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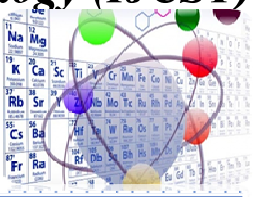

Analysis of The Optical Properties of Ag Nanoparticles With The Assistance of Bioreductors of Saga Leaf Extract (*Abrus pecatorius L.)*

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ABSTRACT

Nanotechnology has become an important and interesting field of physics, chemistry, biology and engineering in recent years. The rapidly growing nanotechnology today is nanoparticles. The characteristic characteristic of nanoparticles is that the particle size is very small in the range (1-100 nm). Silver nanoparticles have been synthesized using saga leaf extract (Abrus pecatorius L.) as a reducing agent. The formation of silver nanoparticles was carried out by adding sage leaf extract to the $AgNO_3$ solution and homogenizing using a magnetic stirrer for 60 minutes. UV-Vis spectrophotometer was used to confirm the formation of silver nanoparticles. Test the inhibition of bacteria using the well method. The results showed that the wavelength values were in the range of 375-395nm.

Keywords: Silver Nanoparticles, Staphylococcus *aureus* bacteria, *Escherichia coli* bacteria

1. INTRODUCTION

Nanotechnology is one of the important and interesting fields of physics, chemistry, biology and engineering in recent years. One of the developments of nanotechnology that is currently growing rapidly is nanoparticles[1]. Nanoparticles have unique properties such as very small particle size and high flexibility [2]. As well as optical, mechanical, electrical and catalytic properties that can be applied in various fields such as environmental, biomedical and optical.[3]

Nanoparticles that have attracted a lot of attention, one of which is metal nanoparticles because of their broad applications, among others, in the fields of optics, electronics, biology, catalysts and medicine. The metal that is often studied is silver (Ag), because silver nanoparticles are non-toxic to human skin[4] Silver nanoparticles can also be applied as antibacterial and antifungal in various products such as socks, wet wipes, skincare, and also in food and beverage storage containers.[5]

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Natural resources in Indonesia are abundant but not optimally utilized. This can make it possible to obtain natural reducing agents. Bio-reductors are obtained from natural materials containing antioxidant compounds or polyols which can reduce silver[3]. The use of plants in the synthesis process by utilizing various organic compounds contained in living things. Especially in the content of secondary metabolites such as flavonoids, alkaloids, saponins, glycosides, terpenoids, and tannins which have antioxidant activity.

Saga leaves (Abrus precatorius L.) is one of the plants whose extract is used for Ag biosynthesis process, because Saga leaves (Abrus precatorius L.) contain phenol derivative compounds, namely polyphenols and flavonoids. Sweet Saga Leaf (Abrus precatorius L.) is a shrub that grows by vines originating from India. The leaves of this plant have a sweet taste on the sides, which has medicinal properties for diarrhea, inflammation of the tonsils, canker sores, coughs and hemorrhoids.[6] The sweet compound has been described as (glycyrrhizin), although in a recent publication by (Kinghorn et al, from Illinois, USA) states that what has a sweet taste in A.precatorius leaves is not from (glycyrrhizin) but glycoside compounds namely Abrusoside A-D.

In Fadillah's research [5], silver nanoparticles synthesized with chemical reducing agents showed stronger antibacterial activity against Gram-positive bacteria (Staphylococcus aureus) than Gram-negative bacteria (Escherichia coli) [5]. research results showed the same thing that silver nanoparticles (AgNP) synthesized with plant extracts were effective in inhibiting the growth of Gram-positive bacteria (Staphylococcus aureus) compared to Gram-negative bacteria (Escherichia coli)[7]. Based on the explanation above, it can be formulated how the characteristics and antibacterial activity of silver nanoparticles (AgNP) were synthesized using chemical reducing agents and bioreductors. The aim of this research was to determine the characteristics and antibacterial activity of silver nanoparticles synthesized using a bioreductor.

2. EXPERIMENTAL

2.1. Chemicals, Equipment and Instrumentation

The materials used in this study included saga leaf extract, $AgNO_3$ solution, 96% ethanol, Aquadest, NA Media (Nutrient Agar), 2N HCl, 5% $FeCl_3$, Concentrated $_{H2SO4}$, anhydrous acetic acid ($C_4H_6O_3$), Mayer's reagent, Bauchardat reagent. , chloroform, plastic wrap (cling wrap), cotton, sterile gauze, kraft paper, and white flannel. The tools used in this study included analytical balances, Bunsen glass beakers, test tubes, watch glass, Erlenmeyer, petri dishes, micro pipettes, magnetic stirrer, spray bottle, Genesys 10S UV-Vis *Spectrophotometry*.

