CONFERENCE PROCEEDING

Synthesis Of Silver Nanoparticles Using Ethanolic-Extract Of *Striga Asiatica* And *Polygala Paniculata*

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ABSTRACT

Synthesis of metal nanoparticles using a green synthesis method has received much attention due to their cost effective and environmental-friendly method. In this work, we aim to synthesize metal nanoparticles such as silver nanoparticles by using ethanolic plant extract of *Striga Asiatica* (Jarum Mas). Recent works have shown that extract of *Striga Asiatica* and *Polygala Paniculata* contains phytochemical compounds such as carbohydrate and flavonoids that may act as reducing agent for synthesis of silver nanoparticles. For the preparation of ethanolic plant extract, 6 g of fresh *Striga Asiatica* was dried and grinded before being subjected to Soxhlet extraction. Later, the ethanolic plant extract will be mixed with water before being added to silver nitrate solution to allow the synthesis of silver nanoparticles to occur. Any observable colour change to the reaction mixture will be observed. The experimental procedure was repeated for preparation of *Polygala Paniculata* ethanolic extract and synthesis of nanoparticles. Nevertheless, it is also very interesting to explore the potential of the collected these ethanolic plant extract as reducing agent for synthesis of other metal nanoparticles such as gold or copper nanoparticles using the same reaction procedure in future.

Keywords: *Ethanolic plant extract, Silver nanoparticles, Striga Asiatica*. *Polygala Paniculata*

INTRODUCTION

Green synthesis is the production of nanoparticles (NPs) using natural resources like plant extracts, microorganisms and energy-saving methods in a sustainable, non-toxic and economical way. Recently, green synthesis is more preferred compared to conventional methods of production due to the numerous benefits that come with the use of NPs synthesis. First of all, NPs produced are more stable and effective. They are eco-friendly, sustainable, inexpensive and free of contaminants. In comparison, physiochemical methods are costly and can be unhealthy (as a result of toxic chemicals used) with high chances of contamination. The purity of NPs is a major consideration for biological and medical applications and green NPs are mostly contaminant-free. In addition, they are energy efficient and do not need high pressure, temperature, or toxic chemicals. Moreover, most NPs produced by the green method show excellent antifungal, antibacterial and antiparasitic properties. The production of NPs using natural substances is an important and emerging area in nanotechnology. The conventional methods of synthesis of NPs using chemicals or reducing agents have potential risks of toxicity and in general, are not environmentally friendly or quick processes. There are two ways to conduct green synthesis either using plants and their extracts or microorganisms. Microorganisms themselves can be considered as nano factories that can produce NPs of different sizes and shapes. Many parts of the plant

can be used to produce NPs like stem, fruit, fruit peels, bark, root, and leaves (Ramanathan *et al.*, 2019; Vadlapudi *et al.*, 2014).

اَوَلَمْ يَرَوْا اِلَى الْاَرْضِ كَمْ اَنْۢبَتْنَا فِيْهَا مِنْ كُلِّ زَوْجٍ كَرِيْمٍ

And do they not consider the earth, how many good plants do We grow therein?

Allah said in the Qur'an (Sura Ash-Shu'ara, verse 26) whether mankind does not observe the earth. Allah has grown various types of plants that have their own benefits to other creatures. For example, *striga asiatica* is a hemiparasitic plant in the family Orobanchaceae. It is native to Asia and sub-Saharan Africa but has been introduced into other parts of the world including Australia and the United States. *Striga Asiatica* is a serious agricultural pest, as it parasitizes important crop species, including corn, rice, sorghum, and sugar cane, often causing substantial yield reductions. *Striga Asiatica* extracts can be used to synthesize silver nitrate into silver nanoparticles. The extraction is using the Soxhlet extraction dissolved in ethanol. The phytochemicals that can be found in the *Striga Asiatica* are resin, flavonoid and phenolic. The dried-grinded *Striga Asiatica* sample was extracted using ethanol. The extraction then undergoes some chemical tests to determine the existence of flavonoids that can be used to reduce silver nanoparticles. Apart from that, Polygala Paniculata belongs to Polygalaceae family are mainly found in tropical regions, with genus Polygala made up almost up to 500 species. *Polygala Paniculata* plant were widely used in folk medicine as a tonic remedy and for the treatment of different inflammatory diseases, such as asthma, bronchitis, arthritis and other pathologies, including disorders of the kidney. Moreover, phytochemical studies showed that compounds such as cytotoxic lignans, saponins, xanthones, coumarins and flavonoid can be found in plants of the genus Polygala. Recent studies also showed that these phytochemical compounds are responsible for many applications including for clinical purposes and as reducing agent for synthesis of metal nanoparticles.

