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# Kitolod (*Isotoma longiflora* Presi) Leaf Extract as a Bioreductor in Silver Nanoparticle Synthesis

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**ABSTRACT.** Silver nanoparticles (AgNPs) were synthesized using kitolod (*Isotoma longiflora* Presi) leaf extract as a bioreductor. This research aims to investigate the ability of extracts to act as reducing agents in the formation of AgNPs and to characterize the resulting AgNPs. The synthesis was carried out under the following conditions: pH of extract 12, reaction time 90 minutes, silver nitrate concentration $2 \times 10^{-4}$ M, and extract concentration 0.08%. Fourier transform infrared (FTIR) spectra confirmed the involvement of phytochemicals in the reduction of $Ag^+$ to $Ag^0$. The synthesized AgNPs were spherical, with an absorption peak at around 420 nm, an average particle size of 67.38 nm, a zeta potential of -23.6 mV, and a polydispersity index (PDI) of 0.697. Stability testing showed that the synthesized AgNPs remained stable for two months at room temperature.

## INTRODUCTION

Over the past few decades, nanotechnology has become one of the most promising and rapidly growing fields due to its wide applications across science and technology (Yerragopu *et al*., 2020). Nanotechnology is a multidisciplinary field of science that focuses on the design and synthesis of nanoparticles to obtain functional materials (Keskin *et al*., 2023). Nanoparticles are known to be very small materials (1 – 100 nm) with superior physicochemical properties compared to large particles, mainly due to their high ratio of surface area to volume. One of the most promising nanoparticles in the development of nanotechnology is precious metal nanoparticles, specifically silver nanoparticles (AgNPs), which are of high significance in the field of nanotechnology as well as their wide applications in the fields of water treatment, optical devices, catalysis, antimicrobials, and medical therapies (Burlec *et al*., 2023).

AgNPs can generally be synthesized using two main approaches: physical and chemical methods. The physical method has several drawbacks, such as requiring relatively high energy and resulting in a less uniform particle size distribution. Meanwhile, the chemical method involves using metal precursors, reducing agents, and stabilizing agents. However, reducing and stabilizing agents used in chemical methods tend to be expensive, toxic, and hazardous when used sustainably. Therefore, to overcome the shortcomings of both methods, the green synthesis approach is a viable solution, as it is simple, cost-effective, environmentally friendly, and capable of producing stable nanoparticles (Abou El-Nour *et al*., 2010; Zhang *et al*., 2016).

The approach of green synthesis utilizes a variety of biological sources, such as bacteria, fungi, yeasts, viruses, algae, and plants. Extracts from plants are often used because they contain secondary metabolites, such as flavonoids, alkaloids, tannins, and terpenoids, which act as reducing and stabilizing agents in the synthesis of AgNPs. These compounds have phenolic groups that can donate electrons to silver ions (Azkiya *et al*., 2018; Purbowati *et al*., 2024). This process is called reduction, in which the compounds in the extract reduce the $Ag^+$ ions to $Ag^0$. After the silver ions are successfully reduced to $Ag^0$, the Ag particles that are formed have the potential to undergo aggregation. Therefore, the compounds in the extract will function simultaneously as stabilizing agents

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by capping the surface of AgNPs, preventing agglomeration, and avoiding oxidation back into $Ag^+$ (Villagrán *et al*., 2024).

Research conducted by Kemala *et al*. (2024) reports that *Calotropis gigantea* leaf extract can act as a bioreductor in the formation of AgNPs with an obtained particle size of about 56 nm, spherical in shape, as well as distinctive optical characteristics. Research by Nurfitri *et al*. (2025) demonstrated that bay leaf extract (*Syzygium polyanthum*) effectively functions as a bioreductor, with the resulting AgNPs exhibiting typical optical characteristics and a particle size of 36.44 nm. The research conducted by Hermanto *et al*. (2024) reinforces the potential of an environmentally friendly approach to AgNPs synthesis using green tea leaf extract, yielding particles with a size range of 8 – 26 nm. Variation in size, shape, and optical properties of AgNPs indicates that plant type and phytochemical composition of the extract significantly affect nanoparticle formation.

