Biosynthesis Silver Nanoparticle Using Fresh Water Algae

Dahlia[1], Sherry Aristyani[1], and Robiatul Hadawiyah[1]
[1] Department of Biology, Faculty of Mathematics and Sciences, State University of Malang, Malang Indonesia, email: dahlia_bio@um.ac.id

Abstract— Fresh water algae such as Hydrodictyon sp.and Oedogonium sp. is common and have wide deployment in Indonesia. Unfortunately, these algae is not widely used by the people except for fish food by the people.In this study, we investigated these algae for synthesizing silver nanoparticle (AgNPs). The AgNPs were prepared by the reaction of 1 mM silver nitrate and aqueous extract of Hydrodictyon sp.and Oedogonium sp. The AgNPs were characterized by spectrophotometer and XRD. From this study, it has been concluded that fresh water algae Hydrodictyon sp.and *Oedogonium* sp .could be materials for producing AgNPs but it was still not perfectly.

Key words— fresh water algae, *Hydrodictyon* sp., *Oedogonium* sp.,silver nanoparticle

INTRODUCTION

Nanoparticles are the small materials which have structure size of 1-100nm [1]. Nanoparticles preserves in the crystals which have a structure of low energy at the expense of the boundary regions which are regions at which all the misfit is concentrated so that a structure far away from equilibrium is formed [2]. So far, the synthesis of nanocrystalline materials have been carried out most frequently by assembling pre-generated small clusters by means of in situ consolidation and sintering. The synthesis methods of nanomaterial can use generation of nanometer-sized cluster, Cluster deposition, High-energy milling, Mixalloy processing, Deposition methods, and Sol-gem method [2]. This methods have undesired impact on the environmental and social life cause their products are toxic solvent or materials. Recently, another studies develop sustainable procedures like green synthesize using special kind of plants, microorganism, or enzyme [3]. It is called biochemical synthesize or green synthesize of nanoparticles. This procedure has more adventage than chemical methods like produce a large number of nanoparticles, lower cost, and environmental friendly for nature [4].

Fresh water algae such as *Hydrodictyon sp.* and *Oedogonium sp*. is common and have wide deployment in Indonesia. They are the macroalgae which have mutiselluler structure and photosynthesize available of the order Chlorococcales. Unfortunately, these algae is not widely used by the people except for fish food by the people. However, reports on freshwater algae are lacking. The use of environmentally materials like algae extract for the synthesize of silver nanoparticles offers more numerous benefits of eco-friendliness and compability for bio-ecology application than use of toxic chemicals for synthesize protocol [6].

MATERIALS AND METHODS

a. Sample collection and preparation

The green microalgae *Oedogonium sp.* and *Hydrodiction sp.* were collected from fresh water areas in Malang, then they have been brought to the laboratory and washed for several times with the tab water to separate the molluscs and another plants sticking on algae. The algae than were dried in the shade area for 3 days, then it was dried in an oven for 3 days, and powdered using powder machine.

b. Preparation of algae extract

Dried powdered of *Oedogonium sp* and *Hydrodiction sp* were mixed with 100 ml destilled water in the beaker glass. The mixture were then centrifuged at 4000 rpm for 10 min at 4°C. Finally, the extracts were collected and stored at 4°C for further uses.

c. Sythesis of silver nanoparticles

10 ml of the aqueous extract of each algae was added into 90ml of aqueous solution of 1 mM silver nitrate ($AgNO_3$). The mixture was exposed for 18 hours in the room temperature. Appearance of red color in solution indicated the formation of silver nanoparticles.

d. UV-spectrophotometer analysis

The reduction of pure silver ions was recorded by measuring the UV Spectrophotometer of the solution at room temperature at the wavelength of 350-550 nm.

e. Powder X-ray diffraction (XRD) analysis

The red solid product was separated by repeated centrifugation at 12.000 rpm for 10 min three times and followed by dispersion of the pellet of SNPs into deionized water. The soled then dried in an oven at 60°C for 3 days. The X-ray diffraction (XRD) pattern was obtained with using Cu-Ka radiation, the data were collected from 10° to 80° (2θ).

RESULTS AND DISCUSSION

When the both the extracts were mixed with $AgNO_3$, the biosynthesis occur for some hours and the color changed into brown color (Fig. 1 and Fig. 2). It indicated that there were formation of silver particles [3, 4, 5, 6]. This color difference was due to the reduction of silver ions. Metallic nanoparticles scatter and absorb light at certain wave lengths due to the resonant collective excitations of charge density at the interface between a conductors and insulator, phenomena known as surface plasmon resonances [4].

Fig 1. The Change of solutions during tge bioreducyion of $AgNO_3$ into AgNPs using Hydrodictyone sp. extract a. control b. the solution after 18 hours

a.

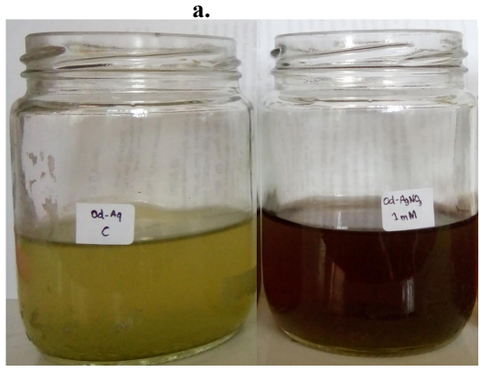

Fig 2. The Change of solutions during tge bioreducyion of AgNO3 into AgNPs using Hydrodictyone sp. extract a. control b. the solution after 18 hours

ISBN: 978-602-60569-5-5

Spectrophotometer is one of the most method for charateriziying the nanoparticles. The result of the measurment using spectrophotometer (Fig.3. and Fig. 4.)

