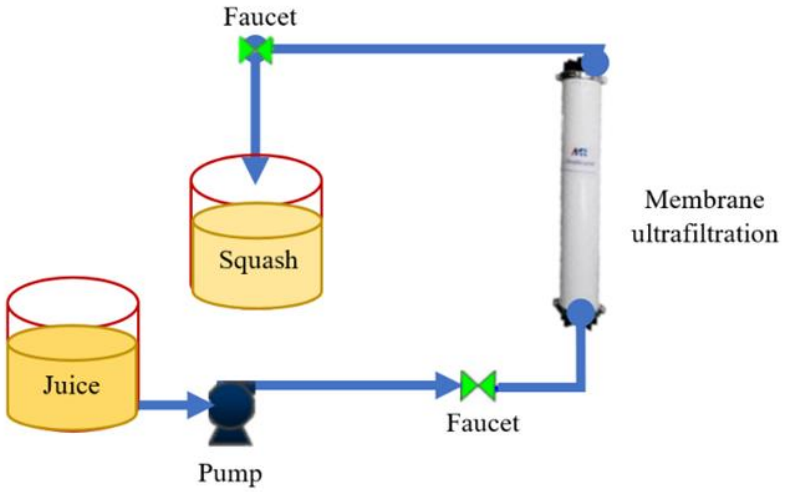

Figure 2. Tool Design for Ultrafiltration Membrane Technology

Particulate and colloidal particles can damage the quality of persimmon juice if filtered through the inner shell of the hollow fibre juice and fruit fibre persimmon pumped flow in tube ultrafiltration open with a scheme like a Figure 2. The fruit juice has been filtered out through the outer shell of the hollow fibre, which flows into the collector from the ultrafiltration membrane. Duration Filtration varies between 20-60 minutes.

After passing the process, We mixed the ultrafiltration membrane and fruit juice with sugar sand. Then, chitosan liquid food grade of as much as 30 mL was added and stirred until mixed flat. Afterwards, fruit juice with natural preservatives was obtained, packaged, and distributed to consumers.

The team distributed questionnaires to 20 consumers to determine their preferences for persimmon juice, including colour, aroma, taste, packaging, and overall appearance. We indicated the likes category based on consumer organoleptic tests on colour, aroma, and taste indicators. In contrast, consumers tended to prefer bottle packaging over cups on the packaging indicator. A comparison of respondents for packaging indicators can be seen in Figure 3. Overall, fruit juice products are liked by consumers, so it can be concluded that the product is acceptable to the public.

This socialization stage is expected to provide a theoretical understanding and increase public interest in making sari fruit persimmon with the natural preservative chitosan. Indicators of the success of this stage can be seen from the understanding and skills practice, with a level of success more significant than 75%. Next, support is provided for production, training packaging, and expansion marketing of product fruit juice persimmon.

Indicators of success are that the partner community has the skills to produce juice and the skills to use ultrafiltration equipment and can market persimmon juice products. In addition, minutes of handing over the tools to partner communities are made in the form of committees that are known by village officials so that the program is always running and sustainable. The team also conducted a product feasibility test in the Central Java Research Center laboratory.

The evaluation stage is carried out to provide solutions to the problems faced by partner communities in the production of the marketing process. This stage is measured through the success of persimmon juice production and sustainable marketing and the development of the persimmon juice business using the methods and skills taught by the team.

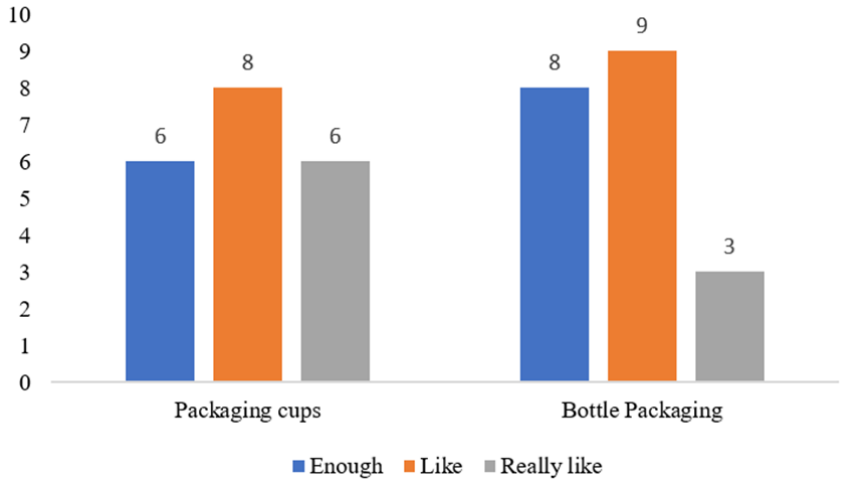

Figure 3. Preference Test of Persimmon Juice for Hedonic Test of Persimmon Juice Packaging

RESULT AND DISCUSSION

The implementation of activities has a better impact on partners, which can be seen from the partners' conditions before and after the training, which is reviewed in Table 1. Partner enthusiastically to try using the apparatus, asking questions, and discussing product diversification, production costs, and estimated product selling reasonable prices.