The phytochemical compounds found in each plant can vary significantly across species, affecting nanoparticle formation efficiency and characteristics (Eker *et al*., 2025). Therefore, exploring diverse plant sources is important to expand the knowledge base on the relationship between phytochemical compounds and nanoparticle formation. Plant kitolod (*Isotoma longiflora* Presi) is known in traditional Indonesian medicine and has been reported to contain a variety of phytochemical compounds, such as flavonoids, alkaloids, tannins, saponins, terpenoids, and steroids that exhibit antioxidant, antibacterial, and anti-inflammatory activity (Dewantoro *et al*., 2022; Romdani *et al*., 2024). The presence of these compounds can support the reduction of $Ag^+$ ions during the synthesis of AgNPs (Eker *et al*., 2025; Kemala *et al*., 2024; Moldovan *et al*., 2018; Purbowati *et al*., 2024).

In this study, AgNPs were synthesized using a green synthesis approach with Kitolod leaf extract. Several synthesis parameters, including reaction time, extract pH, silver nitrate concentration, and extract concentration, were studied to determine optimal reaction conditions. The resulting AgNPs were characterized using UV-Visible spectrophotometers, particle size analyzer (PSA), Fourier transform infrared spectroscopy (FTIR), and transmission electron microscopy (TEM).

## RESEARCH METHODS

### Kitolod Leaf Extraction

The procedure for extracting and testing the phytochemicals of kitolod leaves is based on that reported by Romdani *et al*. (2024), with slight modifications. Samples of kitolod leaves were obtained from North Kayong Regency, West Kalimantan. Plant identification is carried out morphologically by referring to botanical descriptions in the literature that include the characteristics of leaves, stems, and flowers, so that the sample is confirmed as *Isotoma longiflora* Presi. The extraction procedure began with cleaning and drying the Kitolod leaves at room temperature. Next, the dried kitolod leaves were cut and mashed using a chopper. The kitolod leaf powder was weighed up to 266.5 g and placed in a glass container, then added to 2 L of 96% ethanol until the powder was completely submerged, and then left to sit for 1 × 24 hours while stirring occasionally. After 24 hours, the mixture was filtered to separate the filtrate and residue. The residue obtained was re-mixed with 96% ethanol, then left to sit for 24 hours. This process was repeated 3 times. Filtrates from the three maceration processes were combined and concentrated by evaporation until a viscous extract was obtained. Furthermore, phytochemical tests were performed to identify the chemical components of the extract.

Phytochemical tests of kitolod leaf extract include flavonoids, alkaloids, saponins, tannins, steroids, and terpenoids. The flavonoid test was performed using the Shinoda test, with the addition of Mg turnings and concentrated HCl; the formation of red or green colors indicates a positive result. Alkaloid tests were performed using Dragendorff, Mayer, and Wagner reagents after the extract was acidified with HCl. Positive results are characterized by the formation of orange-red precipitate (Dragendorff), white precipitate (Mayer), or brown precipitate (Wagner). The saponin test was performed using the foam method; a stable foam after shaking indicates a positive result. The tannin test was carried out by adding a 1% $FeCl_3$ solution, which resulted in a blackish-blue color, indicating positive results. Steroid and terpenoid tests were performed using the Liebermann–Burchard reagent, where the formation of a blue or green ring indicates the presence of a steroid. In contrast, a purplish red color indicates a terpenoid.

**Silver Nanoparticle Synthesis**

The synthesis of AgNPs was carried out by varying several parameters, including the pH of the extract, reaction time, AgNO3 concentration, and the concentration of the kitolod leaf extract, as previously described (Sulistiorini *et al*., 2024). This was done to determine the optimal reaction conditions in the synthesis of AgNPs.

***Preliminary Test***

A total of 5 mL of 0.01% kitolod leaf extract was mixed with 5 mL of $AgNO_3$ solution $1 \times 10^{-4}$ M in a test tube. The solution was left at room temperature, and discoloration was observed as an early indication of AgNPs formation. Observations were also made for the same process but with heating in a water bath at boiling water temperature for 60 minutes. The reaction products were then cooled and observed for the colloidal color change. Next, the pH of the reaction was adjusted by adding NaOH solution to the kitolod leaf extract until it reached pH 11. Then, 5 mL of the extract solution was added to 5 mL of $1 \times 10^{-4}$ M $AgNO_3$ solution. The mixture was left at room temperature, and a similar treatment was carried out with additional heating. The four treatments aim to determine the effect of heating and pH conditioning in the synthesis of AgNPs.