Silver nanoparticles are increasingly used in various fields, including medical, food, health care, consumer, and industrial purposes, due to their unique physical and chemical properties. These include optical, electrical, and thermal, high electrical conductivity, and biological properties. The existence of silver nanoparticles can be confirmed based on its colour appearance and UV-vis spectroscopy. Synthesis of silver nanoparticles was used to reduce 4-nitrophenol (4-NP) to 4-aminophenol (4-AP) as being shown in previous studies (Geng *et al.*, 2014). 4-NP not only can irritate the eyes, skin, and respiratory tract but it may also cause inflammation of those parts. When ingested, it causes abdominal pain and vomiting. Prolonged contact with skin may cause an allergic response. Later, it is very interesting to study on the potential of the synthesised silver nanoparticles in catalytic applications such as in degradation of harmful 4-NP and dyes that are commonly found in industrial wastewater.

METHODOLOGY

Synthesis of Ethanolic Extract of *Striga Asiatica* and *Polygala Paniculata*

The plant *Striga asiatica* was collected, washed and shade dried. The dried plant material is powdered using mixer grinder. Later, 10 g of the sample was subjected to Soxhlet extraction with 150 ml ethanol for 8 hours. Finally, the collected ethanolic extract was concentrated by using rotary evaporator to yield 15 ml ethanolic extract of *Striga Asicatica*. The procedures were also repeated with 10 g of *Polygala Paniculata* to yield 15 ml ethanolic extract of *Polygala Paniculata* as shown in Figure 1.

Synthesis of Silver Nanoparticles using Ethanolic Plant Extract

A 10 ml of ethanolic extract of *Striga Asiatica* was taken and mixed with 10 mL of 0.1 M $AgNO_3$. This mixture was diluted to 50 mL with distilled water and heated to 60 °C under continuous stirring overnight. The experiment was also repeated using 10 ml of ethanolic extract of *Polygala Paniculata*.

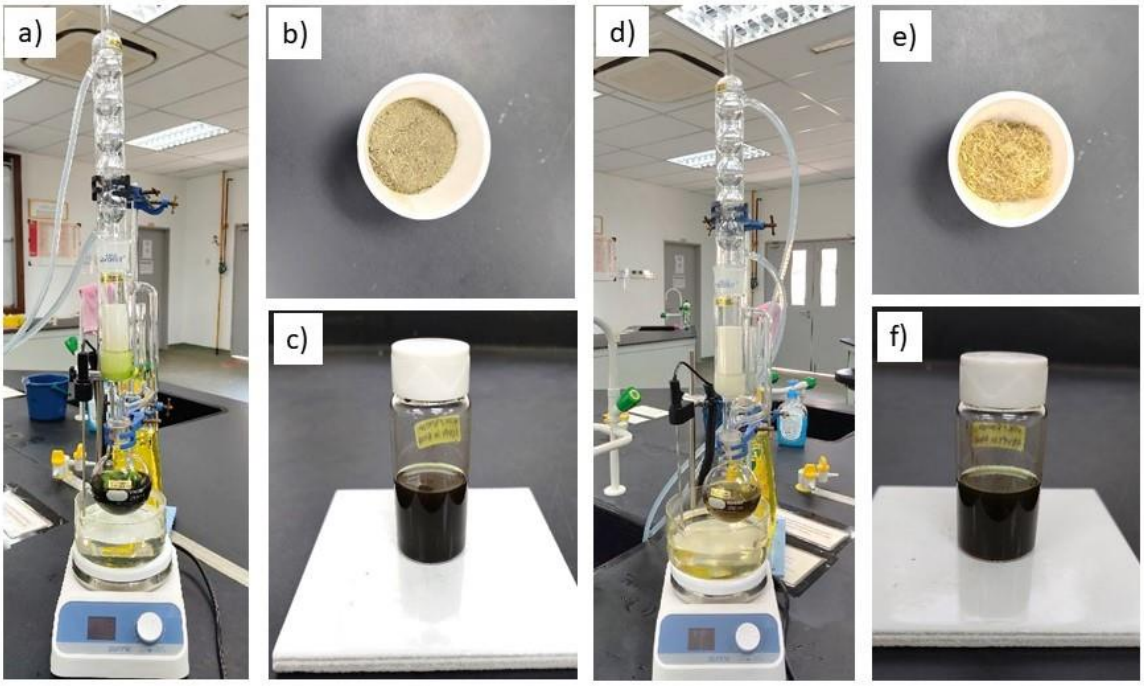

Figure 1: a) Soxhlet extraction setup using ethanol as the solvent for *Striga Asiatica*, b) *Striga Asiatica* sample after being grinded, c) Ethanolic extract of *Striga Asiatica* with dark-greenish colour, d) Soxhlet extraction setup using ethanol as the solvent for *Polygala Paniculata*, e) *Polygala Paniculata* sample after being grinded, f) Ethanolic extract of *Polygala Paniculata* with dark-greenish colour

