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UTILIZATION OF ARECA NUT AS A CORROSION INHIBITOR AND ECOPRINT FABRIC MATERIAL BY THE SUKAKARYA VILLAGE WOMEN'S FARMING GROUP, MUSI RAWAS REGENCY, SOUTH SUMATRA

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Abstract

PT Pertamina EP Pendopo Field, within the GEMILANG (Movement for Women to Preserve Nature through Areca Nut Conservation) program, has successfully empowered the women of Sukakarya Village by promoting the cultivation and utilization of the abundant areca nut trees in the area. As beneficiaries of the GEMILANG program, the Melati Women's Farming Group (KWT Melati) has successfully produced health products from areca nuts, such as ginger areca nut tonic (bandrek) and areca nut juice. Since the program's inception in 2020, KWT Melati has become more productive, engaging in vegetable cultivation and organic fertilizer production using areca nut waste. As the program has grown, GEMILANG has become increasingly inclusive, involving more women from Sukakarya Village. New initiatives under GEMILANG now include the development of areca nuts as a corrosion inhibitor for the industrial sector, using areca nut waste in fabric production through eco-printing techniques, and exporting areca nuts.

Keywords: *Areca Nut, KWT Melati, GEMILANG, Corrosion Inhibitor, Eco Printing, Areca Nut Export*

INTRODUCTION

Sukakarya Village is one of 13 villages in the STL Ulu Terawas District, Musi Rawas Regency, South Sumatra. The village is divided into five hamlets, Hamlets I-V. The majority of the population works in agriculture and plantation sectors. Sukakarya Village is also known as a major producer of areca nuts, as many areca nut trees can be found there.

Despite the adequate level of formal education in this village, the unemployment rate remains relatively high. A significant factor contributing to this unemployment is the low participation of women in the workforce. According to data from the Sukakarya Village Government in 2020, out of the total productive-age population (15-40 years) of 1,843 people, 846 people, or 45.89%, were unemployed. Furthermore, 69.03% of the unemployed population are women. Among these unemployed women, the majority are concentrated in Hamlet 2, with a percentage reaching 33%.

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A deeply rooted patriarchal culture, along with low levels of education for women, has led to a lack of perceived opportunities for them to work and contribute financially to their families. Many women do not work due to low qualifications and skills, exacerbating the problem of poverty in Sukakarya Village. A solution to this situation is to provide equal opportunities for women to access information, new knowledge, and education and participate in decision-making processes.

On the other hand, the abundant areca nut plants in the village have yet to be fully optimized due to the community's limited knowledge and skills. The lack of management of this natural resource has become a barrier to job creation, which in turn fails to address the issues of unemployment and poverty.

In response to this situation, PT Pertamina EP Pendopo Field (Pertamina EP Pendopo) initiated efforts to empower the women of Sukakarya Village by utilizing areca nuts. This effort materialized through a program called the Movement for Women to Preserve Nature through Areca Nut Conservation (GEMILANG). Through the GEMILANG program, areca nuts are processed into various economically valuable products by women's groups, providing them opportunities to develop skills, create products, become self-reliant, and contribute to their family's economy. The program aims to enhance the quality of health, economy, culture, and environment through preventive measures and village-level conservation efforts.

Initially, the GEMILANG-supported group, KWT Melati, focused on utilizing areca nuts to produce health products, such as areca nut "*bandrek*" (a traditional herbal drink), areca nut coffee, and areca nut candy made from *bandrek* residue. The areca nut ginger "*bandrek*" produced by KWT Melati has gained wide distribution across Musi Rawas Regency and has a strong brand reputation. In its third year, a new KWT Melati group was formed, engaging in activities such as converting waste into organic fertilizer, establishing a women's farming cooperative, producing modified cassava flour ("*mocaf*") in collaboration with the Putri 21 Women's Group in Yogyakarta, and establishing a Family Medicinal Plant House (TOGA). In 2023, another KWT group was established to produce eco-friendly containers from areca nut sheaths and cultivate Betara areca nuts.

