

TOBACCO EXTRACT-BASED BIOPESTICIDE FROM CIGARETTE BUTT WASTE FOR CORN PLANTS (*Zea mays L.*)

Nurhidayah, Taufik Abdullah*, Hijriati Sholehah, and Fairuz Safhira

Environmental Engineering Study Program, Mataram College of Environmental Engineering, Mataram, Indonesia

*Email: abdullah.tfk2@gmail.com

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Abstract: Cigarette butt waste can be used for biopesticides for environmentally friendly agricultural activities. Biopesticides cigarette can be produced by conducting a maceration extraction test using polar, non-polar, and semi-polar compounds and conducting a Mass Spectrometer Chromatography (GC-MS) test. This study aims to determine the effectiveness of bio-pesticide based on tobacco extract from cigarette butt waste for maize (*Zea mays L.*). The highest yield value was the ethanol sample of 1.208%, compared to the N-hexane sample of 0.25% and the DCM sample of 0.6%. For the comparison of solvents used were 500 ml of ethanol, 250 ml of N-hexane, and 250 ml for DCM as well. After conducting the GC-MS test, the compounds obtained are alkaloid compounds, phenolic compounds, sesquiterpenoid compounds, and terpenoid compounds, each of which has benefits as a pest control or deterrent to plants. For the effectiveness test results on Corn (*Zea mays L.*), there was no intensity of pest attack on the ethanol sample, N-hexane sample, and DCM sample. In contrast, there was a pest attack intensity of 0.3% for the control sample. Therefore, the Biopesticides studied are similar to synthetic pesticides because they can eradicate pests and make growth effective faster.

Keywords: *Cigarette Butt Waste, Bio-Pesticide, Corn Plant*

INTRODUCTION

The Ministry of Health 2022 released the results of a global survey of tobacco use in adults (Global Adult Tobacco Survey - GATS), which was carried out in 2011 and repeated in 2021. , which is 60.3 million in 2011 to 69.1 million smokers in 2021. The results of the GATS survey also show an increase in the prevalence of electronic smokers up to 10 times, from 0.3% (2011) to 3% (2021). Meanwhile, the prevalence of passive smoking has also increased to 120 million people [1].

Cigarette butt waste is industrial waste that takes 1-12 years to decompose [2]. The existence of cigarette butts waste has not been used properly, and until now, it has only been disposed of as garbage. However, this cigarette butt waste can be used for biopesticides for environmentally friendly agricultural activities. A spectrophotometer is an instrument consisting of a spectrometer and a photometer. A spectrophotometer produces light from a spectrum with a certain wavelength, and a photometer measures the intensity of light transmitted or absorbed [3]. A spectrophotometer is used to measure a sample's transmittance or absorbance as a wavelength function. Each medium will absorb light at a certain wavelength depending on the compound or color formed [4]. The absorbance value of the absorbed light is proportional to the concentration of the solution in the cuvette [5]. Pesticide is a material used to kill or control pests in the process of photosynthesis in agriculture [6]. Pesticides are generally widely used from synthetic chemicals with active ingredient groups such as Amamectidine benzoate. This

chemical belongs to the Amidine group, which is recommended as an insecticide. If used for farmers in the long term, it can interfere with human health and cause disease for farmers who use chemical-based pesticides because the presence of chemical substances is one of the impacts, such as decreased body resistance [7], and causes cancer and disease.

The increasing consumption of Corn per year is due to the increasing population of Indonesia. Corn is a basic ingredient/processed material for cooking oil, cornstarch, ethanol, organic acids, and small food and animal feed industries. Corn farmers in West Nusa Tenggara, Indonesia, use many pesticides containing chemical substances. The use of biopesticides in West Nusa Tenggara is still lacking because they don't know too much about the wastes that can be used as biopesticides, one of which is cigarette butt waste. Based on their origin, biopesticides can be divided into two: vegetable pesticides and biological pesticides. Vegetable pesticides are the result of extraction from plants from leaves, fruit, seeds, or roots whose secondary compounds or metabolites have toxic properties against certain pests and diseases. Vegetable pesticides are used to control insecticidal pests and bactericidal diseases [8]. Vegetable pesticides are natural products from plants such as leaves, flowers, fruit, seeds, bark, and stems with a group of secondary metabolites or bioactive compounds [9].