RESULTS AND DISCUSSION

FTIR spectroscopy was done on the *Striga Asiatica* (black) and *Polygala Paniculata* (blue) grinded samples and their result was shown in Figure 2. Based on the FTIR spectrum of *Striga Asiatica*, these were bands at: 3293 cm^{-1} (OH groups), 2920 cm^{-1} (aliphatic νCH_2), 1602 cm^{-1} (mainly due to C=C and C=O vibrations), 1416 cm^{-1} (CH and aromatic vibrations), 1283 cm^{-1}, and 1028 cm^{-1} (C-O- vibrations) and 945 cm^{-1}. Moreover, for *Polygala Paniculata*, bands at: 3084 cm^{-1} (OH groups), 2912 cm^{-1} (aliphatic νCH_2), 1605 cm^{-1} (mainly due to C=C and C=O vibrations), and in the range of 1233 to 1008 cm^{-1} (C-O- vibrations) were observed. Both FTIR spectra suggested the presence of polyphenolic compounds such as flavonoids as described in previous work (Kakpure *et al*., 2014; Lapa *et al*., 2009). For the synthesis of AgNPs, the ethanolic plant extracts were used as the reducing agent, where the successful synthesis AgNPs was indicated by the presence of dark solids dispersed in the reaction mixture after being left overnight. The polyphenolic compounds such as flavonoids present in both *Striga Asiatica* and *Polygala Paniculata* ethanolic extract is the acting reducing agent which is responsible for the reduction of Ag(I) to Ag(0) to produce AgNPs. This is because the flavonoids can behave as electron shuttling agents for the reduction of silver ions to silver nanoparticles to occur. Figure 3 showed the reaction mixture and resulting AgNPs synthesized by using ethanolic extract of *Striga Asiatica* and *Polygala Paniculata*.

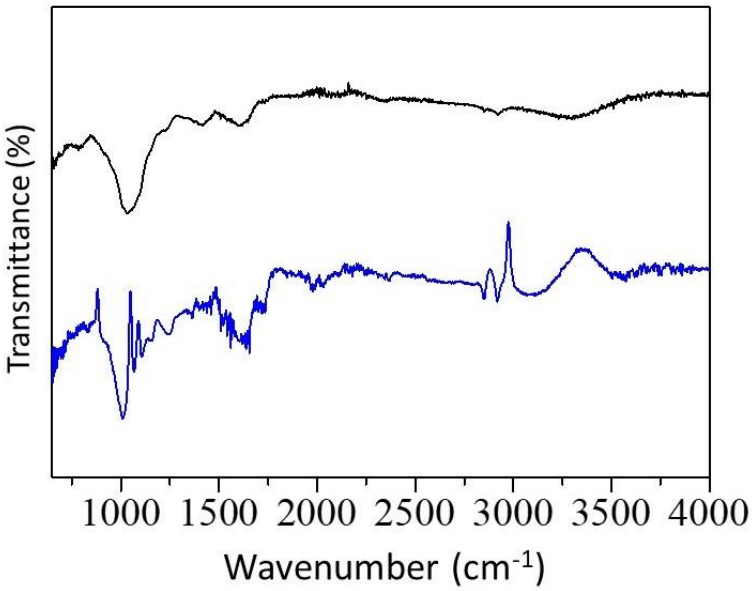

Figure 2: FTIR spectrum of *Striga Asiatica* (black line) and *Polygala Paniculata* (blue line)

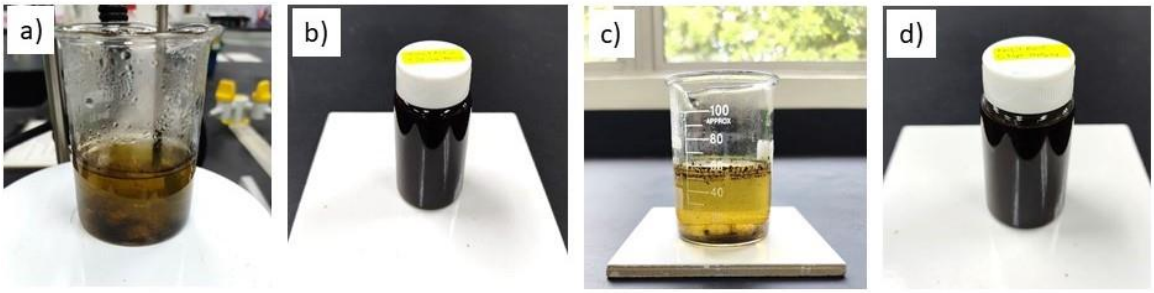

Figure 3: a) Reaction mixture of $AgNO_3$ solution with *Striga Asiatica* ethanolic extract, b) Resulting AgNPs from reduction using *Striga Asiatica* extract dispersed in ethanol with dark-brownish colour, c) Reaction mixture of $AgNO_3$ solution with *Polygala Paniculata* ethanolic extract, d) Resulting AgNPs from reduction using *Polygala Paniculata* extract dispersed in ethanol with dark-brownish colour

CONCLUSION

Herein we report a green approach for the synthesis of gold and silver nanoparticles using ethanolic extract of *Striga Asiatica* and *Polygala Paniculata*. This approach proved to be a simple and efficient method to synthesize the metal nanoparticles without using any harmful chemicals as the reducing agents such as sodium borohydrite. Future works include the analysis of synthesized silver nanoparticles with UV-Vis spectroscopy to further support the results and application of the silver nanoparticles in catalysis reactions.

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