Entering its fifth year, GEMILANG has shifted its focus to institutional development and enhancing community capabilities by expanding the utilization of areca nuts. This expansion program is referred to as GEMILANG PLUS. This journal aims to provide a general overview of GEMILANG PLUS activities, such as producing innovative corrosion

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inhibitors from areca nuts and creating fabric using eco-print techniques that utilize areca nut waste. In addition to these two innovations, GEMILANG PLUS activities include exporting areca nuts to expand their benefits, increasing the number of production facilities and infrastructure, and utilizing the land to conserve areca nut trees.

LITERATURE REVIEW

The areca nut, scientifically known as Areca catechu (AC), is an easily found plant throughout Indonesia. Among local communities, the areca nut is recognized as a multifunctional plant used in construction, medicine, as an economic commodity, and for crafting. Its straight, unbranched, and sturdy trunk makes it suitable for use as a land or yard boundary marker (Silalahi, 2018).

Almost every part of the areca nut plant can be utilized: the trunk for bridges, the sheath for food packaging, the fruit as a fiber source, and the endosperm for traditional chewing practices. Herbal plant traders have long sold the areca nut in the Kabanjahe market as traditional medicine, ritual material, and for other purposes. According to Sari et al (2014), in various regions of Indonesia, the areca nut is used to remedy bleeding disorders such as menstruation, epistaxis, ulcers, diphtheria, parasitic infections, diarrhea, and dysentery. Using plants as medicine is often linked to the bioactive compounds they contain.

The areca nut plant is also valuable as a construction material, particularly as a corrosion inhibitor. Corrosion is a process that deteriorates materials, especially metals, due to reactions between the metal and its environment. Consequently, metal or metal alloy components are susceptible to damage from corrosion (Pattireuw et al., 2013).

Corrosion is a significant issue in large-scale industries. In various industrial processes, such as acid cleaning, etching, and pickling, aggressive media like acids, bases, and salts are used, leading to metal corrosion. As a result, corrosion is considered detrimental, especially in industries that utilize heavy machinery, because the corrosion process weakens materials, thereby increasing maintenance, repair, or replacement costs. Although metal corrosion cannot be avoided entirely, it can be prevented or controlled (Smallman & Bishop, 1999). Several methods have been employed to reduce corrosion in industrial installations, including cathodic protection, coatings to reduce metal-environment contact, and, most effectively, corrosion inhibitors.

A corrosion inhibitor is a substance that can slow down the corrosion process (Singh et al., 2010). Recently, green inhibitors (environmentally friendly) have been developed to address metal corrosion problems. Green inhibitors are non-toxic, inexpensive, readily

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available in nature, renewable, and environmentally benign. These inhibitors are typically derived from plants or seeds and contain organic compounds such as tannins, organic acids, amino acids, and alkaloids, known for their corrosion-inhibiting properties (Oguzie, 2007). According to Lestari et al (2011), tannins in acacia wood extract effectively reduce corrosion rates using the potentiodynamic method, while preliminary tests show that methanol extracts from tobacco leaves, pepper leaves, papaya leaves, tea leaves, and areca nut fruit effectively reduce mild steel corrosion rates using the gravimetric method in seawater. Among these, the methanol extract from areca nut fruit was the most effective, with a corrosion rate of 0.1542 millimeters per year and a protection percentage of 85.28% (Hermawan et al., 2007).

The chemical components found in areca nut seeds (Areca catechu L.), such as alkaloids, fats, essential oils, water, and a small amount of sugar, can produce tannins (Suka & Syafriadi, 2019). Tannins are highly complex organic substances of phenolic compounds known as tannic acid, gallotannins, or gallotannates (Harborne, 1998). Areca nuts contain a substantial amount of tannins, ranging from 26.60% to 22.71%, making them highly effective as environmentally friendly corrosion inhibitors (Syukur & Hernani, 2001).

