

Eco-Friendly Pest Control: Utilizing Plant Extract Composites in Liquid Smoke Pesticides at SMK Pancabudi Medan

Desi Sri Pasca Sari Sembiring¹, Andi Setiawan², Najla lubis³, Rozyanti⁴,
Dwi Hayati⁵

¹Master of Agricultural Sciences, Universitas Pembangunan Panca Budi

^{2,3,5}Agrotechnology Program, Universitas Pembangunan Panca Budi

⁴Universiti Malaysia Perlis, Malaysia

Corresponding author: Desi Sri Pasca Sari Sembiring

DOI: <https://doi.org/10.52403/ijrr.20251106>

ABSTRACT

This Community Service (PKM) initiative aims to educate the public on the use of botanical pesticides derived from composite wood-leaf materials. The activity elaborated on the development method for composite-based liquid smoke pesticides, which encompasses several stages: gathering composite raw materials (e.g., bark, leaves, twigs), processing these materials into a finer form, producing the pesticide by combining the composite materials with a solvent, and testing its effectiveness against plant pests. The implementation began with a location survey and a discussion with the Principal of SMK Panca Budi Medan, followed by the main activity comprising lectures, hands-on practice, and an evaluation, with participation from 20 students. The outcome of this service is assessed based on the participants' absorbed knowledge regarding the use of composite-based liquid smoke botanical pesticides for effective and eco-friendly plant pest control.

Keywords: Composite; Liquid Smoke; Botanical Pesticide; Environmentally Friendly

INTRODUCTION

While botanical pesticides are known for their effectiveness and environmental friendliness, they face limitations such as

inconsistent efficacy and higher production costs compared to their synthetic counterparts. Liquid smoke, produced from the pyrolysis of biomass like wood and other organic waste, presents a promising alternative. This substance contains bioactive components like phenols and organic acids, which can be utilized as active ingredients to control plant pests and diseases. A recent innovation in this field is the development of composite-based liquid smoke pesticides, which combine liquid smoke with other natural materials to enhance its efficiency and performance.

SMK Panca Budi consistently demonstrates its commitment to developing educational quality in line with modern dynamics. Strong collaboration with the entire educational community is key to its mission of nurturing the next generation with Islamic character and global competence. As part of the younger generation, students of SMK Panca Budi must be actively involved in addressing environmental issues. Based on this background, a community service program on "Utilization of Composite-Based Liquid Smoke Botanical Pesticides for Effective and Environmentally Friendly Plant Pest Control" was implemented at SMK Panca Budi Medan.

LITERATURE REVIEW

The implementation of Integrated Pest Management (IPM) practices in communities often encounters challenges, including a persistent reliance on chemical pesticides. A lack of confidence in alternative pest control methods leads to the irresponsible use of these chemicals (Udayanga, S, et al., 2023). Although they play a crucial role in boosting crop yields, the excessive use of chemical pesticides causes negative impacts on the environment, human health, and biodiversity. Developing natural pesticides based on liquid smoke can be a solution to mitigate these effects (Wahjono, T.E. et al, 2024).

Highest *Curvularia* sp. inhibition was shown by liquid smoke type B and liquid smoke type C showed the highest inhibition of *G. boninense*. Main components contained in liquid smoke was phenol consisting of 24.45%–, 85.28%. Phenol was one of the main components thought to inhibit *Curvularia* sp. and *G. boninense* (Setiawan. W., et, al, 2024). These findings reinforce the potential of liquid smoke as a botanical pesticide, enhancing public knowledge on using organic waste for environmental preservation (Bria., D. et, al.2025).

Another advantage of liquid smoke is its ability to reduce dependence on synthetic pesticides, herbicides, and repellents that are toxic to the environment (Wibowo, S, et al., 2023). A study on *P. xylostella* pests proved that coconut shell liquid smoke significantly affected larval mortality, reduced feeding activity, and inhibited the formation of pupae and imago (Zanjabila A. and Silvi Ikawati, 2025). Liquid smoke from solid waste oil palm turned out to have excellent potential as a natural insecticide for the control of plant pests brown planthopper (*Nilaparvata lugens* Stall), with the ability to turn off up to 91.67%. To be more convincing material in the form of liquid smoke is necessary to study the potential for other plant pests and about the chemical properties associated with the active ingredient contained.