Based on the description above, the authors chose this research as an alternative to environmentally friendly pesticides. Chemical compounds present in bio-pesticides were tested using GC-MS. This study aimed to determine the

effectiveness of biopesticides based on tobacco extracts from cigarette butt waste for maize (*Zea Mays L.*).

RESEARCH METHODS

This research will be carried out using an exploratory, experimental test. This study was conducted to determine the effectiveness of a tobacco extract-based biopesticide from cigarette butt waste for Corn (*Zea mays L.*). There are two variables in this study: the independent variable, namely tobacco extract from cigarette butt waste, and the dependent variable found in corn plants. Tools and materials used in this study were tobacco samples from cigarette butt waste, distilled water, ethanol solution, DCM solution, and N-hexane solution, as well as the tools used were containers, filter paper stirring rods, separating funnels, labels, and maintenance. Data sources used primary and secondary data for data collection in the form of observation and documentation. For data analysts, the formula used in this study is.

$$\% \text{ yield} = \frac{W \text{ extract}}{W \text{ sample}} \times 100\%$$

$$\text{effectivity (I)} = \frac{n}{N} \times 100\%$$

RESULTS AND DISCUSSION

Tobacco Extract-Based Biopesticides from Cigarette Butt Waste were given a comparison treatment of 1 L of water and 30ml of DCM biopesticides. It was sprayed on corn plants after three weeks of conditions, and spraying of corn crops was carried out evenly on the surface of the leaves. After monitoring and placing in a place where there are insects for DCM samples, get

insects that perch on the leaves of corn plants for DCM samples. Samples of N-hexane using a biopesticide were treated with a comparison of 1L of water and 30ml of N-hexane biopesticide, which was carried out by spraying corn plants after three weeks, spraying corn crops evenly on the surface of the leaves. After monitoring and placing in a place where there are insects for N-hexane samples, get insects that perch on the leaves of corn plants for N-hexane samples. Ethanol samples using biopesticides were treated with a comparison of 1L water and 30ml Ethanol biopesticides, which were sprayed on corn plants after three weeks, spraying corn crops evenly on the surface of the leaves. After monitoring and placing in a place where there are insects for ethanol samples, get insects that perch on the leaves of corn plants for ethanol. The control sample compared the three samples that did not use any mixture, using only water. A 1 L of water was compared by spraying corn plants after three weeks, spraying corn plants evenly on the surface of the leaves. The control sample compared the three samples that did not use any mixture, using only water. A comparison of 1L of water was carried out by spraying corn plants after three weeks. After monitoring and placing in a place where there were insects for the dick sample, there were leaves that were insect bites for the leaves of the control sample corn plants. The spraying of the corn kernels was carried out evenly on the surface of the leaves.

The results of research on Tobacco Extract-Based Biopesticides from Cigarette Butt Waste for Corn Plants (*Zea mays L.*), namely the results of the tobacco extract chromatogram test for solvents, polar, non-polar solvents, and polar solvents, are as follows:

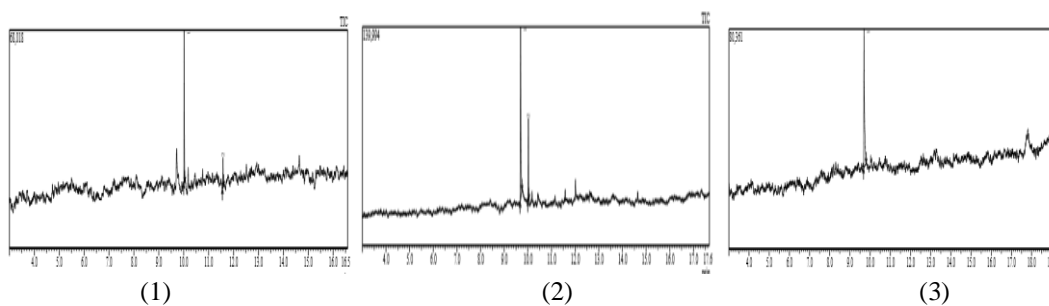


Figure 1. Results Sample chromatogram test results Etanol, (2) N-hexane, (3) DCM

From the tobacco extract's chromatogram results, GC-MS testing was carried out using 3 solvents: polar solvents, non-polar solvents, and semi-polar solvents. There are compounds present in each solvent, and the use of these compounds can be as biopesticides as pest control. The polar solvent is ethanol solution, while non-polar solvents use n-hexane solvent and semi-polar solvents use dichloromethane (DCM) solution. The