Another benefit of areca nuts is their use as a natural dye in the textile industry. Today, traditional communities in Indonesia, such as those in North Sumatra and South Kalimantan, primarily use areca nuts for chewing (betel quid). However, the natural dyes derived from areca nut seeds can beautifully apply to fabrics. Natural dyes are colorants obtained from nature, including animals, minerals, and plants, either directly or indirectly. Every plant has the potential to be a source of color due to its natural pigments. This potential is determined by the intensity of the color produced, which depends heavily on the type of coloring matter present. Coloring matter is the substance that dictates the hue of natural dyes and is an organic compound found in natural dye sources (Sutara, 2009).

Natural materials such as leaves, flowers, stems, and other plant parts that contain color are also used in eco-printing. Eco-printing is a fabric printing technique using natural dyes that is relatively simple but can produce unique and authentic patterns. According to Zumrotun et al. (2023), there are three eco-printing techniques:

a. The pounding technique (where the material is pressed onto the fabric and then pounded)
b. The steaming technique (where the material is pressed onto the fabric and then steamed)

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c. The fermentation technique (where the material is first fermented by soaking in vinegar before being pressed onto the fabric)

RESEARCH METHOD

Based on the GEMILANG roadmap, Pertamina EP Pendopo has focused on strengthening institutional structures and enhancing group facilities through various training programs in its fifth year. These include training in producing eco-print fabrics, developing areca nut products for export, and exploring the potential of areca nuts as corrosion inhibitors. These activities are carefully planned and phased to align with the program's vision and mission, which aim to improve the welfare of women by utilizing areca nuts.

The first step was a social mapping process conducted by a third party. The social mapping was intended to understand the local problems, needs, and potential of the area and its community. The local community actively participated in providing input and considerations for the program's planning through forum group discussions (FGDs), which also included other stakeholders. The outcomes of these planning sessions were mutually agreed upon and formalized in the Strategic Plan (Renstra) and the Work Plan (Renja) documents. During the program's implementation, the community played an active role in executing the initiatives. Additionally, monitoring and evaluation were conducted to ensure the sustainability of these programs. Third-party involvement was crucial in maintaining objectivity, including assessing the Community Satisfaction Index (IKM) and conducting a Social Return on Investment (SROI) analysis.

RESULT AND DISCUSSION

Program Implementation

In the initial efforts to implement GEMILANG PLUS, Pertamina EP Pendopo established two new activity groups:

a. Corrosion Inhibitor Production Group

Pertamina EP Pendopo collaborated with the Faculty of Mathematics and Natural Sciences at Gadjah Mada University (FMIPA UGM) to research the use of areca nut as a natural corrosion inhibitor to address the company's operational challenges. Areca nut extract has anti-corrosion properties that can prevent corrosion in industrial pipelines. This activity focuses on the research and development of areca nuts as an environmentally friendly material for corrosion prevention, with the potential to reduce maintenance costs and the environmental impact of conventional anti-corrosion products currently used by the

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company. The corrosion inhibitor production group received training on processing areca nuts into corrosion inhibitors. This group is currently organized under KWT Melati.

In addition to researching the quality of local areca nuts as corrosion inhibitors, the company is exploring several development options. First, it will monitor the quality and effectiveness of areca nut-based inhibitors and potentially patent the green inhibitor product innovation. Second, it will consider how to involve the Areca Nut Cultivation Group in adding value to the corrosion inhibitor production process. However, if further processing requires advanced technology and strict supervision, the company will oversee the advanced processing stages.

b. Areca Nut Export Group

Women in this group received training on sorting grade A quality areca nuts that meet export qualifications. The plan to export areca nuts arose following an oversupply in the village. To execute this export activity, Pertamina EP Pendopo partnered with national exporters to educate the community on the areca nut export process. KWT Melati also collaborated with areca nut farmers to plant areca nut seedlings in village lands. This initiative aims to ensure a steady supply of areca nuts as raw materials for all KWT Melati activities within the GEMILANG and GEMILANG PLUS programs.

c. Fabric Design Using Ecoprint Techniques

This activity uses areca nut sheaths as natural dyes. The idea stemmed from the desire to manage waste from KWT Melati's production activities to achieve zero waste while creating environmentally friendly creative economic products. Ecorpinting led to the innovation of producing batik using the ecoprint technique, where the leaves and fruit of the areca nut, which have become waste, are utilized as materials for the ecoprint technique—a method currently popular in sustainable fashion design. This technique will result in product diversification by creating batik with unique patterns from Sukakarya Village, establishing it as a symbol of the "Areca Nut Village."