***Determination of the Optimal pH of Kitolod Leaf Extract***

The pH of 0.01% Kitolod leaf extract solution was adjusted with 1 M NaOH to pH 9, 10, 11, and 12. For each pH level, 5 mL of the adjusted extract was placed into a test tube, followed by the addition of 5 mL of a $1 \times 10^{-4}$ M $AgNO_3$ solution. The mixture was heated in a water bath at boiling water temperature for 60 minutes, then cooled. The absorbance was measured using a UV-Visible spectrophotometer (Orion Aquamate 8100) over the wavelength range of 300 – 700 nm.

***Determination of Optimal Reaction Time***

The solution of Kitolod leaf extract at 0.01% was adjusted to the previously determined optimal pH. A 5 mL extract solution was placed in several test tubes. Next, 5 mL of $1 \times 10^{-4}$ M $AgNO_3$ solution was added to each test tube. The mixture was heated in a water bath at boiling water temperature for 30, 45, 60, and 90 minutes, then cooled. The absorbance was measured using a UV-Visible spectrophotometer (Orion Aquamate 8100) over the wavelength range of 300 – 700 nm.

***Determination of Optimal Concentration of $AgNO_3$***

A 0.01% Kitolod leaf extract solution (5 mL), which had been adjusted to the previously determined optimal pH with NaOH, was placed into several test tubes. Next, 5 mL of $AgNO_3$ solution at each concentration of $0.5 \times 10^{-4}$, $1 \times 10^{-4}$, $1.5 \times 10^{-4}$, and $2 \times 10^{-4}$ M was added into each test tube. The mixture was then heated in a water bath at boiling water temperature for the previously determined optimal reaction time. The solution was then cooled, and the absorbance was measured using a UV-Visible spectrophotometer (Orion Aquamate 8100) over the wavelength range of 300 – 700 nm.

***Determination of the Optimal Concentration of Kitolod Leaf Extract***

A total of 5 mL of Kitolod leaf extract solution, with its pH adjusted to the optimal level determined earlier, was placed into separate test tubes. These solutions had varying concentrations of 0.006%, 0.008%, 0.01%, 0.02%, 0.04%, 0.06%, 0.08%, and 0.1%. Next, 5 mL of $AgNO_3$ solution, prepared at the optimal concentration identified previously, was added to each test tube. The mixtures were then heated in a water bath at boiling temperature for the optimal reaction time established earlier. After heating, the solutions were cooled, and the absorbance was measured using a UV-Visible spectrophotometer (Orion Aquamate 8100) over a wavelength range of 300 – 700 nm.

**Characterization and Stability Test of Silver Nanoparticles**

AgNPs were synthesized using predetermined optimal conditions. A total of 5 mL of 0.01% kitolod leaf extract, pH 12, was added to several test tubes. Furthermore, an $AgNO_3$ solution at a concentration of $2 \times 10^{-4}$ M was added as much as 5 mL to each test tube. The mixture is then heated in a water bath at boiling water temperature for 90 minutes. The resulting colloidal AgNPs were then characterized using TEM (JEM-2100Plus JEOL), FTIR (Shimadzu Tracer-100), and PSA (Horiba SZ-100). The stability of AgNPs was assessed by UV-Visible spectroscopy over two months at room temperature.

## RESULTS AND DISCUSSION

**Phytochemistry of Kitolod Leaf Extract**

The results of phytochemical tests on kitolod leaf extract are presented in Table 1. The tests showed that Kitolod leaf extract contained flavonoids, alkaloids, tannins, saponins, and terpenoids. These results are in line with previous studies reporting the presence of these secondary metabolites in Kitolod leaves (Anggyadinata *et al*., 2023; Awaluddin *et al*., 2024). Secondary metabolites play an important role in the synthesis of AgNPs as reducing and stabilizing agents. Compounds such as flavonoids, alkaloids, tannins, saponins, and terpenoids that contain phenolic groups reduce silver ions to $Ag^0$ via an electron-transfer mechanism. In addition, the presence of functional groups in secondary metabolites allows the formation of a protective layer around the nanoparticles, thus preventing agglomeration and increasing their stability in the solution. This combination of roles makes secondary metabolites a key component in the synthesis of environmentally friendly AgNPs (Dhaka *et al*., 2023).