main solvent used is ethanol as a polar solvent, which can bind with ethanol or polar solutions when macerating tobacco samples containing polar compounds.

The second solvent used is n-hexane as a binder for non-polar compounds present in the tobacco sample so that there are non-polar compounds when the GC-MS test is carried out. Meanwhile, the third solvent used is

dichloromethane (DCM), a semi-polar solvent that can bind the compounds in the tobacco sample.

In Figures 1 to (1) ethanol, there is a chemical composition of the ethanol extract of cigarette butts waste, which has a Peak 1, R Time 9.693, with an Area of % 100.00. The molecular formula $C_{10}H_{14}N_2$, the compound contained is Pridine, 3-(1-methyl-2-pyrrolidinyl) and belongs to the Alkaloid group. In Figure 1, sample (2) of n-hexane, there is a chemical composition of n-hexane extract from cigarette butts waste, which has a peak value of 2, namely peak 1, has an R time of 10,021 with an area of % 80.12, and the molecular formula $C_{15}H_{24}$ with a C-compound. Trans-Caryophyllene and sesquiterpenoid group, while for peak 2 with an R time of 11,579 with an area of 19.88 it has the molecular formula $C_{20}H_{38}$ with the compound name Neophytadiene and the Terpenoid group. Figure 1 shows that sample (3) dichloromethane (DCM) has a chemical composition of tobacco extract from cigarette butt waste with 2 peaks. Peak 1 has an R time of 9,690 with an area of % 78.30 and the molecular formula $C_{10}H_{12}O_2$ with a phenol compound, 2-methoxy-3-(2-propenyl) and belongs to the Phenol group. Peak 2 has an R time of 10.020 and are% 21.70, and the molecular formula $C_{15}H_{24}$ has a C-trans-caryophyllene compound with a sesquiterpenoid group.

The group of alkaloids is a group of basic secondary metabolites with one or more nitrogen atoms in a cyclic combination system. Most natural alkaloids generally have certain physiological activities, some are toxic, and some are used for medicine. In plants, alkaloids can be found in the seeds, leaves, twigs, and bark. Alkaloid content in plant tissue is less than 1%, but the bark of plants sometimes contains 10-15% alkaloids, such as chemical bark which contains about 10% quinine [10]. The function of the alkaloid compounds in plants is to function as a poison that can protect against insects and herbivores, growth regulating factors, and storage compounds that can supply nitrogen and other elements needed by plants [11].

The phenol group of compounds is a compound that has a hydroxyl group attached to an aromatic ring. Phenol compounds have a low melting point and a characteristic slightly pungent odor. It is also easily soluble in organic solvents (aromatic hydrocarbons, alcohols, and ketones) and less soluble in aliphatic hydrocarbons [12]. Plants produce many secondary products containing phenol groups, phenols distributed in plants function as antioxidants and are usually used to prevent free radical reactions.

The terpenoid group of compounds is a hydrocarbon compound mostly produced by plants, especially in the sap and cell vacuoles. Hydrocarbons, commonly known as terpenes, and oxygen-containing compounds called terpenoids

are the most important constituents of essential oils. In plants, terpene and terpenoid group compounds are also produced by several animals, especially insects and some marine animals. The function of this terpenoid compound is to function as a plant protector from pests and diseases for plants and the environment [13].

Biopesticides are pesticides that come from nature and are composed of animals, plants, bacteria, and minerals. Biopesticides based on tobacco extract from cigarette butt waste, which is used as cigarette butt waste, namely tobacco leaves from the cigarette. According to the Ministry of Health, in 2021, the number of cigarette butts in Indonesia will increase greatly, with 69.1 million smokers in 2021. The waste of cigarette butts will take 1-12 years to decompose if the soil is processed [14].

