Synthesis Of Silver Nanoparticles (Agnp) From The Extract Of Kemloko Fruit (*Phyllantus Emblica* L.)

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Abstract.
Nanoparticles are nano-sized materials that are widely used because they have many advantages and very beneficial benefits. One method of making nanoparticles biologically. In the process of chemically synthesizing silver nanoparticles, nanomaterials are toxic and not environmentally friendly. So, other options are used, such as biological synthesis with natural materials as reducing catalysts and plant extract bioreductors that can reduce the amount of dangerous materials in the waste. This study aims to make nanoparticles from kemloko ethanol extract with biological methods. Extraction was carried out by the maceration method and synthesis of silver nanoparticles by a biological method with functional group analysis characteristics using FTIR. The results of this study indicate that these nanoparticles indicate that silver nanoparticles can be synthesized biologically for silver nanoparticles and the FTIR characteristic results show that silver nanoparticles contain OH, C=O, N=O, C-O, and C-H groups.

Keyword : *Silver nanoparticles, functional group analysis, FTIR, ethanol extract of kemloko fruit.*

I. INTRODUCTION

Nanoparticles are small particles measuring between 1 and 100 nm, which can be obtained by synthesis of the top-down and the bottom-up methods. The technique of this nanoparticle synthesis method uses excess chemicals and has the effect of polluting the environment because the use of a lot of chemicals will also have an impact on the costs that must be incurred for their procurement [1]. Nanoparticles are a technology that utilizes nanometer-dimensional material structures, nanoparticles are not only nano-sized particles but a technological method that is currently being developed and synthesized mainly from natural materials because they have minimal effects, are more effective and efficient [2].Metallic nanoparticles are used in all areas of science, engineering, and medicine, and they continue to entice researchers to discover new realms of their value, which is typically related to their matching small sizes. Recent studies have established the importance of these substances against microbes. Silver nanoparticles have drawn particular attention among the noble metal nanoparticles[3], [4].High electrical and thermal conductivity, surface-enhancing Raman dispersion, chemical stability, catalytic activity, non-linear optical behavior, broad spectrum bactericidal and fungicidal activity, ability to be used in liquid form, such as colloids and solids, and use in both the textile industry and membrane filtration systems for water purification are just a few of silver nanoparticles' distinctive properties[5].Kemloko fruit (*Phyllanthus emblica* L.), which is historically used as a remedy for diarrhea, has been shown to contain alkaloids, saponins, and flavonoids, secondary metabolites that function as antioxidants and can bind to free radicals and highly reactive molecules to prevent oxidation reactions [6].

Kemloko (*Phyllanthus emblica* L.) is one of the plants produced by Indonesia which is also widely used by the community as a treatment. It is rich in vitamin C and is widely used to have the effect of lowering LDL values and increasing HDL values in cholesterol sufferers [7].The availability of natural resources in Indonesia is very abundant but has not been used optimally. This makes it possible to obtain natural reducing agents. Bioreductants can be obtained from natural materials containing antioxidant compounds or polyols that can reduce silver. The use of plants in the synthesis process is to utilize organic compounds contained in living things. In particular, the content of secondary metabolites such as terpenoids, flavonoids and tannins, which have antioxidant activity [8].Nanotechnology is a method used for the manufacture of nano-sized materials where the preparation of nanoparticles has a large surface area due to the very small particle size. The synthesis of silver nanoparticles with biological methods is one of the most

widely chosen nanoparticle synthesis methods in the manufacture of nanoparticles because the manufacturing procedure is simple, easy, and more environmentally friendly. Polyphenols, flavonoids, proteins, and saponins in roots are effective reducing agents [9].

II. METHODS

a. Apparatus

The apparatus used in this study were Fourier Transform Infrared (FT-IR), blender, porcelain cup, centrifuge tube, hotplate (Hanna), mortar, analytical balance, spatula and laboratory glassware.

b. Materials

Kemloko fruit samples, distilled water, silver nitrate ($AgNO_3$), methanol, polyacrylic acid.

c. Making Kemloko Fruit Simplicia

We cleaned and drained fresh kemloko fruit extrack (*Phyllanthus emblica* L.)The seeds are then taken out and chopped into little bits before being dried at 40 to 50°C in a drying cabinet. The dried simplicia is ground in a blender, then stored in a tightly closed plastic container. The kemloko fruit is deemed dry when it is brittle.

d. Extract Kemloko Manufacturing Process

In a glass container, one part of dry simplicia powder was introduced along with ten parts of solvent. Stirring occasionally, soak for the first six hours, then let stand for the final 18 hours. Filtration separates the masaerate. Repeat the filtering procedure at least once, using a solvent whose total volume is half that of the first filter's total volume. After collecting all of the macerate, a rotary evaporator was used to evaporate it.

