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TRAINING ON MAKING COMPOSITE LIQUID SMOKE-BASED PLANT PESTICIDES FOR VOCATIONAL HIGH SCHOOL STUDENTS

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ABSTRAK

Abstrak: Kegiatan Pengabdian kepada Masyarakat (PKM) ini mensosialisasikan inovasi pestisida nabati berupa asap cair berbasis komposit, yang dibuat dari bahan alam seperti kulit kayu, daun, dan ranting melalui proses pirolisis, untuk menjawab kelemahan pestisida nabati konvensional. Melibatkan 20 siswa SMK Panca Budi Medan, metode pelaksanaan bersifat praktis dan partisipatif dengan menggabungkan ceramah, demonstrasi, dan praktik langsung (*hands-on practice*) dalam mengolah bahan dan memproduksi pestisida. Kegiatan ini secara bersamaan mengasah hardskill teknis peserta dan meningkatkan softskill berupa pemahaman lingkungan serta prinsip pertanian berkelanjutan. Evaluasi melalui kuesioner *pre-test* dan *post-test* menunjukkan keberhasilan program, dengan terjadi peningkatan keterampilan dan pengetahuan peserta sebesar 45%. Hasil ini membuktikan adanya peningkatan pemahaman yang signifikan di kalangan masyarakat sasaran mengenai pemanfaatan pestisida asap cair komposit sebagai solusi pengendalian hama yang lebih efektif dan ramah lingkungan.

Kata Kunci: Komposit; Asap Cair; Pestisida Botani; Ramah Lingkungan

Abstract: *This Community Service (PKM) activity socializes the innovation of a botanical pesticide in the form of a composite-based liquid smoke, made from natural materials such as bark, leaves, and twigs through a pyrolysis process, to address the weaknesses of conventional botanical pesticides. Involving 20 students of SMK Panca Budi Medan, the implementation method is practical and participatory by combining lectures, demonstrations, and direct practice (hands-on practice) in processing materials and producing pesticides. This activity simultaneously hones the technical hard skills of participants and improves soft skills in the form of environmental understanding and sustainable agricultural principles. Evaluation through pre-test and post-test questionnaires showed the success of the program, with an increase in participants' skills and knowledge of 45%. These results prove a significant increase in understanding among the target community regarding the use of composite liquid smoke pesticides as a more effective and environmentally friendly pest control solution.*

Keywords: *Composite; Liquid smoke; Botanical pesticide; Environmentally Friendly.*

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A. INTRODUCTION

Botanical pesticides have strengths such as effectiveness and environmental friendliness, but there are also weaknesses such as unstable effectiveness and higher production costs compared to synthetic pesticides. Liquid smoke is a by-product of the pyrolysis process of biomass materials such as wood, sawdust, and other organic waste. Liquid smoke contains phenolic compounds, organic acids, and other volatile compounds that have potential as active ingredients in controlling pests and plant pathogens. A recent approach is the development of composite-based liquid smoke pesticides, which combine liquid smoke with other natural materials, such as plant materials or minerals, to improve their efficiency and effectiveness.

SMK Panca Budi from its inception until now which remains consistent in building the quality of education according to the dynamics of the times, it increasingly shows that SMK Panca Budi can work together with the entire educational community to move forward together in building the world of education in an effort to produce future generations with Islamic character and global competence. For that, students from Panca Budi Vocational School, who are in fact teenagers, must be involved in overcoming environmental problems. Based on the description above, devotion is required, namely Utilization of Composite-Based Liquid Smoke Botanical Pesticides for Effective and Environmentally Friendly Plant Pest Control at SMK Pancabudi Medan. Pesticides play an important role in controlling pests and diseases in crops, thereby increasing agricultural yields. Smoke liquid is made through a pyrolysis process that results in the decomposition of lignin, cellulose, and hemicellulose. Liquid smoke can be used as a botanical pesticide to control pests and diseases. The results of this activity have increased farmers' awareness of the importance of organic waste for environmental sustainability. Bria et al. (2025) liquid smoke can reduce the use of pesticides, herbicides, and insect repellents made from synthetic chemicals that can poison the environment (Wibowo et al., 2023). Coconut shell liquid smoke can be used as an alternative to P. xylostella pest control. The treatment of coconut shell liquid smoke given has an effect on larval mortality, Utilizing waste from these plants to produce liquid smoke offers an environmentally friendly alternative for termite control (Jannatan & Rahayu, 2025). Liquid Smoke from coconut shells has the potensial to be botanical insecticide to control PBKo pests (Indriati et al., 2018).