Cigarette butt waste used is 1 kg collected directly from cigarette users; cigarette waste collected is from the industry. After collecting the waste cigarette butts, they are sorted, cleaned, and dried by aerating at room temperature. Drying is intended to reduce water content and microbial activity so that simplicia is not easily damaged by fungi or other microorganisms [15]. The dried samples were blended until smooth, which aims to facilitate the extraction process of the active components of tobacco to obtain a sample of 250 grams of fine brownish powder.

The method used in this research is the extraction method by maceration. The maceration technique is used because the process is easy and simple, namely by immersing the sample in a solvent. During the maceration process, the solvent will penetrate the cell wall and enter the cell cavity containing the active substance [16]. Tobacco samples weighing 250 grams were put into a container and then immersed in an appropriate solvent. This process is known as cold extraction by maceration. The solubility of a component depends on the degree of polarity. The law of "Like dissolved like" states that polar compounds can only dissolve in polar and semi-polar solvents. Conversely, non-polar compounds can only dissolve in non-polar and semi-polar solvents [17].

Cigarette butt waste samples that have become tobacco were extracted by cold solid-liquid extraction, namely the maceration method using ethanol for 5 days. The purpose of choosing ethanol as the initial solvent is that ethanol has a small molecular structure that can penetrate all plant tissues and attract active compounds. It is a universal solvent because apart from extracting polar components, it can also extract non-polar components [18].

Cigarette butt waste samples from the remaining ethanol extract that had been soaked with solid-liquid extract were then soaked using N-hexane and DCM solvents for 3 days. The purpose

of selecting N-hexane and DCM is N-hexane and DCM include polar and semi-polar solutions that can attract active compounds out of the plant.

The maceration results are then filtered, and a tea-colored filtrate is obtained. Furthermore, the filtrate is evaporated by vacuum evaporation (rotary evaporator) which aims to separate the extract from the liquid filter.

The principle of separation is the extract from the filter by heating accelerated by the rotation of the round bottom flask, where the liquid

solvent can evaporate 5-10 oC below the solvent's boiling point. It is due to a decrease in pressure. Therefore, the temperature used for the evaporation of the tobacco sample is 45oC because the sample is a methanol extract. With the help of a vacuum pump, the vapor of the filter solution will evaporate up to the condenser and experience condensation into molecules of the pure solvent liquid, which are accommodated in a round bottom flask reservoir [19].

Table 1. Results of Maceration of Tobacco Extract Cigarette Butt Waste

Solvent	Sample (g)	Extract (g/ml)	Yield (%)
Ethanol	250	302	1.208
N-hexane	250	150	0.6
DCM	250	120	0.25

Table 1 shows the results of the maceration of tobacco extract using three solvents: polar solvents, non-polar solvents, and polar solvents. Tobacco ethanol extract has a sample weight of 250 grams, the weight of the thick extract obtained is 302 g/ml, and the yield is 1.208%. As for the extra N-hexane, the weight of the tobacco sample used was 250 grams, getting a thick extract weight of 150 gr/ml and having a yield value of 0.6%. And for the DCM solvent, the weight of the tobacco sample used is 250 grams, with a thick extract weight of 120 gr/ml and a yield value of 0.25%.

The weight of the thick extract obtained from the three solvents has a large ratio, which for the ethanol solution has an extract weight of 302 g/ml, whereas when soaking the tobacco sample, 500ml of ethanol solution is used so that it has a yield value of 1.208%. As for the solvent N-hexane and solvent DCM for immersion of tobacco samples, as much as 250 grams were used solvent N-hexane and solvent DCM as much as 250 ml, then obtained a lower weight extract weight than ethanol solvent. For a solution of N-hexane and DCM included in the solution, which is volatile, the yield obtained is lower than the ethanol solution. The amount of solvent used will determine the number of compounds attracted [20].