(Soedijo, S, M, 2015). Based on the presentation of the results of community service, it can be concluded that the activity of applying smoke liquid as a bio-insecticide to soybean plants in West Aceh went smoothly (Sari.P, M, et, al, 2023) The application of liquid smoke of tobacco stem waste with spray method and the feeding method was able to cause the mortality of *S. litura* up to 95%.(Prabowo, et, al H, 2016) The program also benefits the community through knowledge sharing and applying liquid smoke as a natural pesticide, promoting local economic growth and sustainable practices (Ismil N, et al, 2024) The development of composite-based liquid smoke pesticides offers a sustainable solution to various agricultural challenges. By utilizing abundantly available local raw materials such as wood waste and indigenous plants, production costs can be reduced, making it more economical than commercial chemical pesticides. This product is designed to specifically target plant pests while preserving non-target organisms like pollinators and natural predators, thereby maintaining ecosystem balance and farmland biodiversity.

The program is also complemented by comprehensive training for farmers on production and application techniques. This not only equips them with skills for sustainable agriculture but also provides access to safer pest control solutions. Its application in organic farming systems can improve crop quality by eliminating harmful chemical residues, opening opportunities to access the growing organic market. This innovative technology promises to enhance agricultural productivity with minimal environmental impact, paving the way for healthier and more sustainable farming practices through its multifaceted benefits.

Purpose of the Activity

This Community Service (PKM) activity aims to socialize the use of botanical pesticides made from composite materials of leaves and wood. The socialization explains the development method for

composite-based liquid smoke pesticides, which involves several stages: collecting composite raw materials (bark, leaves, twigs), processing the raw materials into a finer form, creating the pesticide by mixing the composite raw materials with a solvent, and testing the effectiveness of the final product against plant pests.

MATERIALS & METHODS

The community service initiative at SMK Pancabudi commenced with the registration of participating students, followed by an educational lecture delivered by the service team. A collaborative discussion was then conducted between partners and participants to enhance understanding of utilizing plant extract composites for effective and environmentally friendly liquid smoke botanical pesticides in plant pest control. Subsequently, all necessary equipment and materials were gathered for producing this composite-based pesticide. The program proceeded with a hands-on practical session where participants actively engaged in formulating the composite liquid smoke botanical pesticide, followed by its practical application.

The development of the composite-based liquid smoke pesticide was systematically carried out through multiple phases: collection of composite raw materials including bark, leaves, and twigs; processing these materials into finer forms; creating the pesticide by mixing the composite materials with solvent; and finally testing the effectiveness of the resulting composite-based liquid smoke pesticide against plant pests.

The implementation procedure for this community service program involved the participation of twenty SMK Pancabudi students. The team conducted socialization through lectures and facilitated discussions to enhance students' knowledge about developing composite-based liquid smoke pesticides for agricultural purposes. All required tools and materials for creating the pesticide were collected and prepared. The resulting liquid smoke pesticide products

were distributed to participating students under the coordination of group leaders. Monitoring and maintenance of plants treated with the liquid smoke pesticide were jointly supervised by both the participating students and members of the community service team from Universitas Panca Budi Medan.

Phase 1: Research and Formulation

This initial stage focuses on sourcing and formulation. It involves identifying and selecting suitable organic raw materials, including various types of wood waste and other biomass, for liquid smoke production. Subsequently, the core activity is the development of composite-based pesticide formulas by integrating the liquid smoke with supplementary natural active compounds and mineral additives. These prototype formulations then undergo rigorous laboratory testing to determine their efficacy against specific plant pests.

Phase 2: Production and Training

The second phase centers on translating the research into a tangible product and building local capacity. Participants receive practical training on producing liquid smoke using an accessible pyrolysis method. Furthermore, they are instructed in the composite formulation process, which involves incorporating natural ingredients like neem extract or tobacco, along with binding agents such as clay. The outcome of this phase is the small-scale production of a batch of pesticides designated for subsequent field testing.