liquid smoke is an effective and sustainable alternative for pest control in mustard greens. The use of liquid smoke can support safer and more sustainable agricultural practices (Agustina et al., 2024). Liquid smoke of tobacco stem waste has activity as an insecticide to S, litura (Spodoptera & Larva, 2016). The toxicity of LC95 grade 3 husk charcoal liquid smoke towards S, litura 3rd instar was 3%, total percent acid area was 68.19%, Phenol was 19.36%. LC95 Grade 2 was 4%, total percent acid area 14.19 %, Phenol 50.90% (Science, 2024).liquid smoke derived from the pyrolysis of

organic materials such as rice husks and sawdust has been proven effective as a botanical pesticide that can significantly suppress pest attacks (Ramli & Aimanah, 2025), pathogenic fungus Sclerotium rolfsii 100%. The treatment of liquid smoke in the in vivo test showed an effect on inhibition of the growth diameter of fungal colonies, suppressing the disease occurance, and suppressing the lesion diameter (Rahmat et al., 2020).

The use of liquid smoke from palm fronds and fibers can be used as an insecticide as one of the pest control techniques and a solution for utilizing palm oil waste (Protection et al., 2023). The treatment was carried out in 4 levels and carried out 3 times. The results of this research show that there are significant differences in each dose applied, resulting in a decrease in population numbers so that the intensity of Plutella xylostella pest attacks decreases with each observation result along with increasing age of the cauliflower plants (Kustiwi, 2023).

Medang wood liquid smoke effectively inhibited the growth of S. commune fungus about 98.57% at a concentration of 2.5% with liquid smoke pyrolysis temperature used is 430°C (Permana ET, 2021). These properties among others have made Liquid smoke an all-round ingredient to be used for food preservation and reduction of postharvest losses (Krah & Harahap, 2019). The results showed that liquid smoke coconut shell with a concentration of 7% have a presentation armyworm mortality of 88.89% (Isa et al., 2019). Liquid smoke applied at intervals of every 2 days can suppress the population and attacks of aphid pests on chili plants (Kutu et al., 2021). The variation in antibacterial susceptibility may arise from the composition of chemical compounds present in liquid smoke, the raw materials employed in its production, the temperature of pyrolysis,and the specific testing methodology employed (Azizah et al., 2025). Pesticides with a formula of F1, F2 and F3 killed more than 90% of brown planthopper (Al, 2021). The results showed that thickening of latex using grade 3 liquid smoke from Mango leaves had a shorter curdling time and better thickening conditions compared to other grades and control (Hertianti, 2023). The study's findings shed light on Ubah Rukkok wood's potential as a source of raw liquid smoke that may be used for various industrial purposes (Desvita et al., 2025). Utilization of rice husk for production liquid smoke will not only benefit rice milling industries and farmers, but also the environtment (Risfaheri et al., 2018)

The development of composite-based liquid smoke pesticides presents sustainable solutions to several agricultural challenges. By combining natural materials and bioactive compounds derived from biomass, these environmentally friendly pesticides offer a viable alternative to conventional chemical pesticides, reducing dependence on harmful substances while minimizing health risks for both farmers and consumers. The utilization of locally available raw materials such as wood waste, sawdust, and indigenous plants makes production more cost-effective compared to commercial chemical pesticides. These composite-based pesticides are designed to

specifically target pests while preserving non-target organisms including pollinators and natural predators, thereby maintaining ecological balance and enhancing biodiversity in farmlands. The implementation program incorporates comprehensive training for farmers in production and effective application techniques, equipping them with valuable skills for sustainable agriculture alongside access to safer pest control solutions.

Furthermore, the application of these pesticides in organic farming systems improves crop quality by eliminating harmful chemical residues, enabling farmers to access growing organic markets at both local and international levels. This innovative technology holds significant promise for boosting agricultural productivity while reducing environmental impact, paving the way for healthier and more sustainable farming practices through its multifaceted benefits.

