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# USE OF SENGGANI LEAVES AS AN ALTERNATIVE MATERIAL FOR PRINTER REFILL INK THAT IS LOW VOC (VOLATILE ORGANIC COMPOUND) ENVIRONMENTALLY FRIENDLY

**Trilia Ananta Pramita Sari[1*], Eka Angasa[2], Rika Agustin[3], Rewan Jayadi[4], Putri Ramanda[5], Nurhasanah[6]**

[1,2,3,4,5,6]Kimia dan Matematika Fakultas Matematika dan Ilmu Pengetahuan Alam Universitas Bengkulu

e-mail: ***jayadirewan6@gmail.com**,

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**Abstract**

*This study aims to determine the content of senggani leaves and use senggani leaves as a raw material for printer refill ink. This can increase the utilization of senggani leaves into products that are low in VOC levels, environmentally friendly, and provide added value to senggani leaves. The method used in this research is the experimental method and chromatography, the first test was carried out, the ink absorption rate test on HVS paper is done by using a medium such as paper by comparing the length of the absorption path Δx with a time interval t during the absorption process. The next test is the ink performance test using the volume of aqueous solvent and comparing the quality of the ink obtained. The ink consists of 3 components, namely pigment, solvent, and thickening agent the pigment used in this study is carbon obtained from the carbonization of senggani leaves, 98% alcohol is used as a carbon solvent as a thickener and adhesive in the form of gum arabic. The variation of carbon used is 1 gram, 2 grams, and 3 grams, while the volume of aquadest, the volume of alcohol, and gum arabic mass is made fixed that is sequentially 15 mL, 3 mL, and 3.5 grams. So there are variations in the gram mass of carbon that are solid black and less black. At any mass and solvent has a sufficiently high absorption rate. The test results of senggani leaf ink with the best composition resulted in solvent and mass variation values by the standard. Meanwhile, from the results of the print test, the resulting printer ink has provided good print and color results as well as commercial ink and does not cause odor and does not easily fade if exposed to water.*

***Keywords: senggani leaf, ink, pigment.***

## 1. Introduction

The senggani plant (Melastoma malabthricum L.) is one of 22 species of plants in the genus Melastoma. This senggani plant is also known as a plant that grows in tropical and subtropical

areas, with a total of more than 400 species in the world. This plant is often used in the treatment of various diseases, namely leg pain, flatulence, diarrhea, vaginal discharge, hemorrhoids, infected wounds, toothache, and canker sores. Senggani is often used in the treatment of various diseases, namely leg pain, flatulence, diarrhea, vaginal discharge, hemorrhoids, infected wounds, toothache, and canker sores (Zainal et al., 2022). Many people understand that the use of senggani plants is limited to medicine because senggani contains phenols and flavonoids with antioxidant activity, however, there is a lack of public understanding that senggani can be used as a raw material for a product (Suwita and Meldawati, 2022).

Used as medicine, that's why we try to use parts of this plant to process it into useful products. One product that is useful and used as material for printing or printing images and writing is printer ink. Printer ink contains dangerous ingredients, some of which have quite high levels of VOC (Volatile Organic Compound). One type of VOC contained in printer ink is xylene or dimethylbenzene, which is used in industry and medical technology as a solvent. This xylene causes effects ranging from short to long-term, so it can disrupt health (Anova and Hendri, 2017).

This research uses environmentally friendly materials from plants to make ink, namely by using senggani leaves (Melastoma malabthricum L.) as raw material for making printer ink. Senggani leaves contain flavonoid compounds, saponins, tannins, steroids, and glycosides (Suwita and Meldawati, 2022).

One product that is useful and used as material for printing or printing images and writing is printer ink. Printer ink contains dangerous ingredients, some of which have quite high levels of VOC (Volatile Organic Compound) (Haeria, 2013). One type of VOC contained in printer ink is xylene or dimethylbenzene, which is used in industry and medical technology as a solvent. This xylene causes effects ranging from short to long-term, so it can be detrimental to health. Therefore, senggani leaves are used as a natural ingredient for making printer ink which does not pose a danger to human health and is low in VOCs for the environment (Anova and Hendri, 2017).

The pigment is the main constituent of ink because it gives color to the ink when printing text or images. Tannin is a coloring pigment produced in plants that is widely distributed in plants, such as roots, leaves, immature fruit, and bark. Because that's why we raised senggani leaves as raw material for making printer refill ink (Herliana, 2017).