Testing the effectiveness of biopesticides was conducted to determine the effect of the growth of corn plants that were attacked by pests. The effect of corn plant growth caused by many pest attacks will cause plants to be damaged and die, pest control on corn plants is usually used chemical pesticides, but here researchers use biopesticides from cigarette butt waste that can control pests on corn plants. The corn plants used in this study were 5 samples, consisting of sample A (control), sample B (chemical pesticides), sample C (biopesticide 1), sample D (biopesticide 2), and sample E (biopesticide 3).

Corn plants at 14 days are given plant fertilizer commonly used for corn farmers, namely NPK fertilizer, to provide nutrition to corn plants so that corn plants are stronger and bigger. Corn plants aged 21 days were given spraying on each sample of corn plants, whereas for the control sample, only water was given without any mixture. In contrast, for samples of chemical pesticides, biopesticides A, B, and biopesticides C was given a ratio of 1000 ml of water with 30 ml of chemical pesticides, biopesticide A, biopesticide B, and biopesticide C [21]. Samples of corn plants that have been sprayed are left in a place where there are pests for seven days and are monitored every day. If there are insects that land or eat leaves, the results are recorded immediately.

The results of the observation of biopesticides on corn plants showed that biopesticides from cigarette butt waste could inhibit the spread of pests such as insects, and grasshoppers, which caused most of the leaves on corn plants to be damaged or reduced. Insect pests attacked corn plants that were sprayed using biopesticides with an intensity of 0%, which is where observations on the leaves also show that the color of the leaves on corn plants looks greener, fresher, and wider.

Corn plants that use synthetic pesticides (Cobra). The use of a synthetic pesticide (Cobra) in this study is because the synthetic pesticide brand Cobra with the active substance is Alfametrin which corn farmers often use to eradicate pests. Corn plants that use synthetic pesticides (Cobra), on the first day of spraying the corn plants are still fresh until the second day, while for the third day, the corn plants are wilted, and for the fourth day, the corn plants are dead, they have brownish yellow leaves.

Corn plants not sprayed as control are attacked by insect pests, grasshoppers, and others, causing damaged leaves to grow. The intensity of

pest attack on maize as a control was 0.33%. Observations on the leaves show that the color of the leaves looks green to yellowish and there are yellow spots, and the leaf size looks smaller. As for the effect of biopesticides on leaf color: biopesticides can control pests that perch on the

leaves of corn plants so that these pests cannot eat, spit, or be contaminated by the pest attack so that the color of the leaves on the corn plant is more green than the control sample. The smaller the percentage value of pest attack intensity, the better the effectiveness on corn plants (Table 2).

Table 2. The intensity of pest attacks on corn plants

Sample	Number of Leaves observed	Number of leaves affected by pests	The intensity of pest attack (%)
Control	6	2	0.3
Chemical pesticides	4	0	0
Biopesticide (Ethanol)	7	0	0
Biopesticide (DCM)	7	0	0
Biopesticide (N-hexane)	6	0	0

Corn plants sprayed using chemical pesticides died, and they could not continue the research because the chemical pesticides on corn plants were declared unsuitable. The intensity of the attack was 0.3% from pests. Tobacco butt extract using the maceration extraction method with Biopesticides A, B, and C effectively inhibited the spread of pests on corn plants. These results follow researchers who stated that the chemical content in tobacco extracts from cigarette butt waste showed bioactivity in corn plants [22].

Bioactivity has a function as a repellent, an antifeedant, an insect growth regulator, and an oviposition deterrent. Biopesticides from cigarette butt tobacco extracts include antifeedants and oviposition deterrents. Biopesticides are similar to synthetic pesticides because they can eradicate pests and make growth effectiveness faster. The excess content of biopesticides obtained in polar compounds is that they can control pests on plants, especially corn plants, and can be toxic to pests that land on plants and can be used as drugs in the pharmaceutical world [23]. Meanwhile, non-polar compounds have advantages. Apart from being pest control agents, they can also be used as antiolcides [24].

CONCLUSION

The effectiveness of biopesticides of tobacco extract from cigarette butt waste can prevent the spread of insect pests, grasshoppers, and others with an attacking intensity of 0% and make plant leaves look greener and fresher. The controlled intensity of 0.3% can be seen on the leaves of corn plants' yellowish spots. So it can be concluded that the smaller the percentage of pest attack intensity on plants, the better the pesticide performance.

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