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The Green Synthesis AgNPs from Basil Leaf Extract

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***Abstract*—**Bioreduction of silver nanoparticles (AgNPs) from silver ions (Ag^+) using water extract of Thai basil leaf was successfully carried out. The basil leaf extract provided a reducing agent and stabilizing agent for a synthesis of metal nanoparticles. Silver nanoparticles received from cut and uncut basil leaf was compared. The resulting silver nanoparticles are characterized by UV-Vis spectroscopy. The maximum intensities of silver nanoparticle from cut and uncut basil leaf were 410 and 420, respectively. The techniques involved are simple, eco-friendly and rapid.

***Keywords*—**Basil leaves, Silver Nanoparticles, Green Synthesis, Plant Extract.

I. Introduction

RECENTLY, metal nanoparticle (NP) research is expected to progress [1] because the advantage of properties such as large surface area to volume ratio, optical catalysis and electrical properties [2]. The development of nanotechnology has grown with the creation, production, characterization and application of nanoparticles in many fields [3]-[5]. Noble metal nanoparticles, such as gold (Au) and silver (Ag), have gained the attention of many scientific due to applications in medicine, biology, and the environment [6]. In this research, we were interested in the method for synthesized silver nanoparticles. There are a lot of methodologies for producing silver nanoparticles but greener and eco-friendly synthesis required considerable investigation. Plant extracts are rich bioreducing agents that can reduce silver ions to silver nanoparticles [7]-[10]. The advantage of the biosynthesis of silver nanoparticles is that it is an environmental friendly method that does not use toxic and expensive reagents and chemicals, the production of nanoparticles are suitable for use in medicine and health products because the particle's surface does not contain toxic reducing agents. Moreover, the rate of nanoparticles synthesis is fast and the reducing form is more stable in plant extracts. Thai basil or holy (Fig. 1) is well-known as a popular ingredient in Thai cuisine and as a Thai herb. The major chemical compounds in basil leaf extract are triterpens, flavonoids and eugenol [11]-[14]. These components have great potential in the reduction of silver ions to silver nanoparticles. The silver nanoparticles were characterized by UV-Vis spectrophotoscopy [15].

By taking advantage of the bio-synthesis of metal nanoparticles, we report here a synthesis of silver nanoparticles by Thai basil leaf extract using water extraction.

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Fig. 1 Fresh basil leaf from a local market in Bangkok, Thailand

II. Experiment

A. Reagents and Chemicals

Silver nitrate was purchased from Merk (Germany). Basil leaf was obtained from a local market in Bangkok. All chemicals and reagents used were of the analytical grade as received and without further purification. All aqueous solutions were prepared with doubly-distilled water, which was obtained from a Milli-Q water purifying system (>18.2 MΩ cm).

B. Preparation of Basil Leaf Extract

Extract was prepared by using fresh basil leaves. The basil leaves were washed thoroughly in running water for 5 minutes before being washed with deionized water. For increasing of the reaction rate, 1.5g of fresh basil leaves was placed in the blender with 5mL deionized water. Next, 1.5g of finely cut basil leaves and fresh basil leaves were taken and boiled in 100mL of deionized water for 5min. The basil leaf extract solution was then filtered through sterile serene cloth and re-filtrated through Whatman No. 1 filter paper. The filtrate was collected and stored at 4°C for further used.

C. Synthesis of Silver Nanoparticles

Nanoparticles of Ag were prepared by using basil leaf extract as a bioreducing agent. Aqueous solution of 1mM $AgNO_3$ was prepared. The basil leaf extract with different volume (1, 5, 10, 15 and 20mL) added to 5mL 1mM $AgNO_3$ in the conical flask under constant stirring rate and incubation at room temperature (30 °C). The bioreduction of Ag^+ ions into the formation of AgNPs with the reddish brown colors was observed within 8 hours. After that, the solutions were left at room temperature for 24 hours for complete settlement of nanoparticles. The solution was then centrifuged for the reaction mixture and the supernatant in the solution was discarded. The AgNPs solution was poured into the petri dishes and left in the oven for drying at 250°C for 24 hours.

D.Characterization of Silver Nanoparticles

The bioreduction of Ag^+ ions was monitored by measuring UV-Vis spectrum. For UV-Vis spectra analysis, 1mL of AgNPs solution was recorded on the UV-Vis spectrophotometer (JASCO-V630) with the scanned wavelength from 300-800 nm compared with 1mL of distilled water used as blank solution.