Based on the color properties above, senggani leaves can be used as raw material for making printer ink by extracting the senggani leaves and formulating them with addictive ingredients as a constituent of the ink. The use of natural senggani leaves as raw material for printer refill ink has not yet been developed. This research aims to determine the content of senggani leaves and to use senggani leaves as raw material for printer refill ink. This can increase the utilization of senggani leaves into a product that has low VOC content, is environmentally friendly, and provides added value to senggani leaves (Herliana, 2017).

## 2. Methods

This research used experimental and chromatographic methods. The materials used in this research were senggani leaves, the coordination compounds used were distilled water, alcohol, and gum Arabic. The equipment used includes a blender, pan, oven, beaker, Erlenmeyer, 100 mesh sieve, stirrer, pan, stove, analytical balance, viscometer, spatula, and pipette. The steps taken are that the senggani leaves are cleaned and dried directly in the sun until dry. Then it continues with the combustion process with low oxygen conditions to become carbon. After the material becomes charcoal or carbon, it is then cooled. Next, grind the carbon obtained from the combustion process using a blender and filter it using a 100-mesh sieve, to produce homogeneous carbon powder. Then the carbon powder is filtered using a 100-mesh sieve. The next step is to make a 3.5-gram gum Arabic solution with three types of distilled water, namely 10 mL, 12.5 mL, and 15 mL. In the research (Minjong Ha and Sang-hoon Kim, 2020) a variety of distilled water was used, namely 15 mL, 20 mL, and 30 mL so there were differences in the results obtained. The third stage is to prepare carbon from the results of the first stage in a beaker with variations between 1 and 3 grams. The carbon is then dissolved in 3 milliliters of 98% alcohol. The dissolution of carbon in alcohol is carried out gradually until the two substances are completely mixed. Next, a mixture of carbon solution and 98% alcohol is mixed evenly. Then 3.5 grams of gum arabic solution is added to the carbon solution and mixed thoroughly.

The first test carried out was the ink absorption rate test on HVS paper, namely testing the ink absorption rate using media such as paper by comparing the absorption path length $\Delta x$ with the time interval t during the absorption process (Andreou et al., 2022). The next test is the ink performance test using a volume of distilled water solvent and comparing the quality of the ink obtained (Ghigo, et al., 2020). The results obtained from several tests will be compared to research data that has been carried out previously. The difference in results is influenced by the volume of material used.

## 3. Result and Discussion

The carbonization results of senggani leaves in Figure 1 show that the organic pigment produced in printer ink has a particle size that passes through a 100-mesh sieve. This printer ink has a fairly large particle size. The ink produced is very smooth on HVS-type paper media and does not clump, or have a texture or smell. In addition, the very small or fine particle size affects the solubility level of the ink to be made. The solubility level of carbon in alcohol increases with smaller particle sizes, and vice versa (Aprianti et al., 2021).

**Figure 1. Senggani leaf carbon**

Larger particle sizes cause lumps and a rougher texture in the ink, which can damage the output device (printer) and cause scratches on the media. After the carbon is obtained in a uniform micron size, the printing ink manufacturing process is carried out (Rahayu and Siti, 2021). The ink consists of three main parts: pigment, solvent, and thickening agent. The pigment used in this research is carbon obtained from the carbonization of senggani leaves, 98% alcohol is used as a carbon solvent as a thickener and adhesive in the form of gum arabic. Gum Arabic is used because it comes from nature and is environmentally friendly. The choice of alcohol solvent is based on the fact that this solvent dries quickly and thus can be a drying agent for ink products (Aprianti et al., 2021).

During this process, the volume of distilled water and the mass of carbon change. Volumes of 10 mL, 12.5 mL, and 15 mL were added to the distilled water variable (Table 1) to ensure the correct volume of distilled water as a solvent for gum Arabic so that the gum Arabic solution was not too thick or dilute.

**Figure 2. Ink samples with various distilled water solvents**

To compare, this variable uses a fixed carbon mass of 1 gram, an alcohol volume of 3 mL, and a gum Arabic mass of 3.5 grams. As can be seen in Figure 2, the distilled water solvent looks the same, namely black and difficult to distinguish. The results of this variable are as follows:

**Table 1. The ink results are related to the distilled water volume variable**

| Number | Aquades (ml) | Ink form |
|---|---|---|
| 1 | 10 ml | Runny |
| 2 | 12,5 ml | Thick |
| 3 | 15 ml | In accordance |

The mass of carbon and distilled water changes. Too much carbon mass will cause low solubility in the gum Arabic solution, which has an impact on the quality of printer ink, especially during the printing process on paper.