After the socialization stage, the community is more educated regarding the procedures for making ready-to-sell persimmon juice from persimmon fruit, as shown in Figure 4. The improvement results show that more than 80% of the partners can accept the team's message. However, there is still one activity, namely the procedure for selling online, only 75% of all partners. It is challenging to understand online marketing from a technological point of view, so it needs to be better understood.

The team has formed an organizational structure for the persimmon juice production house, which is approved directly by the local village officials. The process of monitoring production is carried out by partners via Whatsapp messages periodically every two weeks. Monitoring has been carried out five times for three months. Based on the monitoring process carried out so far, partners have produced fruit juice and sold it. The head of the team of partners carried out the handover of a set of ultrafiltration membrane devices and partners' manuals.

Table 1. Tabulation of Impact on Partner Conditions

Activity	Condition of Partners Before Activities	Partner Conditions After Activities
Dissemination of potential sources of power nature of Grabag Village, namely persimmon, through applying Science Knowledge and Technology to affected communities layoffs.	Villagers, as many as five women (target partners), do not know the potential of persimmon fruit, apart from eating it directly and having a slightly astringent taste.	The community knows the potential of persimmon fruit, which can be used to make many processed products into ready-to-drink drinks and can be commercialized.
Dissemination of membrane ultrafiltration technology in processing persimmon juice so that it has a higher value, is economical, and can be marketed, that carried out by demonstrating, practising, and handing over ultrafiltration equipment.	The villagers need to understand ultrafiltration technology, clearer filtering of persimmon juice, and improve the product's shape.	Socialization activities regarding the introduction of membrane ultrafiltration technology. Assistance activities for persimmon juice production partners from the processing stage to filtering using an ultrafiltration filter
Socialization method preservation experience uses chitosan, which helps increase the shelf life of persimmon juice packaging.	These partners must familiarize themselves with chitosan (a shrimp shell product derivative) as a persimmon juice packaging and labelling preservative.	Partners know chitosan as a natural preservative and practice adding it directly to fruit juice, packaging, and labelling.

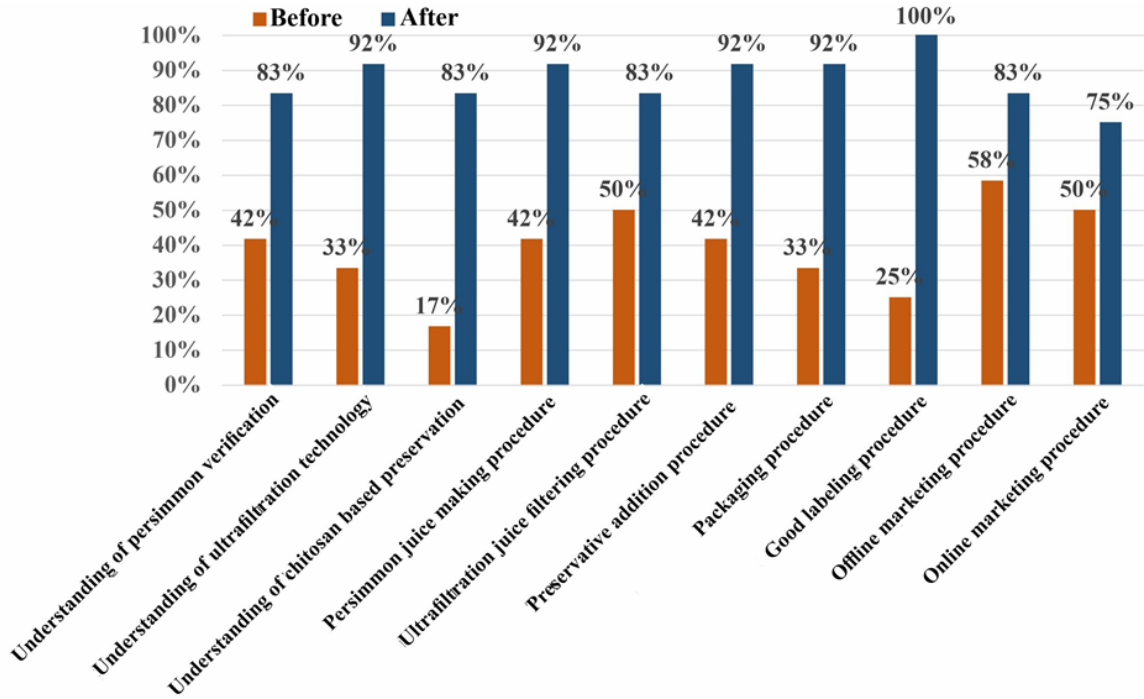

Figure 4 . Graph of Improved Partner Knowledge and Understanding

The persimmon juice production house's organizational structure consists of an advisor responsible for reviewing the sales system, a chairman coordinating activities, a secretary managing administration, and a treasurer managing cash flow. Then, it oversees three areas: the production sector is responsible for meeting production targets, the public relations and marketing sector acts to develop marketing and promotion strategies, and the media and branding sector conducts market research and consumer needs. The guidebook contains information about persimmon fruit, the formula for making persimmon juice, how to use and care for ultrafiltration equipment, and how to package and sell the product, which is delivered using illustrations in the form of pictures and language that partners can easily understand.

