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Green Synthesis of Silver nanoparticles in different media based on Syzygium cumini Extracts

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Abstract

This study aimed to synthesis of silver nanoparticles in different media by green synthesis, it was from Syzygium cumini extracted, which prepared by two methods: Aqueous extraction and ethanol by soxhlet apparatus and which represent equeous and ethanol media, respectively. Also syntheized silver nanoparticles by reducing agent of Trisodium citrate in order to comparison with green synthesis method. it was study the extracted of physiochemical properties such as: Density, viscosity, the percentage, pH and test of some activeness materials as Aldehyde And study biological activeness for silver nanoparticles prepared by green synthesis – Aqueous media. The results showed that, activeness of green synthesis for silver nanoparticle prepared of Syzygium cumini extracted and can utilized as antibiotic such as Coli. So we recommend, benefit of plant biomasses which has strength for preparation of silver nanoparticles by green synthesis which prepared in Ethanol media in order produced it by high quality and utilized it as antibiotic for Bacteria.

Keywords: Green synthesis; Syzygium cumini; Silver nanoparticles; Different media used for synthesis.

Introduction

*S*yzygium cumini, commonly known as Malabar plum, Java plum, or black plum, is an evergreen tropical tree in the flowering plant family Myrtaceae, it could consider one of plant biomasses for the manufacture of sustainable nanocomposites and nanoparticles, which are frequently used in biological approaches [1 – 2].

Silver nanoparticles have attracted and demandable research of interest due to its distinct properties such as good catalytic activity, Surface Enhanced Raman Scattering (SERS) and antimicrobial activity. Silver is widely used as catalyst for the oxidation of methanol to formaldehyde and ethylene oxide. Due to colloidal nature it use as substrate for surface enhanced spectroscopy, as it partly require electrical conducting surface. In this era silver is use as antimicrobial agent. Recent focuses towards silver nanoparticle synthesis for increasing the treat of antibiotic resistance, caused by the misuse of antibiotic [3 – 4].

Silver nanoparticles can be synthesized using various methods: Biological, chemical Electrochemical, γ-radiation, photochemical, laser ablation etc. The most popular preparation of Ag colloids is by chemical reduction of silver salts using sodium borohydride or sodium citrate. This preparation is rather simple, but the great care must be exercised to make stable and reproducible colloid. However, the particle size influenced by the solution temperature, concentrations of the metal salt, the reducing agent and the reaction time [5 - 6].

However, these reports on the synthesis of silver nanoparticles use hazardous chemicals, have low material conversions, high energy requirements and consist of difficult and elaborate purification steps. Researchers have since initiated the synthesis of nanoparticles using green methods [7].

In order to benefit of plant biomasses such as Syzygium cumini, this study aimed to use the extracts for green synthesis of silver nanoparticles, utilized as antibiotic such as E. Coli. Also the synthesis, the structure, the morphology and the size were investigated by UV/VIS, SEM and biological activity.

Materials and Methods

Area of Study
Dry Samples taken from local market in Port Sudan, Red Sea State, Sudan.

Preparation of Samples
Syzygium cumini extracted, which prepared by two methods, after dried the sample in room temperature for removing moisture and made it small pieces by mortar, then separated it to two part for extraction preparation: Firstly: Aqueous extraction: Fresh Hypoxis Hemerocallidea plant, Deionized water: 15 g: 150 ml. And then the extracted was filtered by filter paper in order to purified of extracted. Secondly: Ethanol using soxhlet extractor apparatus: Dry sample, Ethanol: 15 g, 150 ml, which represent aqueous and ethanol media, respectively. Also prepared silver nanoparticles by reducing agent of Trisodium citrate (1mM) in order to compare with green synthesis method.

Green Synthesis of Silver Nanoparticles by different media based on Syzygium cumini Extracted

Green Synthesis of Silver Nanoparticles by aqueous extracted of Syzygium cumini:
Green synthesis of silver nanoparticles by aqueous extracted of Hypoxis Hemerocallidea, was done by reacted 90 ml of Silver nitrate (1mM) with 10 ml of aqueous extracted of Hypoxis Hemerocallidea at room temperature [8]. Then silver nanoparticles solution was kept it, to be ready

for characterization (for UV/VIS it was tested after 24 hours from synthesis and after one week). For SEM test, separated silver nanoparticles solution by Separating Funnel, in order to get silver nanoparticles. After that it dried by added of MgSO4.