**Figure 3. Ink samples with variations in carbon mass**

The variations in carbon used were 1 gram, 2 grams, and 3 grams (Table 2), while the volume of distilled water, alcohol volume, and mass of gum arabic were kept constant, namely 15 mL, 3 mL, and 3.5 grams respectively. As can be seen in Figure 3, the carbon masses are dark black and less black. Data on variation results can be seen in the following table:

**Table 2. Ink results for carbon mass variables**

| Number | Carbon mass (gram) | Ink form |
|---|---|---|
| 1 | 1 gram | Not black enough |
| 2 | 2 gram | Quite black |
| 3 | 3 gram | Pitch black |

### 3.1 Test the ink absorption rate on HVS paper

In this test, an ink absorption rate test is carried out using media such as paper and comparing the length of the absorption path with the time interval t during the absorption process. three pieces of paper cut to size 2×15cm, with the time used during the absorption process being 2 minutes. This test was carried out by taking absorption rate data from transmittance, namely at masses of 1 gram, 2 grams, and 3 grams with volume variations of 10 ml, 12.5 ml, and 15 ml with an absorption time of 2 minutes.

**Figure 4. Ink absorption on HVS paper**

From the picture, it can be seen that at a mass of 3 grams with a volume of 15 ml, ink is obtained which has a dense absorption capacity on HVS paper. The table of ink absorption rates on paper is shown in Table 3.

**Table 3. Ink absorption rate data with variations in mass and solvent**

| Number | Absorption length (cm) | Absorption rate (cm/minute) |
|---|---|---|

| | | |
|---|---|---|
| | 2 | 1 |
| 2 | 3 | 1,5 |
| 3 | 3,5 | 1,75 |

**Table 4. Ink absorption rate data with variations in mass and solvent**

| Number | Absorption length (cm) | Absorption rate (cm/ minute) |
|---|---|---|
| 1 | 1 | 0,5 |
| 2 | 3 | 1,5 |
| 3 | 3,5 | 1,75 |

**Table 5. Ink absorption rate data with variations in mass and solvent**

| Number | Absorption length (cm) | Absorption rate (cm/ minute) |
|---|---|---|
| 1 | 2 | 1 |
| 2 | 1 | 0,5 |
| 3 | 3,5 | 1,75 |

**Table 6. Ink absorption rate data with variations in mass and solvent**

| Number | Absorption length (cm) | Absorption rate (cm/ minute) |
|---|---|---|
| 1 | 2 | 1 |
| 2 | 3 | 1,5 |
| 3 | 3,5 | 1,75 |

**Table 7. Ink absorption rate data with variations in mass and solvent**

| Number | Absorption length (cm) | Absorption rate (cm/ minute) |
|---|---|---|
| 1 | 2 | 1 |
| 2 | 3 | 1,5 |
| 3 | 2,5 | 1,25 |

From the data obtained, it was found that each mass and solvent had a fairly high absorption power or rate according to theory (Medi et al., 2022).

### 3.2 Ink performance test

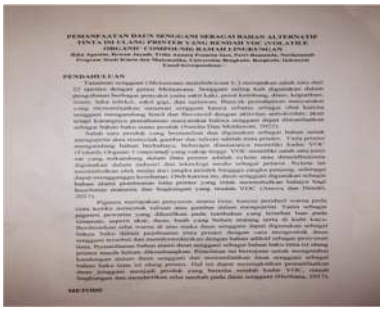

**Figure 5. Test results of senggani leaf ink printing**

The ink performance test on paper is as shown in Figure 5, using a solvent volume of 40 ml distilled water, 5 ml alcohol, 3.5 grams of gum arabic, and 4 grams of carbon mass. From the picture, it can be seen that the optimum solvent produces ink that is black and not opaque when printed. This corresponds to the ink viscosity being proportional to the amount of solvent used (Rahmad et al., 2018). The senggani leaf ink produced also does not cause an odor and does not fade easily when exposed to water.

## 4. Conclusion

The results showed that 4 grams of the right carbon composition was dissolved in 5 mL of alcohol and mixed with a mixture of 3.5 grams of gum arabic in 40 mL of distilled water. The test for senggani leaf ink with the best composition produced solvent and mass variation values that were by the standards. Print test results show that the printer ink has the same printing quality and color as commercial ink and does not smell or fade easily when exposed to water.

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