**Table 1.** Results of phytochemical tests of kitolod leaf extract.

| Metabolite | Positive Reaction | Observation Result | Conclusion |
|---|---|---|---|
| Flavonoids | Red, yellow, or orange | Orange | + |
| Alkaloids | Orange precipitate (Dragendorff) | Orange precipitate | + |
| | White precipitate (Mayer) | White precipitate | + |
| | Brown precipitate (Wagner) | Brown precipitate | + |
| Tannins | Blue or greenish-black | Bluish-black | + |
| Saponins | Formation of foam | Stable foam | + |

## Silver Nanoparticles Synthesis

### *Preliminary Test*

Preliminary tests of AgNPs synthesis were conducted to evaluate the effects of heating and pH conditioning on the formation of AgNPs using Kitolod leaf extract. Visual observations indicated that, without pH conditioning or heating, the solution did not discolor, suggesting that the reduction of $Ag^+$ ions had not yet occurred. However, when heated, the solution turned a clear yellow, indicating the formation of AgNPs due to an increased reduction rate. Additionally, adjusting the pH of the extract solution by adding NaOH without heating did not result in significant discoloration. In contrast, combining alkaline pH conditioning (pH 11) with heating produced a more intense yellow color. This observation suggests that alkaline conditions enhance the reactivity of the phytochemical compounds in the extract, while heating accelerates the reduction of $Ag^+$ ions to $Ag^0$. Therefore, both heating and pH conditioning are critical factors that support each other during the early stages of AgNPs synthesis.

The successful formation of AgNPs is confirmed by UV-Visible spectroscopy, as shown in Figure 1, with the appearance of a typical surface plasmon resonance (SPR) peak of AgNPs at around 420 nm, which is the main indicator of the change of $AgNO_3$ precursors to AgNPs. Surface plasmon resonance is a collective oscillation of free electrons at the surface of metal nanoparticles when they interact with light. This phenomenon produces sharp absorption bands at certain wavelengths and is used as a key indicator of the formation of metal nanoparticles (Kemala *et al*., 2024).

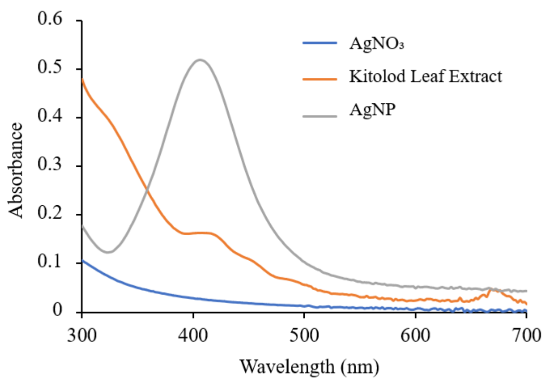



**Figure 1.** UV-Visible spectrum of silver ions, kitolod leaf extracts, and AgNPs.

## Effect of pH

The discoloration of the solution to yellow is observed as an early indication of the formation of AgNPs, as presented in Figure 2. The synthesis of AgNPs was conducted using Kitolod leaf extract at pH levels of 9, 10, 11, and 12. The UV-Visible spectra in Figure 3 show that the pH of the extract influences AgNPs synthesis, as evidenced by changes in the SPR intensity and peak position. The main absorption band of AgNPs is observed at about 420 nm, characteristic of the AgNPs spectrum.