Green Synthesis of Silver Nanoparticles by ethanol extracted of Syzygium cumini:
Green synthesis of silver nanoparticles by ethanol extracted of Hypoxis Hemerocallidea, was done by reacted 90 ml of Silver nitrate (1mM) with 10 ml of ethanol extracted of Hypoxis Hemerocallidea at room temperature. Then silver nanoparticles solution was kept it, to be ready for characterization.

Synthesis of Silver Nanoparticles by Trisodium citrate:
Silver nanoparticles was synthesized by reducing agent of Trisodium citrate (1mM), was done by reacted 20 ml of Silver nitrate (1mM) after heated at 90 ˚C with 6.25 ml of Trisodium citrate with stirring for 15 minute. Observed it change colour to yellow pale, indicated that to formation of silver nanoparticles, as in Figure 1. Then it kept to be ready for characterization. And in order to comparison it with silver nanoparticles which were synthesized by green synthesis [9].

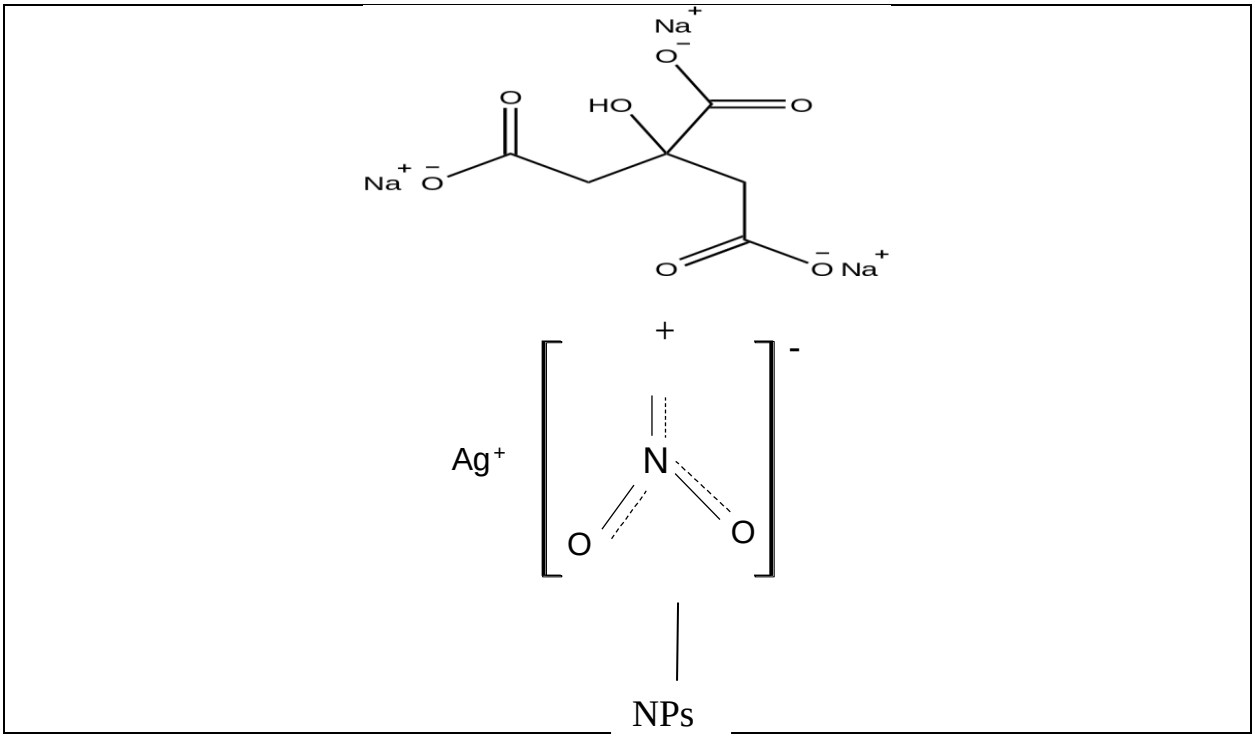

Figure 1: Synthesis of Silver nanoparticles by reducing agent of Trisodium citrate. [10-11].