e. Nanoparticle Synthesis

The synthesis of silver nanoparticles was carried out by adding the ethanol extract of Phyllanthus emblica with various concentrations (0.125%, 0.25%, and 0.5%) dropwise into a 1.0 mM $AgNO_3$ solution and stirring continuously for 20 minutes at a temperature of 50-60°C. Then the solution was stored in the dark at room temperature for 12 hours. To confirm the synthesis of silver nanoparticles due to phytochemical compounds from the ethanolic extract of *Phyllanthus emblica* fruit, a comparison in the form of $AgNO_3$ solution and distilled water was used. Reduction of silver ions can be observed by the presence of a color change to dark brown [10].The synthesized silver nanoparticles were separated from the solution by centrifugation at a speed of 10000 rpm for 10 minutes, followed by washing using distilled water until no impurities were seen, then drying in an oven at 100°C until the silver nanoparticles became dry [10].

f. Sample Functional Group Analysis

The FTIR characterization of silver nanoparticles was carried out to show a shift in wavenumber, indicating that there was an interaction between the functional groups and the nanoparticles. The shift in the spectrum of the extract after the formation of silver nanoparticles in the O-H, C=O, and C-O groups indicates that these groups play a role in the reduction reaction of silver metal [11].

III. RESULT AND DISCUSSION

3.1 Results of the Synthesis of Silver Nanoparticles Using Ethanol Extract of Kemloko Fruit (*Phyllanthus emblica* L.)

The synthesis of silver nanoparticles was carried out using the green synthesis method using $AgNO_3$ as a precursor and ethanol extract of kemloko fruit as a bioreductant and stabilizer agent, and turning it into a dark brown color, indicating the formation of silver nanoparticles [12].Biological synthesis uses natural ingredients, namely the use of plant extracts as reducing agents. The process of forming nanoparticles using the green synthesis method is closely related to the presence of functional groups in secondary metabolites contained in plant extracts. This method is an environmentally friendly method because it is able to minimize the use of hazardous inorganic materials and waste. This method uses organic or natural materials as a reducing catalyst, so it is known as a bioreductant [13].In the table below, you can see how much silver nanoparticles were made based on how the concentration and volume of the ethanolic extract of kemloko fruit (*Phyllanthus emblica* L.) changed.

Table 1. Yield of Silver Nanoparticles

Variations in concentration and volume of ethanol extract of kemloko fruit (*Phyllanthus emblica*) in 1mM $AgNO_3$ 100 mL	Yield weight (g)	Yield weight (%)
0.125% 5 mL	0.0010	0.10
0.25% 5 mL	0.0021	0.21
0.5% 5 mL	0.0054	0.54
0.5% 10 mL	0.0057	0.57

Based on the results of the orientation carried out, the variation of concentration and volume of the ethanol extract of the kemloko fruit (*Phyllanthus emblica* L.) selected was a concentration variation of 0.5% with a volume of 5 ml because it can produce silver nanoparticles weighing 0.54% when compared to a volume of 10 ml which only produces silver nanoparticles weighing 0.54%. 0.57% of the yield weight. The difference in the results shown was less significant even though the volume of the added extract was more than doubled. The synthesis was carried out using 30 L of 1 mM $AgNO_3$ and 0.5% reductant in 1.5 L of ethanol extract of kemloko fruit *(Phyllanthus emblica*) to obtain 1.5984 silver nanoparticles powder with a yield of 49.33%.

3.2 Results of FTIR Characterization of Silver Nanoparticles

The results of the FTIR characterization of the ethanol extract of the kemloko fruit can be seen that there are OH bonds from the phenol group at the peak of 3317.56 cm-1, C=O bonds from the aldehyde and ketone groups at the peak of 1724.36 cm-1 and 1614.42 cm-1. , the C-H bond of the alkene and C=C at the peak of 873.75 cm-1. The results of the FTIR characterization of silver nanoparticles showed the presence of OH bonds from the phenol group with a peak of 3421.7 cm-1, C=O bonds from aldehyde and ketone groups at a peak of 1627.92 cm-1, N=O at a peak of 1384.89 cm-1. , the C-O bond of the ester group at the peak of 1099.43 cm-1, and the C-H bond of the alkene group and C=C at the peak of 875.68 cm-1.