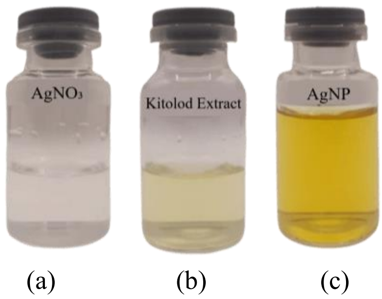



**Figure 2.** (a) $AgNO_3$ solution, (b) Kitolod leaf extract, and (c) synthesized AgNPs.

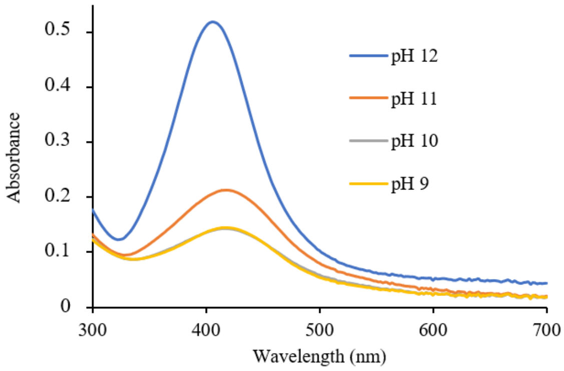



**Figure 3.** UV-Visible spectra of AgNPs synthesized using extracts with varying pH levels.

The UV-Visible spectrum shows that AgNPs synthesized at pH 12 have the highest absorbance intensity compared to those at pH 9 – 11, indicating the formation of more AgNPs. The intensity of SPR absorbance increases as the number of AgNPs particles increases (Corciovă *et al*., 2024; Sati *et al*., 2025). The alkaline condition is known to increase the rate of reduction of $Ag^+$ ions to $Ag^0$ due to the enhanced electron-donating ability of the phenolic groups in the phytochemicals of plant extracts. The faster rate of reduction yields a larger number of nuclei in a shorter period, leading to more limited particle growth and smaller, relatively homogeneous AgNPs. This is evident from the shift in the absorption peak towards shorter wavelengths (blueshift) at pH 12 (Kazemi *et al*., 2023; Savvidou *et al*., 2024). Therefore, pH 12 is selected as the optimal pH for use in subsequent synthesis procedures.

***Effect of Reaction Time***

AgNPs generated through varying reaction times exhibit an absorption peak at about 420 nm. The UV-Visible spectra in Figure 4 indicate that the absorption intensity at 30, 45, and 60 minutes is noticeably lower than at 90 minutes. This indicates that at reaction times of 30, 45, and 60 minutes, the reduction of $Ag^+$ to $Ag^0$ has not yet been complete (Khan *et al*., 2024). Too short a reaction time can result in imperfect reduction of $Ag^+$ ions to $Ag^0$, while too long a reaction time can cause agglomeration due to unstable particle accumulation. Therefore, the optimal reaction time in this study is 90 minutes. This is because at 90 minutes, the highest absorbance intensity is obtained (Mehata, 2021).

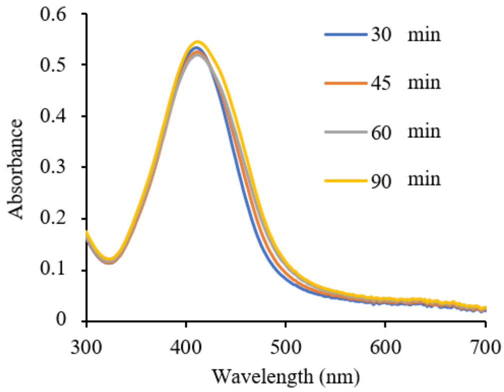



**Figure 4.** Spectra of UV-Visible AgNPs synthesized with a wide range of reaction times.

***Effect of $AgNO_3$ Concentration***

$AgNO_3$ concentration is a crucial factor in the synthesis of AgNPs because it directly influences the availability of $Ag^+$ ions, which are reduced to $Ag^0$. If the $AgNO_3$ concentration is too low, it may lead to incomplete nanoparticle formation. Conversely, if the concentration is too high, there is a risk of agglomeration, which can compromise particle stability (Kaabipour and Hemmati, 2021).

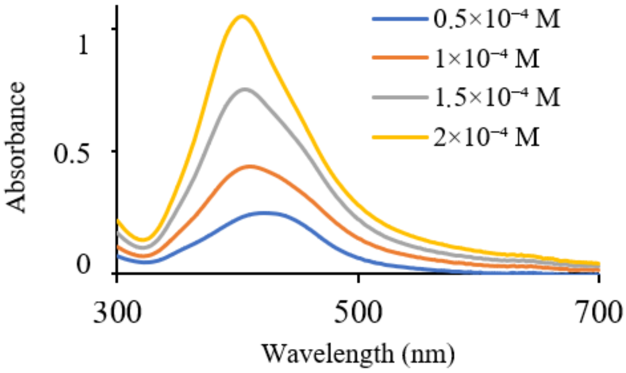



**Figure 5.** Spectrum of UV-Visible AgNPs synthesized with various concentrations of $AgNO_3$.

The UV-Visible spectra in Figure 5 show that $AgNO_3$ concentrations from 0.5 × $10^{-4}$ M to 2 × $10^{-4}$ M result in an increase in absorption intensity. The SPR absorption peak occurs around 420 nm. As the $AgNO_3$ concentration increases, the SPR peak shifts to a shorter wavelength (blueshift), suggesting a smaller particle size (Savvidou *et al*., 2024). The highest absorption intensity was obtained at an $AgNO_3$ concentration of 2 × $10^{-4}$ M, indicating that the 0.01% extract solution could still reduce $Ag^+$ ions to $Ag^0$. The balance between the number of $Ag^+$ ions and the number of compounds in the kitolod extract plays a very important role. Therefore, after obtaining the maximum $AgNO_3$ concentration of 2 × $10^{-4}$ M, Kitolod extract concentration was optimized to determine the most effective concentration for reducing all $Ag^+$ ions at 2 × $10^{-4}$ M.

