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PHYSICAL TESTS OF ORGANIC INK BASED ON GUM ARABIC, GAMBIER, AND JANGGELAN LEAVES

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Abstract. The basic color of ink is black, which contains carbon, making it easier for us to use natural elements around us as the raw material for making organic ink, and it is, of course, more cost-effective. One potential natural material that can be used as a color source to replace synthetic materials in ink production is gum arabic, gambier, and janggelan leaves. This study aims to determine the physical tests of organic ink made from gum arabic, gambier, and janggelan leaves based on the Indonesian National Standard (SNI) No 06-1567-1989. The physical tests conducted include density, viscosity, and color pigment tests. The results of testing the three materials used—gum arabic, gambier, and janggelan leaves—showed that gum arabic is the most optimal for making organic ink. This is evident from the test results, which showed a density of 1.076 g/cm^3, a viscosity of 2.56 poise, and a deep black color pigment.

Keywords: *organic ink, gum arabic, gambier, and janggelan leaves.*
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INTRODUCTION

Various problems and shortcomings arising from the use of synthetic inks such as environmental pollution, toxicity, and difficulty to decompose encourage us to start the development and use of organic inks as an alternative dye that is more environmentally friendly is one way to minimize the use of synthetic inks.

Organic ink is a type of ink processed from natural materials obtained from the surrounding environment. This ink is usually produced from pigments derived from plants, animals, or natural minerals, and uses solvents and resins that are also organically based (Hutasoit et al., 2024).

The components of ink include color components, binding agents (varnish), and additives (Pratama et al., 2022). Colorants consist of two types: pigments and other dyes. Pigments include organic and inorganic pigments. Suspension is essential for pigments as it acts as a binder in the form of a solution or liquid. Pigments are solid particles with a certain fineness according to the printing technique used. The function of pigments is to provide color to the ink and apply a layer of color to the surface of the printed material (Rahayu, 2021). The content of the pigments affects the appearance of the color

produced (Farika et al., 2019). The smaller the pigment size, the better the pigment quality, and thus the better the color intensity (strength) produced in the ink (Aprianti et al., 2021).

The organic materials in stamp ink refer to natural and environmentally friendly materials used in the production of stamp ink (Putro et al., 2018). Common organic materials used in ink consist of natural substances derived from animals, plants, and minerals (Evitasari et al., 2023). Additionally, water-based solvents and natural adhesives facilitate the pigments adhering to the surface of stamped media, such as tree sap or materials derived from insects. Other additives like vinegar (as a preservative) or sea salt (to adjust viscosity) can be used in organic stamp ink (Puspita Rengganis et al., 2017). These additives help improve ink characteristics without using synthetic chemicals. Some organic stamp inks may contain natural fragrances like essential oils to provide a pleasant aroma without using synthetic chemicals (Rengganis et al., 2017).

The basic color of ink is black, which contains carbon (Ayu Lestari et al., 2021), making it easier for us to utilize natural parts around us as the raw materials for making organic ink, which is more economical (Brillyantina et al., 2023). One potential natural material that can be used as a substitute for synthetic coloring agents (Pendapatan et al., n.d.) that can be made into ink is gum arabic, gambier, and janggelan leaves. This study aims to determine the physical tests of organic ink made from gum arabic, gambier, and janggelan leaves based on SNI No. 06-1567-1989.

The use of gum arabic, gambier, and janggelan leaves as the base materials for organic ink was tested. The physical characterization of the ink includes density, viscosity, and color pigment. The results of the ink tests are compared with the SNI Ink Standard No. 06-1567-1989, as shown in Table 1 for organic stamp ink testing (Wulandari & Masthura, 2023).

Table 1. Characterization of organic ink

Testing	Value standard	Reference
Density	Min 1,0 g/cm^3	SNI No. 06-1567-1989
Viscosity	1,12 – 2,568 poise	Rahayu, 2021
Color pigment	Black	SNI No. 06-1567-1989

RESEARCH METHOD

In this study, a sample product was made in the form of ink based on gum arabic, gambier, and janggelan leaves with the addition of activated carbon. The tests conducted consisted of ink density, viscosity, and color pigments.

The equipment used in this research included a digital scale, measuring glass, blender, hot plate, magnetic stirrer, oven, spatula, and filter paper. The materials used in this study were gum arabic, gambier, janggelan leaves, activated carbon, distilled water, polyethylene glycol 400 (PEG), propylene glycol (PG), and 96% alcohol. Below is the flowchart for making organic ink.