In addition to monitoring production activities, an evaluation of product feasibility has also been carried out through tests that include nutrition adequacy rate, total plate rate, total sugar, total calories, fat content, crude fibre content, moisture content, ash content, protein content, total carbohydrates, sodium, and *Escherichia coli bacteria*. In addition, the ultrafiltration and concentration effects provide an optimal product for producing clear persimmon juice, including the maximum function in the technology (Toker et al., 2014).

Superior and competitive products and competent human resources support a business's success through the product's and its contents' feasibility, which benefits consumers. Based on the results of laboratory tests for microbial contamination of *Escherichia coli*, the feasibility of the product was <3 APM/g. The processed persimmon juice produced has passed the Standard Nasional Indonesia Fruit Juice Drinks analysis 3719:2014. According to the Regulation of the Food and Drug Supervisory Agency Number 13 of 2019 concerning the maximum limit for indicators of microbial contamination in processed food, fruit juice products are safe with a maximum limit of 3 APM/g. As well as the results of the Nutrition Adequacy Rate, the total

carbohydrate content, and the sugar content, which was still below the daily sugar usage limit based on the Ministry of Health data. In addition to the adequacy of the nutritional value of carbohydrates and sugar, fruit juice products have advantages in terms of vitamins contained in persimmon fruit. Fruit juice intake was associated with better diet quality and higher nutrient intake (Agarwal et al., 2019). Application of polymer membranes to separate/concentrate biologically active compounds from natural extracts using membrane materials for ultrafiltration functions using polysulfone materials (Tylkowski & Tsibranska, 2017). Water ripe heated at a temperature of 60 ℃ using pan heating water. Making juice by dissolving fruit solids so that it becomes gel juice takes 80-85% of the initial yield of raw material mass (Hafizov, 2022).

The local juice processing industry produces solid dregs. The pulp is considered to have nutrients, especially pro-vitamin A carotenoids (~278 μg equivalent to retinol activity) and low methoxy pectin (9 g/100 DW) (Lalou et al., 2021). Persimmon fruit contains vitamin C, vitamin A, beta carotene, vitamin K, vitamins B1, B2, B3, B6, and catechins, which are beneficial for health. According to (Pasla et al., 2022), persimmon fruit contains vitamin C. Vitamin C or L-ascorbic acid is classified as a water-soluble vitamin, so the use of membrane ultrafiltration technology does not reduce the nutritional value of fruit juices that have been filtered or filtered. Vitamin C and sugar (carbohydrate) levels are not lost much due to the size of the molecule, and smaller ones can pass through the pores of the ultrafiltration membrane. Persimmon is a fruit that is rich in bioactive compounds in the form of tannins, polyphenols, ascorbic acid and carotenoids, which are the main species (Pérez-Burillo et al., 2018). The highest nutrient content in persimmon extract is the content of dietary fibre and pectin (Tardugno et al., 2022). The feasibility of the product shows that the fruit juice product has the potential to be developed as an economic activity for the partner community. It is not limited to product feasibility, but competent and adequate human resources must support this economic activity.

Talented human resources support activities to increase knowledge and skills through community activities. Socialization activities in this program are carried out in two stages: technology and marketing socialization. Technology socialization activities help increase partners' knowledge regarding the production process by utilizing technological innovation. After socialization, partners who previously needed help understanding ultrafiltration material in processed food products became aware. It was shown based on the percentage of partners' knowledge on ten indicators, which exceeded 75%, with the portion of highly skilled reaching 42%. The results of increasing knowledge and skills affect performance, indirectly affecting the quality of production results' quality. Human resource competence is related to knowledge, skills, abilities, and personality characteristics directly affecting performance. Subsequent socialization was also carried out in marketing and finance, including account creation, buying and selling systems on the marketplace, and the importance of a sense of touch through online buying and selling media.

This activity also teaches how to calculate product COGS and financial management so that people can determine the selling price independently if there is a price change in the materials used. The community's ability to manage finances will affect the image of the persimmon juice of the production house community. Financial aspects affect the performance of small and medium enterprises; the better the financial management system, the

better the small and medium enterprises will be so that they have high competitiveness as business actors.

CONCLUSION

The results of this community program are empowered, as shown by 87.5% of partners skilled in selecting persimmons, using membrane ultrafiltration technology, producing fruit juice with chitosan preservatives, product packaging, product labelling, and product marketing. As many as 92% of partners understand membrane ultrafiltration technology, and 83% understand the application of natural methods of preserving persimmon juice using chitosan.

ACKNOWLEDGEMENT

Thank the Ministry of Education, Culture, Research and Technology and the Universitas Negeri Semarang for helping us with research funding with contracts to perfect and improve the quality of this research.

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