To carry out this activity, Pertamina EP Pendopo formed a new group, KWT IV, which received ecoprint technique training from KANANTRA DANANTRA (Kreasi et al.), a small business specializing in fashion made from ecoprint fabrics and natural materials. The training began with selecting materials for the eco-print process, requiring plants with high heat sensitivity to facilitate color pigmentation on the fabric. Members were then taught to boil and dry the fabric to create unique colors and patterns. Additionally, they were trained

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to design and produce clothing using the eco-print fabric they created. The training was initially conducted in response to the potential of young women who had graduated from school but had yet to find employment.

Monitoring and Evaluation

The various activities carried out under the GEMILANG PLUS program this year have resulted in several key achievements, including:

a. Increase in Participant Numbers in the Groups

GEMILANG has continued to organize various activities to empower the women of Sukakarya Village. New groups, such as the Corrosion Inhibitor Group and the Ecoprint Group, were established this year. Additionally, the program facilitated the formation of new groups like the Sukakarya Ecoprint Sewing Group and the Sukakarya Disabled Ecoprint Group, officially recognized through the 2024 Village Head Decree (SK Kades). Currently, the program has grown to include 75 participants, up from just 12. The program has also engaged 15 male areca nut farmer partners.

b. Reducing Poverty and Improving the Economy of Beneficiaries

GEMILANG now directly benefits 75 people and indirectly benefits 300 others. Economically, 40 of the 75 members belong to the underprivileged group. Additionally, out of eight members, six are women who serve as heads of their households. These six women have seen their incomes rise to match the minimum wage (UMK) of Musi Rawas Regency, IDR 3,404,177. As a result, approximately 20% of the impoverished participants in the program have successfully improved their living standards.

c. Expanding the Uses of Areca Nut Plants

Initially, GEMILANG focused on supporting KWT Melati in producing health products from areca nuts. Today, this plant has expanded into two other sectors: industry and creative economy. For instance, after successful trials and development in the industrial sector, areca nuts can now be used as an environmentally friendly corrosion inhibitor for iron pipes. This innovation adds value to the company by utilizing natural resources to reduce operational costs while preserving the environment. Similarly, in eco-printing, the use of natural dyes creates not only authentic batik patterns but also offers additional benefits. Natural dyes are safer for the skin than synthetic dyes commonly used in the fashion industry.

d. Changing Habits and Behaviors Leading to Positive Community Transformation

The use of areca nut leaves for eco-print fabric production by KWT Melati IV has taught the community that what was once considered waste can generate economic benefits by creating creative products. Previously, areca nut leaves were regarded as waste and were often burned. The leftover leaf residue from eco-print fabric is now processed into organic waste, reducing carbon emissions by 1,118.72 KgCO2eq from 184.8 kg of organic waste. Additionally, planting areca nut seedlings this year ensures a steady supply of raw materials for production. It helps convert areca nut plantation land from the threat of land use change.

e. Emergence of New Social Norms Regarding Women's Roles

The GEMILANG program has fostered a shift in social norms concerning women's participation in economic activities. The program has changed perceptions of women by enhancing women's capabilities through training and opening up job opportunities. Whereas women were previously confined to household duties and rarely engaged in work, they now have economic opportunities to contribute to their families' well-being. Women can even lead initiatives, as demonstrated by KWT Melati.

f. Collaboration with the Private Sector to Enhance Competence

Pertamina EP Pendopo collaborated with a private sector entity, Kanantra Danantra, which specializes in handmade eco-print fabric production in the areca nut utilization for eco print fabric production. Kanantra Danantra operates sustainably, using environmentally friendly natural materials. The collaboration between the two parties includes providing ecoprint technique and fashion design training for KWT IV Melati. The fabric produced by KWT will be used as raw material for Kanantra Danantra's operations.