***Effect of Concentration of Kitod Leaf Extract***

The UV-Visible spectra of AgNPs synthesized with various extract concentrations are shown in Figure 6, which indicates that increasing the extract concentration from 0.006% to 0.08% results in a gradual increase in absorbance, suggesting an increase in the number of AgNPs formed. This is due to the increasing number of compounds in the extract that act as reducing agents and stabilize $Ag^+$ ions. Increasing the extract concentration to 0.1% also causes a slight shift in the SPR peak towards a longer wavelength, indicating an increase in particle size (Fahim *et al*., 2024). At a concentration of 0.1%, there is a decrease in absorption intensity, which can be attributed to excess compounds in the extract, leading to some of the silver ions being completely reduced at 0.08%. In addition, excess active compounds can cause agglomeration, resulting in decreased nanoparticle stability and a non-uniform particle size distribution (Sulistiorini *et al*., 2024). The maximum absorption intensity was obtained at a concentration of 0.08% kitolod leaf extract. This shows that at a concentration of 0.08%, the amount of compounds in the extract is sufficient to reduce all $Ag^+$ ions at an $AgNO_3$ concentration of 2 × $10^{-4}$ M, while also acting as a stabilizing agent. Therefore, a concentration of 0.08% was chosen as the optimal concentration of kitolod leaf extract.

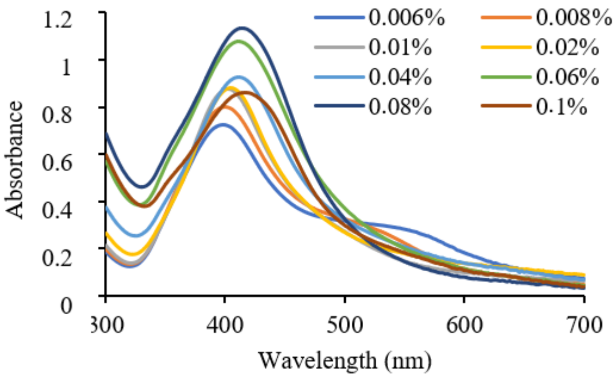



**Figure 6.** Spectrum UV-Visible AgNPs synthesized with various extract concentrations.

**Characterization of Silver Nanoparticles**

The FTIR spectra of Kitolod leaf extracts and AgNPs are shown in Figure 7, which reveal several functional groups responsible for the reduction and stabilization of AgNPs. Both extracts and AgNPs showed a wide peak at 3299.30 $cm^{-1}$ and 3307.01 $cm^{-1}$, corresponding to the O–H stretching of the phenolic group (Doğan and Gündoğan, 2020; Espinoza *et al*., 2020; Garibo *et al*., 2020). The –OH stretching band undergoes a small shift accompanied by a decrease in intensity, indicating the involvement of phenolic groups in the process of reducing $Ag^+$ ions to $Ag^0$ as well as their coordination on the nanoparticle surface. Peaks at 1639.52 $cm^{-1}$ are associated with C=C stretching, likely from flavonoids (Baran *et al*., 2023; Ponsanti *et al*., 2020). The absorption bands associated with the aromatic C=C stretching undergo a shift towards a lower wave number, indicating a change in the electron environment in the aromatic ring due to indirect interaction with the silver atom.

The extract's spectrum shows similarities to that of AgNPs, indicating that the compounds in the extract bind to the AgNPs' surfaces and act as stabilizing agents. The involvement of extract compounds in synthesis can be observed through the determination of the peak intensity ratio between the –OH peak at the wave number of 3299.30 $cm^{-1}$ and the C=C peak at the wave number of 1639.52 $cm^{-1}$. The ratio of peak intensity (–OH:C=C) in the extract spectrum was 2.2356, while the ratio for AgNPs was 1.9050. The decrease in the peak intensity ratio indicates that the phenolic groups in the extract are involved in the reduction process.