III. Result and Discussion

The synthesis of AgNPs using basil leaf extract as a bioreducing agent at room temperature was obtained from finely cut and uncut basil leaves. The aqueous solution of basil leaf extract is shown in Fig. 2.

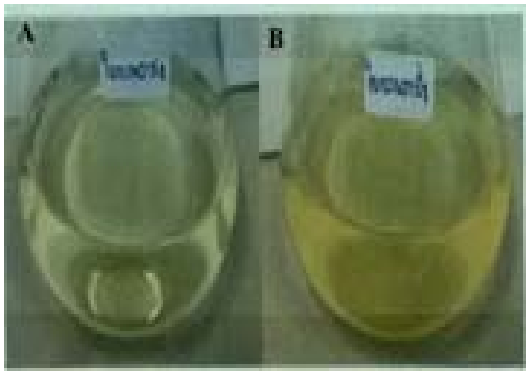

Fig. 2 Plant extracts from (A) uncut basil leaf and (B) cut basil leaf

The preliminary study of leaf extract was done by adding 5mL of 1mM $AgNO_3$ into the different volumes of plant extract. The reaction mixture was incubated for 24 hours at 30°C. The color change of the mixture solution from green transparent to reddish-brown is due to the occurrence of silver nanoparticle production (Fig. 3).

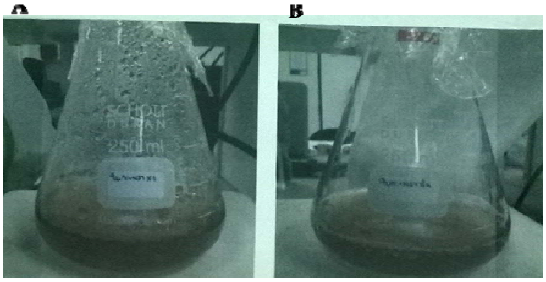

Fig. 3 Reddish-brown color change of silver nanoparticles by (A) uncut basil leaf and (B) cut basil leaf

Optical absorbance of the formation of silver nanoparticles was recorded on UV-VIS spectrophotometer in the wavelength from 300-800nm to confirm the reduction of silver ions. The reduced metal solution showed highly optical absorption band peak at 410nm for uncut basil leaf extract and 420nm for finely cut basil leaf extract. When the wavelength is increased, the absorption intensity is decreased leading to the formation of bigger particles of silver. The weak absorption peak at around 300 and 500nm indicate the presence of several organic compounds that can be reduced silver ion in the solution. From Fig. 4, the absorption peak of uncut basil leaf was slightly higher than cut basil leaf. This result indicated; it is unnecessary for basil leaves to be finely cut before extraction. The uncut basil leaf was then used for further experimentation.

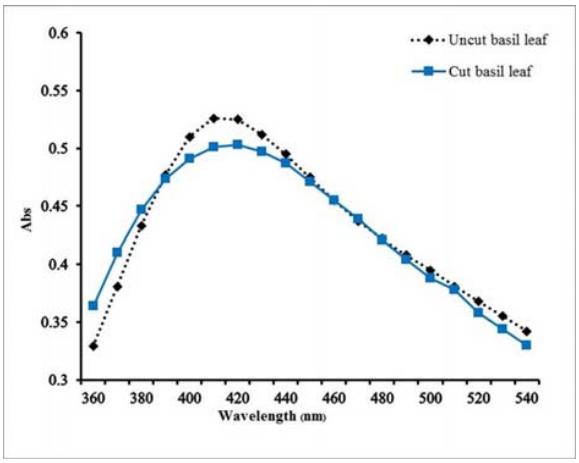

Fig. 4 UV-Vis spectra of silver nanoparticle received from uncut basil leaf (A) and cut basil leaf (B)

IV. Conclusion

This report was showed the basil leaf extract contained an active reducing agent, so it reduced metal ions into metal nanoparticles. The study demonstrated that herbal silver nanoparticle could be produced by a green synthesis method. The method provided a lot of advantages over other techniques such as being a simple method, low-cost, effective, eco-friendly, and leading to point-of-care laboratory. The average estimate particle size obtained from his method was around 40 nm. Silver nanoparticles will used for antibacterial investigations in the future work.

Acknowledgment

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