2.2. Research procedure

Preparation Of Saga Leaf Simplicia

The first stage is sample preparation, namely first the leaves of saga (Abrus precatorius L.) are cleaned of dirt using swirling water. Furthermore, it was dried in the sun until dry, then blended, and sieved using a no.44 mesh sieve. And obtained saga leaf simplisia powder

Extraction Of Saga Leaves

The second stage is the maceration extraction process, first weighing 100 grams of saga leaves that have been thoroughly washed, dried and mashed. Then, it was macerated with a ratio of 1:10 using 70% ethanol

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solvent, maceration time was 5 days, filtered and a liquid extract was obtained. Finally, the resulting liquid extract was evaporator for 2 hours, to remove the ethanol odor. The extract results were stored at 4ºC. This extract can be used for further biosynthesis processesResearch procedures may include preparation of reagents, reactions, preparation of samples to be measured and methods of measurement. Everything must be written as clearly as possible and if it is deemed necessary, in addition to the procedure, the research scheme can also be displayed.

Secondary Metabolite Test of Saga Leaf Extract

The third stage is the Secondary Metabolite Test of saga leaf extract which includes examination of the content of saponins, glycosides, alkaloids, flavonoids, tannins, and triterpenoids/steroids.

Synthesis of Silver Nanoparticles

The fourth stage is Nanoparticle Biosynthesis and Characterization of $AgNO_3$ Nanoparticles. A total of 30 mL of distilled water is put in a beaker glass, weigh $AgNO_3$ with various concentrations of 0.01 M; 0.05M; Put 1.0 M each into a beaker glass containing distilled water then add 1 mL of Saga leaf extract then homogenize with a magnetic stirrer for 60 minutes until the color changes to pink. The solution was cooled to room temperature. Then each solution was measured for its maximum wavelength using a UV-Vis spectrophotometer. The characterization of Ag nanoparticles was carried out using the UV-Vis spectrophotometer method to determine the formation of silver nanoparticles.

Testing The Antibacterial Activity Of Nanoparticles

The sixth stage is the Antibacterial Activity Test using gram-positive bacteria (*Staphylococcus aureus*) and negative bacteria (*Escherichia coli*).

3. RESULTS AND DISCUSSION

3.1. Secondary Metabolite Test of Saga Leaf Extract

The first objective was to test secondary metabolites, namely to determine the bioactive compounds in saga leaf extract that have the opportunity to be bioreductors in Ag synthesis. In Table 1. shows the qualitative results of the secondary metabolite test which shows the results of the color test reaction on saga leaf extract. Based on the test results showed that the saga leaf extract in the sample positively contained flavonoids, saponins, alkaloids, glycosides, tannins, and steroids.

Table 1. Secondary Metabolite Test Results of Saga Leaf Extract

Secondary Metabolite Test	Test result	Information
Saponins	+	

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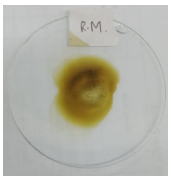
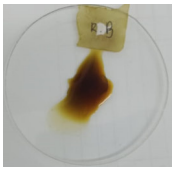
Secondary Metabolite Test	Test result	Information
Glycosides	+	
Alkaloids (Reagen Mayer)	+	
Alkaloids (Reagen Bauchardat)	+	
Flavonoids	+	
Tannins	+	
Steroids	+	

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3.2 Synthesis and Characterization of AgNO3 Nanoparticles

The synthesis of Ag nanoparticles from saga leaf extract contains several secondary metabolites including flavonoids, saponins, alkaloids, glycosides, tannins, and steroids. There are various phenolic contents in it, namely flavonoids, saponins, alkaloids, glycosides, tannins, and steroids. The maximum wavelength range used in the UV-Vis spectrophotometry test using various concentrations of Ag nanoparticles from saga leaf extract is 375nm-395nm.