Phase 3: Implementation and Education

This phase is dedicated to dissemination and hands-on application. Knowledge and skills are transferred to vocational school students through comprehensive training sessions on the preparation and use of the composite-based liquid smoke pesticides. The learning is reinforced with practical, in-field demonstrations of correct pesticide application, accompanied by ongoing monitoring to assess initial results and address any challenges.

Phase 4: Assessment and Impact Analysis

The final phase involves a systematic evaluation of the project's outcomes. This includes continuous monitoring of the pesticide's performance and long-term effectiveness within real-world farming conditions. A thorough evaluation is also conducted to measure the impact of this intervention on key agricultural indicators, specifically crop health and overall yield, thereby determining the practical benefits and sustainability of the adopted method.

RESULT

This community service initiative was successfully conducted on February 12, 2025, at SMK Pancabudi Medan, engaging 35 participants comprising students from the agricultural program and their supervising teachers. The program was a collaborative effort involving the Community Service Team from Universitas Pembangunan Panca Budi, a partner team from Malaysia (UNIMAP), and the school's administration. The event commenced with a series of lectures and interactive discussions. The service team delivered presentations covering several key topics: the fundamental concepts and significant potential of composite-based liquid smoke botanical pesticides, the technical procedure for producing liquid smoke, the utilization of supplementary natural ingredients like neem and tobacco leaf extracts as active agents, and the comparative benefits of these eco-friendly pesticides over conventional chemical alternatives. These sessions fostered a dynamic dialogue, with students demonstrating considerable interest

in exploring these safer and more cost-effective pest control methods.

Following the theoretical session, participants actively engaged in the collection of the necessary tools and raw materials. They gathered wood powder, twigs, dry leaves, fermentation bottles, local plant extracts (neem and tobacco), and clay to be used as a composite binder. This was followed by a hands-on practical session where participants, divided into small groups, performed the simple pyrolysis process to generate liquid smoke. Under close supervision, they then formulated the pesticide by mixing the liquid smoke with the plant extracts and binder, with the final products being packaged in labeled plastic bottles. The entire practice was thoroughly documented through photographs and video recordings.

A demonstration was subsequently held to apply the newly created pesticide on chili plants cultivated by the students in the school's practice field. Initial observations were conducted post-application to monitor its effects, focusing on the intensity of pest infestation, changes in leaf color, and the emergence of new shoots. Promising preliminary results indicated a visible reduction in pest populations, such as aphids, within just three days of application.

To conclude the activity, an evaluation and reflection session was held with the students. This forum provided them with an opportunity to share their impressions, recount their hands-on experiences, and propose innovative ideas for the future development and refinement of the botanical pesticide products.



Figure 1. The service team explains the procedure for creating botanical-based liquid pesticides during a discussion with participants.

DISCUSSION

The implementation of composite-based liquid smoke pesticides demonstrated significant potential as a viable alternative for managing plant pests. The program successfully utilized locally sourced materials, including sawdust, neem leaf extracts, and clay. Participant engagement was notably high, which fostered a deeper understanding and greater appreciation for sustainable agricultural methods among the students.

Some challenges were encountered, primarily related to the lengthy pyrolysis procedure and the requirement for more advanced distillation apparatus. However, these were outweighed by the recognized advantages, particularly the method's minimal environmental footprint and the provision of a safer approach to pest control, which were highly valued by all involved.

CONCLUSION

The community service initiative conducted at SMK Pancabudi Medan successfully established the viability and advantages of utilizing composite-based liquid smoke pesticides. A combination of instructional seminars, interactive dialogues, and practical workshops effectively equipped students with both the theoretical understanding and technical proficiency required to manufacture and utilize these natural pest control solutions. This program significantly enhanced ecological consciousness among participants while presenting a tangible method to diminish reliance on synthetic chemical pesticides.

Declaration by Authors

Acknowledgements: The authors express their profound gratitude to the Rector of Universitas Pembangunan Panca Budi, Universiti Malaysia Perlis (UniMAP), and the principal alongside the teaching staff of SMK Panca Budi Vocational School. Their invaluable provision of resources and unwavering support were instrumental to the successful execution of this community service endeavor.

Source of Funding: None

Conflict of Interest: No conflicts of interest declared.