CONCLUSION

The GEMILANG program has successfully tapped into the potential of the women in Sukakarya Village. Various activities and innovations, such as the export of areca nuts, the development of areca nuts as corrosion inhibitors, and the production of eco-print fabrics from areca nut plants, have directly enhanced and refined the capabilities of the program's beneficiaries. Has GEMILANG improved the community's economy by adding economic value to areca nuts and effectively addressing social and ecological issues in the village? Previously, women were less prioritized in education and employment opportunities. Now, through training and guidance from Pertamina EP Pendopo, the women of Sukakarya Village have succeeded in contributing to their household economies and even creating innovations

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tailored to the community's conditions and needs. From an ecological perspective, GEMILANG has successfully engaged the villagers in environmental preservation efforts, such as ceasing the burning of areca nut waste and planting areca seedlings for conservation in the village area.

However, the program will still require some refinements in the future. These include finalizing the trials of areca nuts as corrosion inhibitors, obtaining certification and permits for corrosion inhibitor products and eco-print fabrics, improving facilities, providing marketing support for derivative products, assisting with areca nut export activities, and more.

REFERENCESS

Harborne, A. J. (1998). *Phytochemical methods a guide to modern techniques of plant analysis*. springer science & business media.

Hermawan, A., Hana, W., & Wiwiek, T. (2007). Pengaruh ekstrak daun sirih (piper betle l.) terhadap pertumbuhan staphylococcus aureus dan escherichia coli dengan metode difusi disk. *Universitas Erlangga*.

Lestari, S., Yayan, & Ratnaningsih, E. S. (2011). Ekstrak Tanin dari Kulit Kayu Akasia (Acacia Mangium) dan Pemanfaatan sebagai Inhibitor Korosi Logam Pada Feed Water Boiler. *Sains Dan Teknol. Kim*, *2*(2).

Oguzie, E. E. (2007). Corrosion inhibition of aluminium in acidic and alkaline media by Sansevieria trifasciata extract. *Corrosion Science*, *49*(3), 1527–1539.

Pattireuw, K. J., Rauf, F. A., & Lumintang, R. C. A. (2013). Analisis laju korosi pada baja karbon dengan Menggunakan air laut dan H2SO4. *Jurnal Poros Teknik Mesin UNSRAT*, *2*(1).

Sari, L. M., Suyatna, F. D., Utami, S. R. I., Chairul, C., Subita, G. P., Whulandhary, Y. S., & Auerkauri, E. I. (2014). Acute oral toxicity study of Areca catechu Linn. aqueous extract in sprague-dawley rats. *Asian J Pharm Clin Res*, *7*(5), 20–22.

Silalahi, M. (2018). The ethnobotanical study of edible and medicinal plants in the home garden of Batak Karo sub-ethnic in North Sumatra, Indonesia. *Biodiversitas*, *19*(1), 229–238.

Singh, A., Singh, V. K., & Quraishi, M. A. (2010). Effect of fruit extracts of some environmentally benign green corrosion inhibitors on corrosion of mild steel in hydrochloric acid solution. *Journal of Materials and Environmental Science*, *1*(3), 162–174.

Smallman, R. E., & Bishop, R. J. (1999). *Modern physical metallurgy and materials engineering*.

Butterworth-Heinemann.

Suka, E. G., & Syafriadi, S. (2019). Inhibisi korosi ekstrak buah pinang (Areca catechu L.) sebagai penghambat laju korosi pada baja karbon rendah C-Mn steel dengan medium korosif HCl dan NaCl. *Jurnal Teori Dan Aplikasi Fisika*, 17–28.

Sutara, P. K. (2009). Jenis tumbuhan sebagai pewarna alam pada beberapa perusahaan tenun di Gianyar. *Jurnal Bumi Lestari*, *9*(2), 217–223.

Syukur, C., & Hernani. (2001). *Budi daya tanaman obat komersial*. Penebar Swadaya.