Characterization of Syzygium cumini extracted and Silver nanoparticles

Physiochemical properties of Syzygium cumini extracted were done such as: Density, viscosity, the percentage, pH and test of some activeness materials as Aldehyde.

Characterization of Silver Nanoparticles

Characterization of silver nanoparticles which synthesized by green synthesis and by reduce reagent was done by ultraviolet visible (UV/Vis) and Scanning Electron Microscopy (SEM). And study biological activeness for silver nanoparticles prepared by green synthesis.

Results and discussion

The Result of Green Synthesis of Silver Nanoparticles by aqueous extracts of Syzygium cumini, as shown in Figure 2:

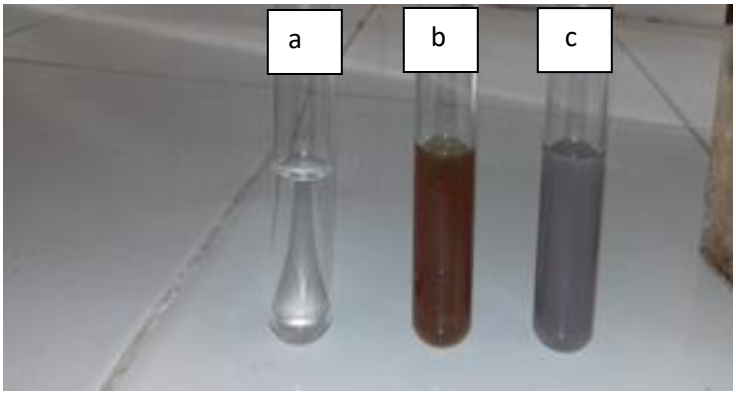

Figure 2: Steps of Green Synthesis of Silver Nanoparticles: a: Silver nitrate, b: Aqueous extracted of Syzygium cumini, c: Silver Nanoparticles

From above Figure 2, observed it change extracted color, indicated that to formation of silver nanoparticles.

The Result of Physiochemical properties of Syzygium cumini extracted, as shown in Table 1:

Samples / Tests	Aqueous extracted	Ethanol extracted
Density	1.01 g/cm^3	-
Viscosity	-	1.08 kg/m/s
Percentage	75 %	% 10
Quantity test of Aldehyde	Blue gel precipitation appears by Fehling reagent and Violet precipitation appear by Schiff reagent	-

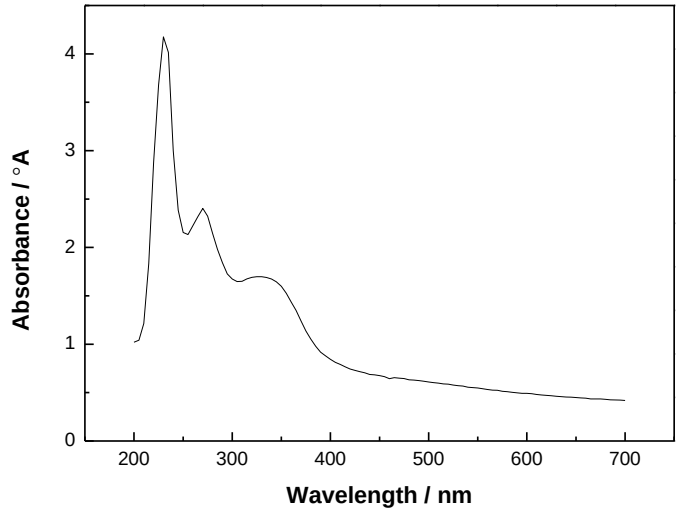

Figure 3: UV/VIS to confirmation green synthesis of Ag – NPs based on aqueous media.