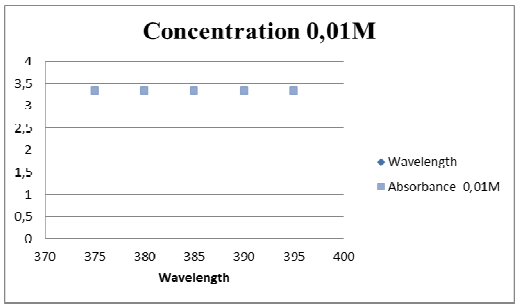

Figure 1. Absorbance spectrum of 0.01M Ag nanoparticles

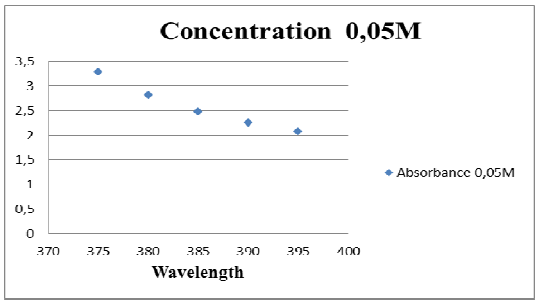

Figure 2. Absorbance spectrum of 0.05M Ag nanoparticles

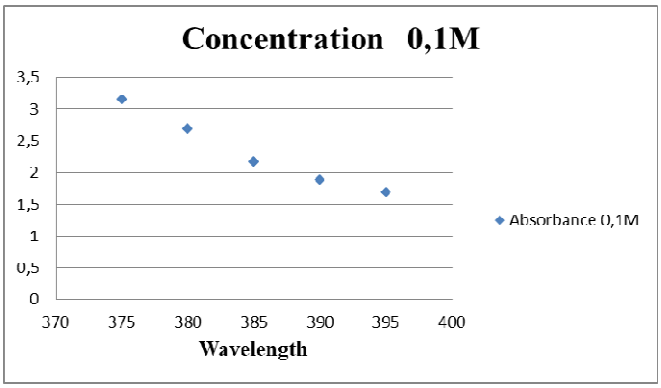

Figure 3. Absorbance spectrum of 0.1M Ag nanoparticles

The Ag nanoparticle samples of saga leaf extract were used from several concentrations including 0.01M, 0.05M, and 0.1M. The maximum peak wave point from the biosynthesis results was at a height of 375nm.

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3.3 Well Method Antibacterial Test

Calculation of the inhibition test of bacteria

$$\frac{D1 + D2}{2} .\times$$

Information:
D1 = Vertical diameter of the clear zone in the media
D2 = The horizontal diameter of the clear on the media
X = tool size (Cork borer) used

Gram Positive Bacteria (*Staphylococcus aureus*)

Table 2. Results of Gram Positive Antibacterial Test (*Staphylococcus aureus*)

Concentration	Diameter (1)	Diameter (2)	Average	X (5mm)	Results
0,01M	21,91	20,91	21,41	5mm	107,05
0,05M	22,90	15,04	18,97	5mm	94,85
0,1M	38,37	15,89	27,13	5mm	135,65

Gram Negative Bacteria (Escherichia coli)

Table 3. Test Results for Gram Negative Antibacterials (*Escherichia coli*)

Concentration	Diameter (1)	Diameter (2)	Average	X (5mm)	Results
0,01M	14,01	10,80	12,405	5mm	62,025
0,05M	30,61	17,91	24,26	5mm	121,3
0,1M	25,39	25,77	25,58	5mm	127,9

Table 4. Categories of bacterial inhibition zones

Inhibition Zone Diameter	Category
≤5mm	Weak
5-10mm	Currently
≥10-20mm	Strong
≥20-30mm	Very strong

From various concentrations of Ag nanoparticles of saga leaf extract, it was found that the antibacterial test obtained both gram-positive and gram-negative bacteria. In the smallest gram-negative bacteria test results, the average final result was at a concentration of 0.01M and the highest average concentration was at 0.1M. The results of the inhibitory power test for gram-positive bacteria had the highest concentration at 0.1M and the lowest concentration at 0.05M. The average yield obtained also affects the room temperature when it is synthesized. In principle, the silver ions that have been formed will turn into Ag nanoparticle nuclei and can inhibit the further reduction process in the previous reduction process. At a concentration of 0.1M a higher

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average is produced so that it is more dominant only for reduction without making a capping agent which can cause the size of the Ag nanoparticles to become larger.

4. CONCLUSION

Analysis of the optical properties of Ag nanoparticles with the help of saga leaf extract bioreductors can be concluded that in the secondary metabolite test by testing several phenolic compounds the results obtained were all positive, which means that the saga leaf extract tested contained good secondary metabolites. The results of Ag biosynthesis with the help of saga leaf extract bioreductor obtained that there is good optical absorption..

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