The purpose of this Community Service activity (PKM) is to convey the socialization botanical pesticides from composite materials of wood leaves. in socialization explain the methods development of composite-based liquid smoke pesticides is carried out through several stages like collection of composite raw materials, such as bark, leaves, and twigs, processing of composite raw materials into a finer form, preparation of composite-based liquid smoke pesticide by mixing composite raw materials with solvent, testing the effectiveness of composite-based liquid smoke pesticides against plant pests. The primary objective of this Community Service (PKM) activity is to enhance the capacity and awareness of students at SMK Panca Budi Medan in applying environmentally friendly agricultural technology, specifically by introducing and providing hands-on training in the production of composite-based liquid smoke pesticide as an effective and sustainable alternative for pest control.

B. RESEACH METODOLOGY

Registration of students who participated in Community Service at SMK Pancabudi, Lecture by the Community Service team, Discussion with Partners and participants to add information about the Utilization of Plant Extract Composites for Liquid Smoke Botanical Pesticides for Effective and Environmentally Friendly Plant Pest Control, Collection of tools and materials for Making Plant Extract Composites for Liquid Smoke Botanical Pesticides for Effective and Environmentally Friendly Plant Pest Control. Practice of Making Liquid Smoke Botanical Pesticide Composites. Utilization of Plant Extract Composites for Liquid Smoke Botanical Pesticides.

The development of composite-based liquid smoke pesticides is carried out through several stages, namely: Collection of composite raw materials, such as bark, leaves, and twigs., Processing composite raw materials into a finer form. Making composite-based liquid smoke pesticides by mixing composite

raw materials with solvents, Testing the effectiveness of composite-based liquid smoke pesticides against plant pests.

The procedures for community service with the title Effective and Environmentally Friendly Plant Pest Control at Pancabudi Vocational School are as follows: 1. One Partner with 20 participants attending, consisting of 20 students from Pancabudi Vocational School, 2. Socialization with lectures by the community service team and discussions with participants to add information to students about the Development of Composite-Based Liquid Smoke Pesticides for Farmers, 3. Collection of equipment and materials in Making Composite-Based Liquid Smoke Pesticides for Farmers. 4. The results of the use of Liquid Smoke Pesticides are submitted to SMK students who participated in the service activities and coordinated by the group leader. 5. Supervision in plant maintenance using Liquid Smoke pesticides is carried out by students who participated in the service along with members of the community service team from Panca Budi University Medan.

Phase 1: Research and Development

Identify raw materials for liquid smoke manufacturing (such as wood waste, sawdust, and other organic materials). Develop composite-based liquid smoke pesticide formulations with additional natural active ingredients and minerals. Laboratory trials to test effectiveness against plant pests.

Phase 2: Pesticide Manufacturing

Training on liquid smoke manufacturing through simple pyrolysis process. Composite formulation by adding natural active ingredients (such as neem leaf extract, tobacco) and binders (such as clay). Production of a limited number of pesticides for field trials.

Phase 3: Extension to Vocational School Students

The target of this activity is students of Panca Budi Vocational School, with the aim of equipping them as future successors or practitioners in the agricultural sector who are literate in environmentally friendly technology.

Phase 4: Evaluation and Monitoring

The PKM implementation team conducted a comprehensive evaluation of the program's effectiveness using a mixed-method approach. Cognitive aspects were measured quantitatively by comparing pre-test and post-test scores using the same questionnaire, while skills were assessed qualitatively through structured observations during practical sessions. Success indicators focused on improving understanding of environmentally friendly concepts and mastery of manufacturing procedures, with evaluations conducted at two key points: at the beginning of the activity (pre-test) and immediately after the entire training series was completed (post-test and observation).

C. RESULTS AND DISCUSSION

The implementation of this community service activity was carried out on February 12, 2025, at SMK Pancabudi Medan, attended by 35 participants consisting of agricultural vocational students and mentoring teachers. This activity was a collaboration between the Community Service Team of Panca Budi Development University, the Malaysian Partner Team (UNIMAP), and the school administration. The event series included Lectures and Interactive Discussions. The activity began with the presentation of material by the service team, specifically regarding. Understanding and potential of composite-based liquid smoke vegetable pesticides. The process of making liquid smoke. The use of additional ingredients such as neem and tobacco leaf extracts as active agents. The advantages of environmentally friendly pesticides over chemical pesticides. The discussion was active between students and resource persons. Students showed interest in safer and more economical pest control alternatives.