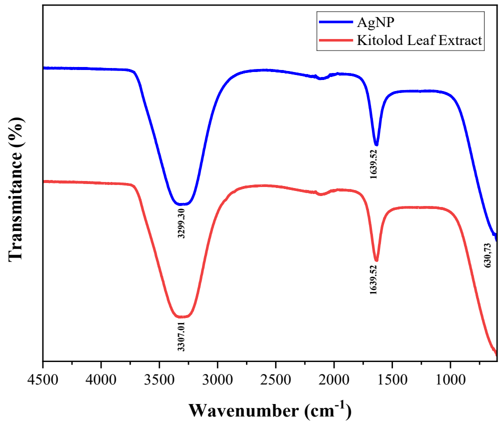
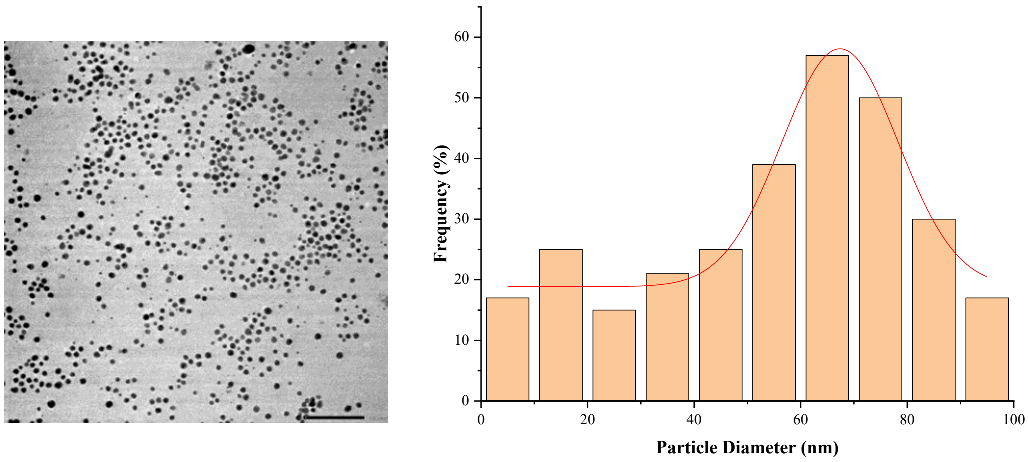



**Figure 7.** FTIR spectra of Kitolod leaf extracts and AgNPs.

Based on the morphological analysis and size distribution of AgNPs obtained by transmission electron microscopy (TEM) in Figure 8, the formed AgNPs exhibit a spherical morphology. This is confirmed by the SPR spectrum, with a $\lambda_{max}$ of about 400 – 418 nm, which characterizes spherical AgNPs (Cieśla *et al*., 2020). The particle size ranged from 6 to 100 nm, with an average of 67.38 nm. The polydispersity index (PDI) of 0.697 for AgNPs indicates a polydisperse particle distribution. This relatively high PDI value indicates that particles have a range of sizes (Grigoras and Grigoras, 2024).




(a) (b)

**Figure 8.** (a) TEM imagery and (b) Silver particle size distribution.

Measurements of zeta potentials, as seen in Figure 9, show that the resulting AgNPs have a potential of -23.6 mV with a negative surface charge. Based on the colloidal stability criteria, the value indicates sufficient stability, as the electrostatic repulsive force between particles inhibits aggregation. This negative charge is associated with the presence of phytochemical compounds in the Kitolod leaf extract, which are adsorbed onto the nanoparticles and function as a capping agent (Pérez-Marroquín *et al*., 2022). In addition to the electrostatic mechanism, the stability of AgNPs using plant extracts is also affected by the steric stabilization of the biomolecular layer, so that the system remains stable even though the potential zeta value is below the threshold of ±30 mV, which is categorized as very stable (Németh *et al*., 2022). These findings are consistent with previous reports on plant extract-based AgNPs, which generally show potential zeta values in the range of -20 to -25 mV and adequate colloidal stability (Pérez-Marroquín *et al*., 2022; Purbowati *et al*., 2022; Yuniarsih *et al*., 2025).