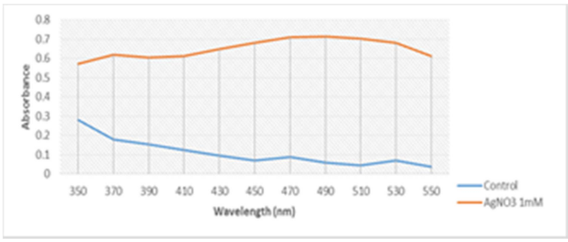

Fig. 3. The spectrophotometer result of biosynthesis AgNPs using Hydrodictyon sp. extract

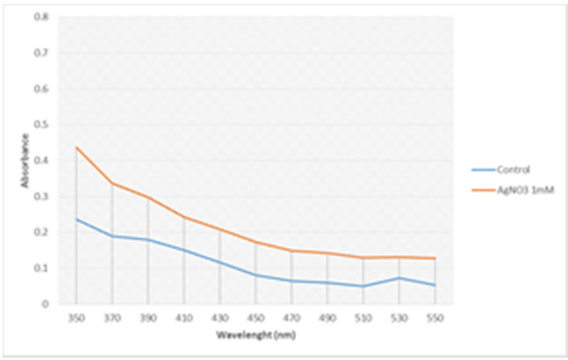

Fig. 4. The spectrophotometer result of biosynthesis AgNPs using Oedogonium sp. extract

According to the spestrophotometer result, it indicated that (Fig. 3.) surface plasmon resonance was observed at 470 – 490 nm. However, the plasmon surface value of nanosilver was in the 420-450 nm (Salari). Moreover in the (Fig. 4.) the result show there was no peak. It indicated that AgNPs were could not be synthesis perfectly.

The sampel were also charactizised by X-ray Diffraction analysis. The diffracted intensities were recorded from 10^o to 80^o at 2θ angles (Fig. 5.) and (Fig. 6.)

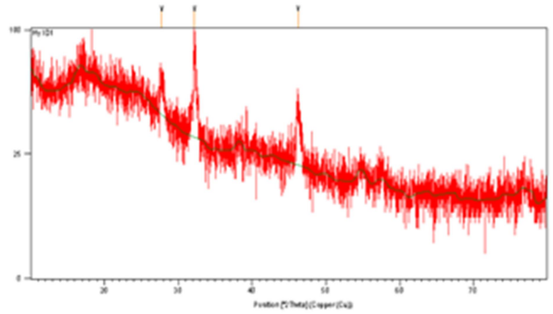

Fig. 5. The XRD pattern of synthezied of AgNps using Hydrodictyon sp. extract

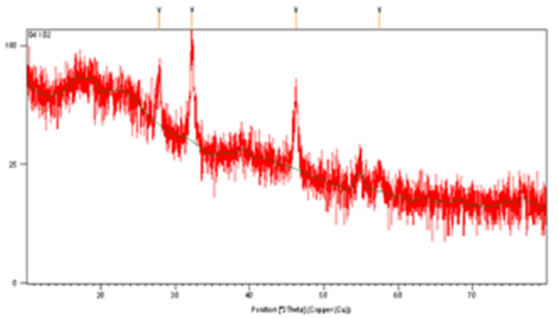

Fig. 6. The XRD pattern of synthezied of AgNps using Oedogonium sp. extract

There was three peaks showed in (Fig.5), and the peaks of 2θ were appeared (27.7729^o; 32, 232^o and 46,2250^o). That corespondence [-311], [-411], and [-612]. However, in (Fig. 6) showed four paeaks, and the peaks 2θ were appeared (27.8132^o; 32.2742^o ; 46.242479^o; and 57.4837^o). That corespondence [-311], [-411], [-612], and [131] . Both of the result were not indicated the Ag pure christale. We assumed that it was contaminated with nitrat (NO_3), and the $AgNO_3$ still not reduced well. The size of particle that showed in (Fig. 5) was 67.8; 30 and 80 nm and the mean value was 59.27 nm. In another side, The particle size of (Fig. 6) was 17.33; 21,08; 27,4 and 7.9 nm, and the mean value was 15. 44 nm.

According of the result, we could know that *Hydrodictyon sp* and *Oedogonium sp* colud synthezise silver nanoparticles, nevertheless it was still not pure Ag particles.

REFERENCES

[1] Góralska, M.K. Senze, M. Polechoński, R. Dobicki, D. Pokorny, P. Skwarka, T. 2015. Original Research Biocidal Properties of Silver-Nanoparticles in Water Environments Pol. J. Environ. Stud, 24 (4): 1641-1647

[2] Gleiter, H. 1989. Nanocystalline material. Progress in Materials Science, 33: 223-315.

[3] Salari, Z. Danafar, F. Dabaghi, S. Ataei, S.A. 2016. Sustainable Synthesis of Silver Nanoparticles Using Macroalgae Spyrogyra Varians And Analysis of Their Antibacterial Activity. Journal of Saudi Chemical Society. 20: 459-464.

[4] Sinha, S.N. Paul, D. Halder, N. Sengupta, D. Patra, S.K. 2015. Green Synthesize of Silver Nanoparticles Using Fresh Water Green Alga Pithophora oedogonia (Mont) Wittrock and Evaluation of Their Antibacterial Activity. Appl Nanosci, 5: 703-709.

[5] Firdhouse, M.J & Lalitha, P. 2013. Biosynthesis of Silver Nannoparticles Using the Extract of Alternanthera sessilis – antiproliferative Effect Againts Prostate Cancer Cells. Cancer Nano, 4:137-143

[6] Logeswari, P., Silambarasan, S., & Abraham, J. 2015. Synthesis of Silver Nanoparticles Using Plants Extract and Analysis of Their Antimicrobial Property. Journal of Saudi Chemical Society. 19 (3): 311-317