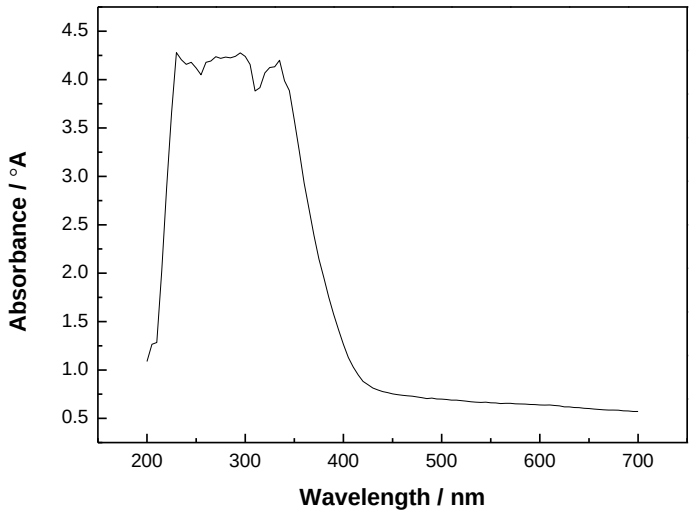

Figure 4: UV/VIS to confirmation green synthesis of Ag – NPs based on Ethanol media.

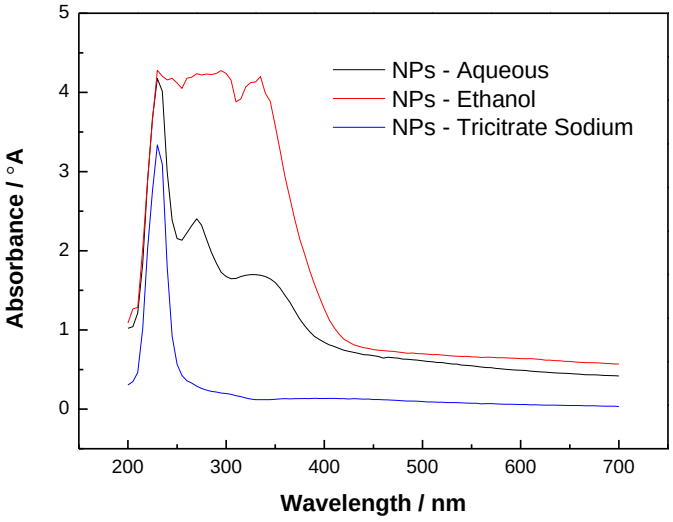

Figure 5: Comparison synthesis of Ag – NPs based on green synthesis by Syzygium cumini extracted and reducing agent of Trisodium citrate.

Ag – NPs synthesized by green synthesis based on Syzygium cumini extracted (ethanol media) better than reducing agent of Trisodium citrate as shown in Figure 5. Absorbance of Ag – NPs synthesized by ethanol, aqueous media and Trisodium citrate were 4.270 ºA at wavelength 230 nm, 4.176 ºA at wavelength 230 nm and 0.25 ºA at wavelength 300 nm, respectively.