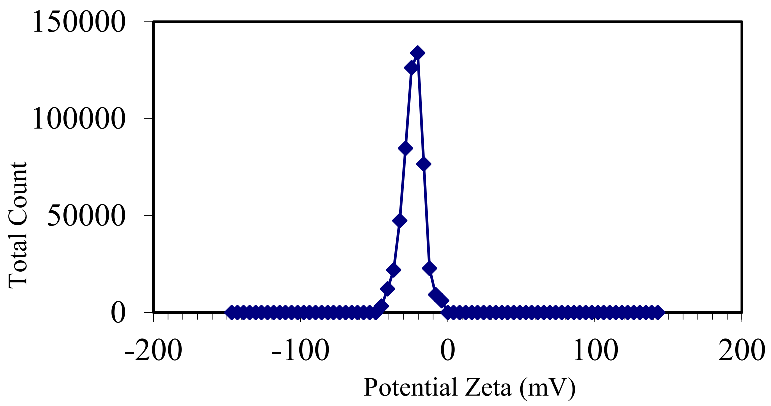



**Figure 4.** Potential zeta distribution of synthesized AgNPs.

**Stability of Silver Nanoparticles**

Stability test data show that AgNPs synthesized using Kitolod leaf extract maintain their nanostructural properties and prevent aggregation during storage. AgNPs were stored in sealed vial bottles at room temperature, and SPR spectra were measured over 2 months. Stabilization of AgNPs was observed by monitoring changes in absorption intensity and position of $\lambda_{max}$ in the UV-Visible spectrum (Gusrizal *et al*., 2021).

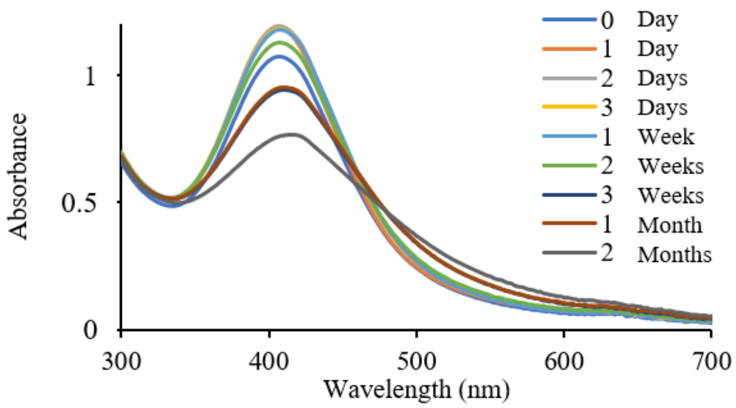



**Figure 5.** Spectra UV-Visible stability test for AgNPs.

The UV-Vis spectra shown in Figure 10 indicate that each storage condition exhibits a characteristic absorption peak of AgNPs at 420 nm. During storage, a shift in the position of $\lambda_{max}$ for synthesized AgNPs was observed. At storage times of 0 and 2 days, $\lambda_{max}$ was detected at 406 nm. On day 3 and during weeks 1 and 2, the $\lambda_{max}$ shifted to 408 nm. In the third week and at the one-month mark, the λmax shifted again to 410 nm. By the second month, the $\lambda_{max}$ further redshifted to 414 nm. This progression from 406 nm on day 0 to 414 nm by the second month, accompanied by a decrease in absorbance values observed during storage, indicates that the occurrence of partial oxidation of $Ag^0$ back to $Ag^+$ by dissolved oxygen, resulting in a reduction in the number of AgNPs (Rosman *et al*., 2021). In addition, the redshift of the SPR peak is associated with the gradual increase in nanoparticle size during storage (Fahim *et al*., 2024; Ntolia *et al*., 2025). The shift in $\lambda_{max}$ and the decrease in absorbance values were relatively small during the two-month storage period, indicating that the synthesized AgNPs exhibit good stability.

## CONCLUSION

*Isotoma longiflora* Presi leaf extract can act as a reducing and stabilizing agent in the synthesis of AgNPs. The FTIR spectrum confirms the involvement of the extract compounds in the synthesis process. The AgNPs formed have an average size of 67.38 nm, a spherical morphology, and good stability over 2 months of storage at room temperature.

## CONFLICT OF INTEREST

There is no conflict of interest in this article.

## AUTHOR CONTRIBUTION

AM: Methodology, Data Analysis, Manuscript Draft Writing; GG: Validation, Supervision, Finalization of Manuscript Drafts; AS: Supervision, Validation.

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