1. Collection of Tools and Materials

Participants were directly involved in the process of collecting materials such as Wood powder, twigs, and dry leaves. Fermentation bottle Local plant extracts (neem and tobacco). Clay as composite binder Practice of Making Composite-Based Liquid Smoke Pesticide. Participants were divided into small groups to perform Simple pyrolysis process to produce liquid smoke. Formulation of liquid smoke mixture with plant extracts and binders. Product packaging in labeled plastic bottles. Practices were conducted under close supervision and documented through photos and videos.

2. Demonstration and Application of the Pesticide on Chili Plants

Pesticide application was carried out on chili plants grown by students in the school practice field. Initial observations were made on the effects of pesticides on Intensity of pest attack, Leaf color changes, Growth of new shoots, Preliminary results showed a reduction in the number of pests such as aphids within three days post-application.

3. Evaluation and Reflection Session with Students

After the field practice, an evaluation session was conducted. Students conveyed their impressions, experiences, and ideas for further development of vegetable pesticide products, as shown in Figure 1.

Figure 1. Discussion With Participan and explain how to make liquid pestiside from botanical ingredient

The significant increase in knowledge (45%) indicates that the training method, which combines lectures, demonstrations, and hands-on practice, is effective in transferring knowledge. The 90% of participants who were proficient in the practice reinforces this finding, demonstrating that technical skills (hard skills) can be achieved in a short intervention. These results align with literature that suggests hands-on learning improves retention and competency. The main challenge faced was the variation in the quality of natural raw materials, which can affect the consistency of the final product. Consequently, this activity not only successfully increased individual capacity but also demonstrated a concrete solution for sustainable agriculture, highlighting the need for standardized raw material processing guidelines for future program replication.

4. Evaluation of Community Service Activities

To strengthen the evaluation results, a key recommendation for follow-up activities is to conduct controlled field trials to measure the actual impact of the pesticides developed. At this stage, product efficacy can be quantified using objective parameters such as the percentage reduction in target pest populations or changes in plant growth index before and after application. This will provide more valid outcome data directly related to the goal of sustainable pest control.

Table 1. Utilization of Liquid Smoke Plant Extract Composite for Effective and Environmentally Friendly Plant Pest Control at Pancabudi Vocational School, Medan

Evaluation Aspects	Conditions Before the Activity	Conditions After Activity	Changes/Achievements
Participant Knowledge	Lack of understanding of composite-based botanical pesticides and liquid smoke	Participants understand the concept, raw materials, and methods of making environmentally	Increased knowledge by 80% based on questionnaire results

Evaluation Aspects	Conditions Before the Activity	Conditions After Activity	Changes/Achievements
		friendly pesticides.	
Practical Skills	Not yet skilled in processing raw materials into pesticides	Able to make a simple liquid smoke pesticide prototype	75% of participants can practice independently
Availability of Materials	Raw materials (wood waste, leaves) have not been optimally utilized	Identification of local raw material sources and their utilization	Reducing organic waste in the school environment
Environmental Awareness	Dependence on synthetic chemical pesticides	There is a growing awareness to switch to natural pesticides	90% of participants agreed to reduce the use of chemical pesticides
Economic Impact	High costs of chemical pesticides	Potential cost savings with local materials	Estimated savings of 40-60% for pesticide needs
Documentation	There are no records of making natural pesticides.	Guide modules and practical video tutorials are available.	Creation of sustainable educational materials
Adoption Rate	There is no implementation in schools yet	Trial plan in the school garden by a team of students	Formation of organic farming study group

ervasisipatif, serta diskusi kelompok.

D. CONCLUSION AND SUGGESTION

The implementation of a community service program at SMK Pancabudi Medan has proven the feasibility and benefits of a composite-based liquid smoke pesticide. Through lectures, discussions, and hands-on practice, the students, as partners, experienced significant improvements in their skills. Evaluation results showed a 75% increase in participant skills, as reflected in the majority's ability to produce and apply natural pesticides independently. This program effectively raises awareness of environmental sustainability and provides practical solutions to reduce dependence on chemical pesticides. For suggestion is the development and sustainability of the program, future community service activities are recommended to: (1) conduct advanced training that includes dosage formulation, field effectiveness testing, and marketing of simple natural products; (2) provide regular mentoring to ensure sustainable implementation in the school environment and participant households; (3) expand the target reach by involving local farmer groups so that the benefits of the technology can spread more widely; and (4) establish strategic partnerships with the agricultural service or the private sector for technical support and funding.

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