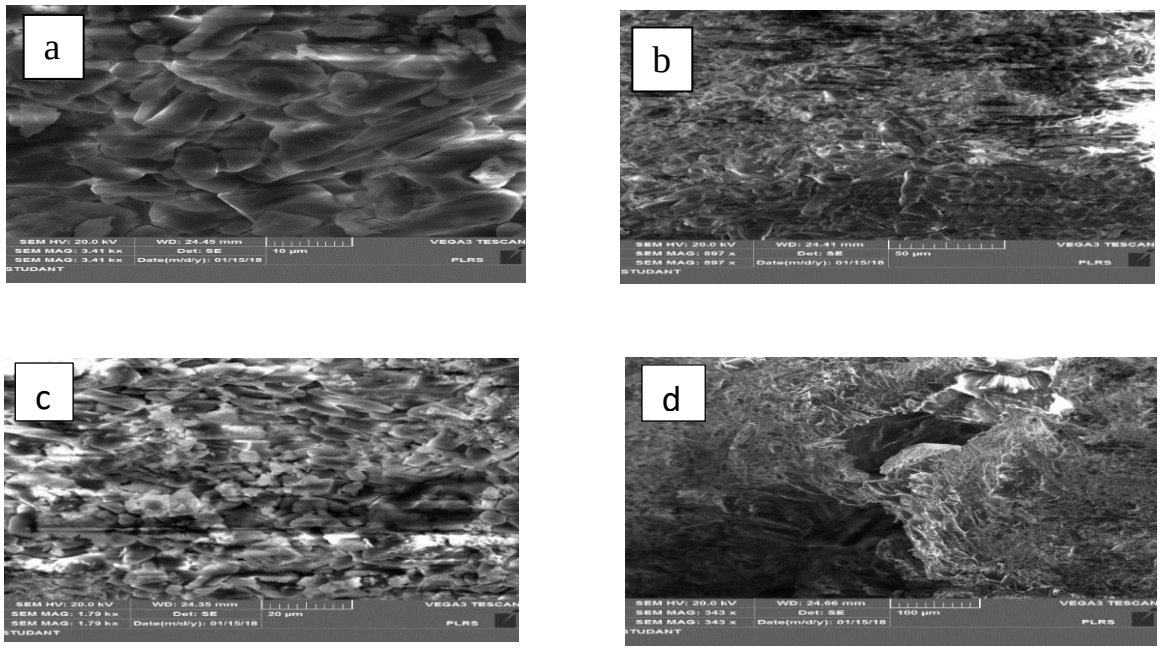

Figure 6: SEM test, confirmation synthesis of Ag – NPs based on green synthesis (Aqueous extracted) at different magnification.

The Result of biological activeness of Ag – NPs synthesized by green synthesis of aqueous extracted of Syzygium cumini, as shown in Figure 7:

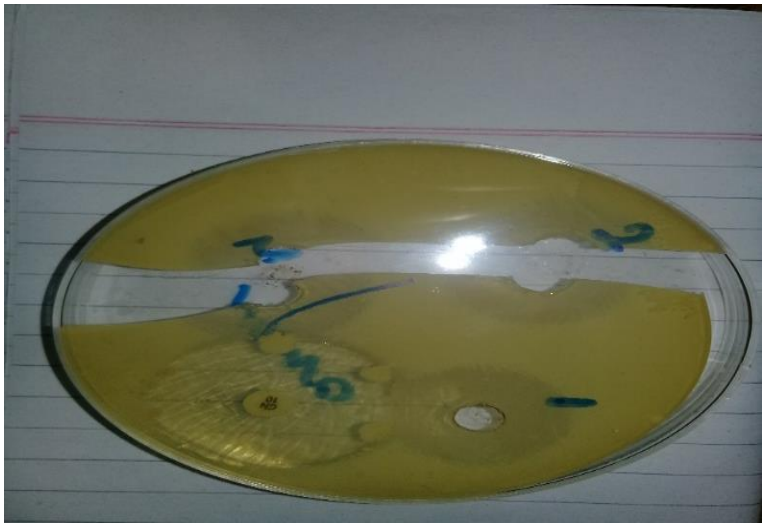

Figure 7: Biological activeness of Ag – NPs synthesized by green synthesis of aqueous extracted of Syzygium cumini, (1: Ag – NPs synthesized in this study, 2 and 3 our other work in green synthesis of Ag – NPs based in Maonolia Virainiana and Hypoxis hemerocallidea, respectively).

Conclusion

Plant biomasses can benefit of it in order to green synthesis, such as Syzygium cumini which utilized its extracted in this study to synthesis of silver nanoparticles in different media by green synthesis, it was prepared by two methods: Aqueous extraction and ethanol by soxhlet apparatus and which represent equeous and ethanol media, respectively. Also synthesized silver nanoparticles by reducing agent of Trisodium citrate in order to comparison with green synthesis method. it was study the extracted of physiochemical properties such as: Density, viscosity, the percentage, pH and test of some activeness materials as Aldehyde. And then characterization of silver nanoparticles by ultraviolet visible (UV/Vis) and Scanning Electron Microscopy (SEM). and study biological activeness for silver nanoparticles prepared by green synthesis – Aqueous media. The results showed that, activeness of green synthesis for silver nanoparticle prepared of Syzygium cumini extracted and can utilized as antibiotic such as E. Coli.

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