Procedure for Making Organic Ink

1. Prepare the equipment and materials: gum arabic, gambier extract, and janggelan leaf extract.

2. Vary the composition of gum arabic, gambier extract, and janggelan leaf extract with the following composition:

Material Type	Material Mass	Activated Carbon	Solution (Distilled water, Alcohol & PEG)
Gum arabic Gambier Janggelan Leaves	7 g	7 g	(50 ml : 35 ml : 15 ml)

3. After all materials are mixed evenly, stir the materials using a magnetic stirrer on a hot plate until homogeneous at a stirring speed of 1000 rpm for 1 hour.
4. Then, the organic ink sample, which is ready and homogeneous, is tested for sample ink variations,

RESULTS AND DISCUSSION

The results and discussion in this study consist of test results, including density, viscosity, and color pigment tests of organic ink samples based on gum arabic, gambier, and janggelan leaves. The test results are compared with the standards of SNI No. 06-1567-1989 and relevant references.

Density Test

The purpose of the ink density test is to determine the mass density or compactness of the ink. The density value of ink affects the level of clumping formed in the ink; thus, the smaller the density value (less compact), the smaller the clumps. Below is the data from the organic ink density test in Table 2.

Table 2. Density Test Data

Material type	Density (g/cm^3)	SNI No. 06-1567-1989
Gum arabic	1,076	
Gambier	1,056	Min 1,0 g/cm^3
Janggelan leaves	0,876	

Based on Table 2, the density values of organic ink using gum arabic, gambier, and janggelan leaves as base materials can be seen. The highest density value was obtained with gum arabic at 1.076 g/cm^3, and the lowest was with janggelan leaves at 0.876 g/cm^3.

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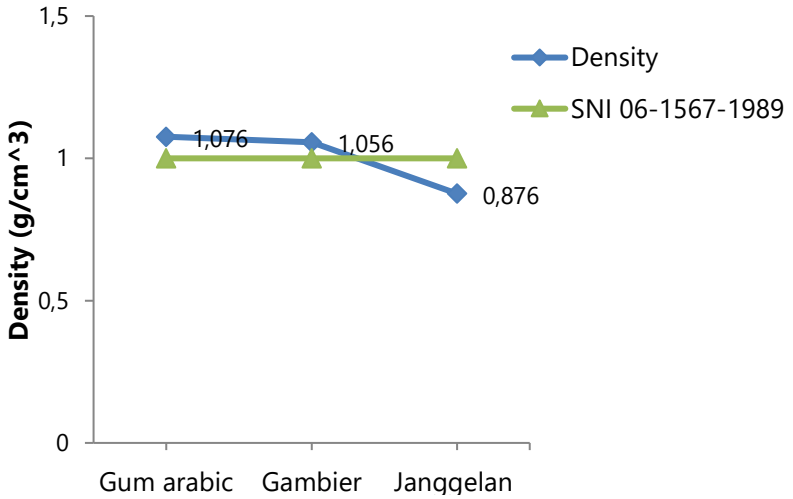

Figure 1. Density Graph

Figure 1 shows the graph of the relationship between density values and variations in the base materials of organic stamp ink. According to this figure, the highest density value is with gum arabic at 1.076 g/cm^3, followed by gambier at 1.056 g/cm^3, and the lowest with janggelan leaves at 0.876 g/cm^3. When compared with SNI No. 06-1567-1989 regarding stamp ink, which requires a minimum density of 1.0 g/cm^3, the densities of gum arabic and gambier meet this standard. This is because gum arabic and gambier have characteristics that allow them to dissolve easily in water, forming stable colloidal solutions and thus achieving high density values.

Viscosity Test

The viscosity of ink is determined by its binding materials (color carriers), so the correct concentration is needed to produce ink with a viscosity level that meets the standard range of 1.12 poise to 2.568 poise. The results of the viscosity test can be seen in the data presented in Table 3.

Table 3. Viscosity Test Data

Material type	Viscosity(poise)	Reference
Gum arabic	2,56	
Gambier	1,93	1,12 – 2,56 poise
Janggelan leaves	1,82	(Rahayu, 2021)

Based on Table 3, the viscosity values of organic ink using gum arabic, gambier, and janggelan leaves as base materials can be seen. The highest viscosity value was obtained with gum arabic at 2.56 poise, while the lowest was with janggelan leaves at 1.82 poise.