REFERENCES

1. Bria, D., Hoar, O., Nino, J., Klau, A. M., Sibagariang, L. V., & Tuas, M. A. (2025). Production of liquid smoke as a botanical pesticide in the Agricultural and Food Security Office Garden, Belu Regency. *Jurnal Agriej: Agricultural Animal Science Innovation and Empowerment Journal*.
2. Prabowo, H, Edhi Martono & Witjaksono, 2016. Activity of Liquid Smoke of Tobacco Stem Waste as an Insecticide On Spodoptre litura Fabricus Larvae. *Jurnal Perlindungan Tanaman Indonesia*. Vol.20. No1.2016.22-27
3. Ismil, N, S Mahdiantil, Andriansyah1, F Wardana1, A Azhar1, I F Nugraheni1, S Wahyuni1, 2024, Indonesia-production of liquid smoke using auto thermal slow pyrolysis method and its application for plant pesticide. INCRID-2024 IOP Conf. Series: Earth and Environmental Science 1414 (2024) 012041 IOP Publishing doi:10.1088/1755-1315/1414/1/012041
4. Sari, P. M., Lisa, Oviana, L., Chairudin, Andriani, D., Weihan, & Siregar, M. P. A. (2023). Application of coconut shell liquid smoke as a bio-insecticide on soybean plants in West Aceh. *Jurnal Abdi Masyarakat Indonesia (JAMSI)*, 3(5), 1293–1296. <https://doi.org/10.54082/jamsi.858>
5. Setiawan, W., Majid, M., Putri, S. D. P., Tambunan, V. B., & Wibowo, C. S. (2024). In vitro liquid smoke potential as biopesticide on major oil palm diseases. *Jurnal Perlindungan Tanaman Indonesia*, 28(2), 127–133.
6. <https://doi.org/10.22146/jpti.95130>
7. Soedijo, S, M. Indar Pramudi, Salamiah and St Aisah., 2015. Introduction Study of Potential of Natural Insecticide Liquid Smoke from Solid Waste Oil Palm to Brown Plant Hopper (*Nilaparvata lugens* Stall) in South Kalimantan. *Asian Journal of Applied Sciences* (ISSN: 2321 – 0893) Volume 03 – Issue 01
8. Udayanga, S., Bellanthudawa, B. K. A., & De Zoysa, H. L. S. (2024). Sustainable agriculture and responsible use of pesticides: Commercial crop cultivators' knowledge, attitudes, and practice

- perspectives regarding pesticide use. *Frontiers in Sustainable Food Systems*, 8. <https://doi.org/10.3389/fsufs.2024.1490110>
9. Wahjono, T. E., Suhatman, A., Wihermanto, W., & Hadiyanto, H. (2024). Neem (*Azadirachta indica* A. Juss.; Meliaceae) as the source for plant-based pesticides as an effective and sustainable biocontrol alternative. *Journal of Bioresources and Environmental Sciences*, 3(3), 128–141. <https://doi.org/10.61435/jbes.2024.19928>
 10. Wibowo, S., Syafii, W., Pari, G., & Herliyana, E. N. (2023). Utilization of lignocellulosic waste as a source of liquid smoke: A literature review. *Journal of Environmental Health*, 15(3), 196–216. <https://doi.org/10.20473/jkl.v15i3.2023.196-216>
 11. Zanjabila Anida and Dr. Silvi Ikawati, S.P, M.P, M.Sc. (2024) Efektivitas Insektisida Asap Cair Tempurung Kelapa Grade C dan Insektisida Bahan Aktif Broflanilide Terhadap Hama Ulat Kubis *Plutella xylostella* L. (Lepidoptera: Plutellidae) Pada Tanaman Kubis. Sarjana thesis, Universitas Brawijaya.

How to cite this article: Desi Sri Pasca Sari Sembiring, Andi Setiawan, Najla lubis, Rozyanti, Dwi Hayati. Eco-Friendly pest control: utilizing plant extract composites in liquid smoke pesticides at SMK Pancabudi Medan. *International Journal of Research and Review*. 2025; 12(11): 44-49. DOI: <https://doi.org/10.52403/ijrr.20251106>