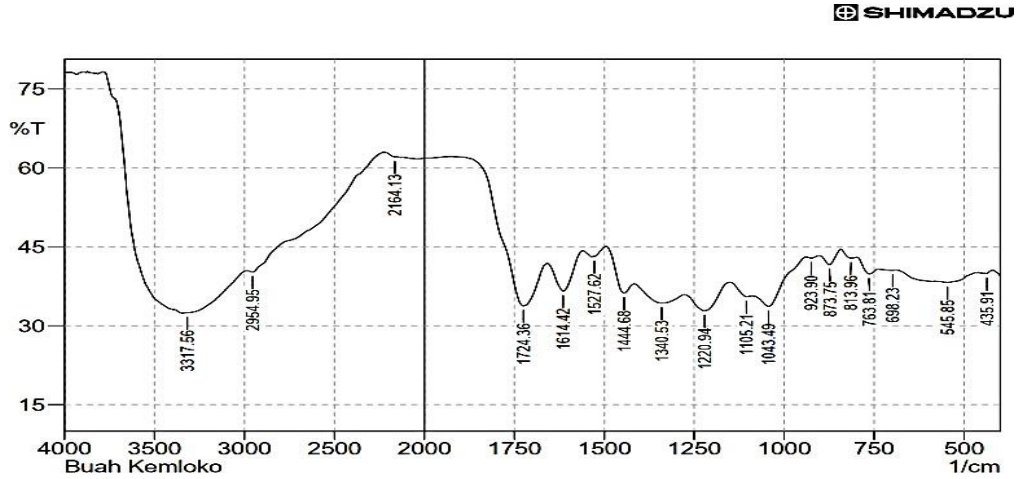

Fig 1. Results of Extract Kemloko Characterization Using FTIR

In FTIR, infrared radiation is passed through the sample. Some of the infrared radiation is absorbed by the sample and some is transmitted. When chemicals in kemloko leaf extract are characterized using FT-IR Spectroscopy, functional groups that they contain can be seen [14]. FT-IR is a method that uses electromagnetic radiation with a wavelength of 0.75 to 1000 m or a wave number of 13,000 to 10 cm^{-1} to examine chemical interactions[15]. If the frequency of a specific vibration is equal to the frequency of infrared radiation that goes directly to the molecule, the molecule will absorb the radiation. When a molecule absorbs infrared radiation, the absorbed energy causes an increase in the vibration amplitude of the bonded atoms. So this molecule is in an excited vibrational state. This absorbed energy will be dissipated in the form of heat when the molecule returns to the ground state [16].

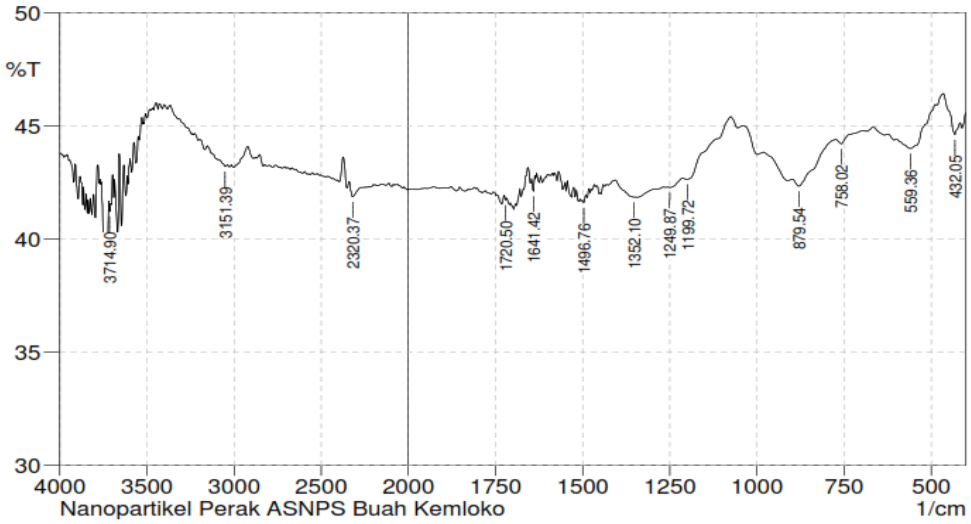

Fig 2. Results of Silver Nanoparticle Characterization Using FTIR

The results of the FTIR characterization of silver nanoparticles showed the presence of OH bonds from the phenol group with a peak of 3421.7 cm^{-1}, C=O bonds from aldehyde and ketone groups at a peak of 1627.92 cm^{-1}, N=O at a peak of 1384.89 cm^{-1}, the C-O bond of the esther group at the peak of 1099.43 cm^{-1}, and the C-H bond of the alkene group and C=C at the peak of 875.68 cm^{-1}. An absorption spectrum results from FTIR characterization of an ethanol extract of kemloko fruit and silver nanoparticles.

IV. CONCLUSION

Silver nanoparticles can be synthesized biologically using a reductant ethanol extract of kemloko fruit (*Phyllanthus emblica* L.).

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