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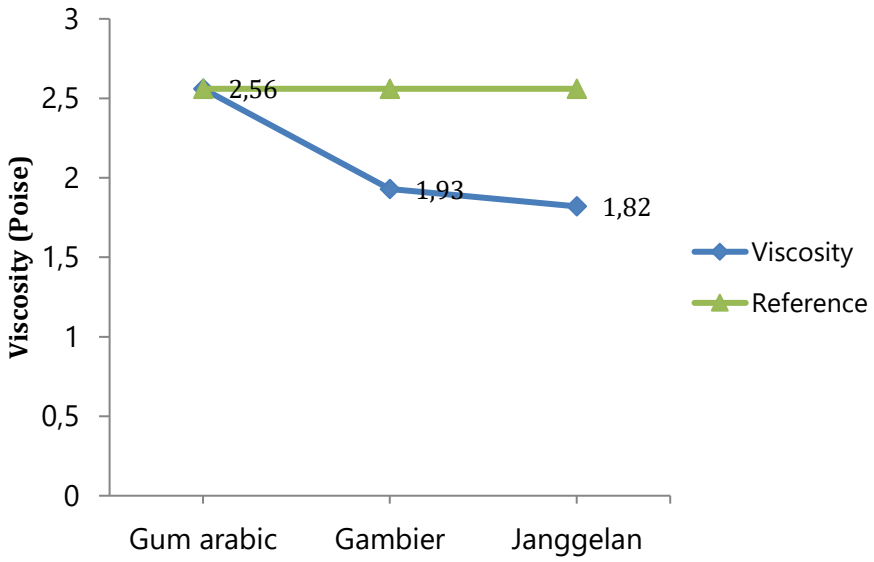

Figure 2. Viscosity Graph

Figure 2 shows the graph of the relationship between viscosity values and variations in the base materials of organic stamp ink. According to this figure, the highest viscosity value is with gum arabic at 2.56 poise, followed by gambier at 1.93 poise, and the lowest with janggelan leaves at 1.82 poise. When compared with the reference from the study by Rahayu and Siti (2021), where the optimal viscosity range is 1.12 – 2.56 poise, the viscosity values for all three base materials used in this study meet the reference standard.

Color Pigment Test

The color pigment test is a process for evaluating and measuring the quality, consistency, and characteristics of pigments used in ink. Pigments are solid particles that provide color to a material by absorbing and reflecting specific wavelengths of light. The density and viscosity values influence the color pigments obtained. Higher density and viscosity values in the ink will result in more concentrated color pigments.

Table 4. Pigment Color Test Data

Material type	Observer	SNI No. 06-1567-1989
Gum arabic	Deep black	
Gambier	Black	Black
Janggelan leaves	Faded black	

Based on Table 4, the color pigment test results of organic ink using gum arabic, gambier, and janggelan leaves as base materials can be observed. A deep black color pigment was obtained with gum arabic, a black color with gambier, and a faded black color with janggelan leaves.

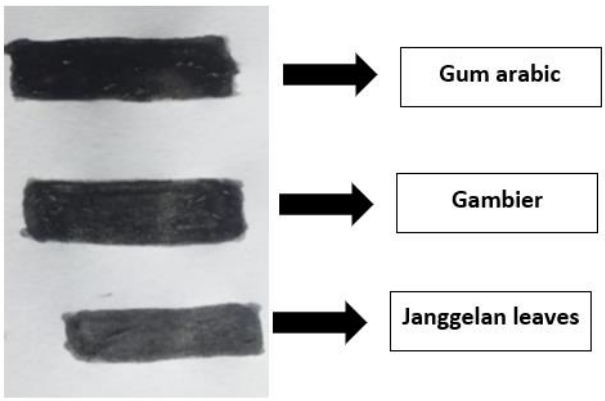

Figure 3. Ink Pigment Color Test

In Figure 3, it is evident that with gum arabic, the ink swatch is deep black; with gambier, the ink swatch is black; and with janggelan leaves, the ink swatch is faded black. The differences in color pigments are due to the effects of density (compactness) and viscosity of the materials used. Higher density (compactness) and viscosity values in an ink material result in more concentrated color pigments. Additionally, the use of activated carbon as a blending material in the liquid organic ink production process also affects the pigment color.

Based on the tests conducted, including density, viscosity, and color pigment tests for making organic ink with three materials—gum arabic, gambier, and janggelan leaves—the most optimal material for making organic ink is gum arabic. This is evidenced by the test results, which show a density of 1.076 g/cm^3, viscosity of 2.56 poise, and a deep black pigment that meets SNI standards and references.

CONCLUSION

The physical tests performed in this study include density, viscosity, and color pigment tests. Among the three materials tested—gum arabic, gambier, and janggelan leaves—the most optimal and compliant material for organic ink, according to SNI No. 06-1567-1989, is gum arabic. This conclusion is supported by the test results showing a density of 1.076 g/cm^3, viscosity of 2.56 poise, and a deep black pigment.

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