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Synthesis and Study of Silver Nanoparticles Using Iraqi and Indian *Lawsonia inermis* Plant and their Catalytic Performance in Degradation of Organic Pollutant

Abstract- In this work, we depict the cheap, friendly environment, an unreported and easy methodology for the synthesis of silver nanoparticles using the extract of leaf concentrate of Lawsonia inermis as a green, reducing agent. Silver nanoparticles display exclusive physical characteristics, which have appealed serious research attention due to their essential uses. In present work, silver nanoparticles were synthesized for environment uses by means of a completely green biosynthetic process using Lawsonia inermis flowers extract (henna). The structure, as well as properties of silver nanoparticles, was investigated with UV-visible spectroscopic techniques, scanning electron microscopy (SEM), energy dispersive X-ray spectrometers (EDS) and zeta potential. The maximum peak absorption by using UV-visible spectroscopic analysis was found at 460and 495nm, which point to the production of silver nanoparticles. Usual slight particle diameter that is determined by SEM was found to (10-46nm). Furthermore, zeta potential investigation shown that silver nanoparticles have good stability. EDX analysis also displays the presentation of a silver element. The methylene The catalytic effectiveness using light (LED) with silver nanoparticles was additionally researched in catalytic degradation of methylene blue dye. blue dye degrades 16 - 24.8% within 40 min for Iraqi & Indian henna produced better catalytic activity because of smaller particle size of silver, which is less than (10) nm in Indian henna.

Keywords- *Lawsonia inermis(henna); green synthesis of silver nanoparticles, degradation of Methylene Blue, zeta potential, zeta sizer, SEM-EDS.*

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1. Introduction

Nanoparticles are reflected as the main structural sufficient of nanotechnology. The greatest important property of the nanoparticles is that they unveil higher activity. There are significant uses of metal nanoparticles in the felids of diagnostic biological probes, catalysis, devices, and optoelectronics [1]. The extensive practical application of metal nanoparticles (<100 nm) is owed to a number of their unique properties and activities [1,2]. Metal nanoparticles are usually synthesized using physical and chemical processes [3]. Many procedures like hydrothermal [4], conventional heating [5], anodization [6], deposition-precipitation [7], wet oxidation [8], electro deposition [9], and sonicating [10] are being applied to synthesize the nanoparticles. In addition, these creation approaches are usually costly and manual and are potentially dangerous to the location and living organisms.

Green synthesis has advanced over chemical and physical process as it is price operative, ambiance friendly, and easily convert up for great rate synthesis and in this process; there is no need to use high power, temperature, and lethal chemicals. Green synthesis offers well influence, control over crystal growth, and their stability. Green synthesized nanoparticles are low-cost and efficient and have many applications in science [11].

From the dawn of civilization, human beings have used several medicinal plants to fight diseases [12].

Lawsonia inermis is generally known as "Henna." It is famous worldwide because of its cosmetic use

for the reason of exclusive active values in the leaves. It contains a different variation of molecules, which are bioactive.

Organic dyes are used in many activities such as pharmacy, food, plastics, cosmetics, and paints. These manufactured dyes are unsafe for social wellbeing as well as hazardous to environmental treatments like coagulation; filtration, adsorption, and reverse osmosis have been used for dye removal. However, it is hard to take away these dyes from water because of their aromatic structural stability. Nano-catalysts are one of the capable agents for the reduction of synthetic dyes[13]. Therefore, in the current study, we have been examining the degradation of methylene blue dye with the silver nanoparticles, which is synthesized by a green method from henna as a catalyst by light cracking. Green synthesis leaf extract as bio-decreasing and bio-improving material t. withal, to the finest of our facts, use of such a plant from unalike places in the world and match for the synthesis of metal nanoparticles.

2. Experimental

I.Materials

$AgNO_3$ was bought from Merck (Darmstadt, Germany). Samples of *Lawsonia inermis* (henna) were gotten from a local source. The solutions were prepared with deionized water. Further chemicals were of analytical grade.

II.Extraction Preparation

As shown in Figure 1.

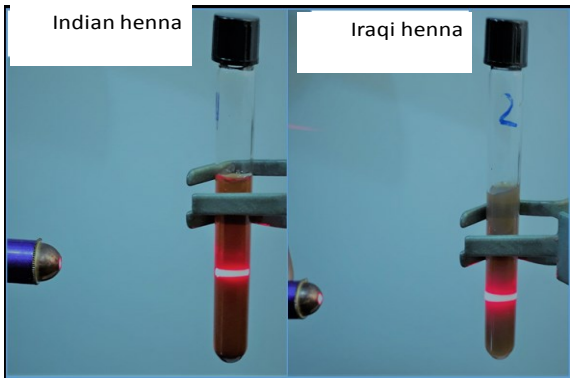


Figure 1: displays the mixture after (3) min with the formation of silver nanoparticles confirmed by laser beam

3. Results and Discussion

I.Characterization of silver nanoparticles

a. UV-Vis spectroscopy

The reduction of Ag^+ ions to Ag^0 was observed by procedure the UV–Vis spectroscopy technique. (1.0) ml of silver nanoparticles solution was diluted to (3.0) ml using deionized water. The spectra graph analysis was done by UV- Vis spectrophotometer type (UV-160 v, Shimadzu, Japan) on the range between (300-500) nm, absorption peaks were detected at (460-550) nm sections and this is agreed with Nicholas [14], because of the excitation of surface Plasmon vibrations in the silver nanoparticles solution, which is matching to the characteristics of UV metallic silver. Figure 2 shows UV-visible absorption spectra of silver nanoparticles 465 nm and 495 for Indian and Iraqi henna, respectively.

The reduction of AgNO3.lead to the presence of the dark brown color could be because of the excitation of (SPR) effect .

The centered of (460, 495) nm absorption spectrum displayed a strong absorption peak, which presented the formation of silver nanoparticles (Figure 2), which agreed with the data absorption peaks that are reported by [1] to synthesize silver nanoparticle by means of green procedures. These products were fine dispersed without using different chemical and physical capping agents. The synthesized silver nanoparticles from the leaf of Lawsonia inermis extracts were detected to be very stable in the solution, about one month after their synthesis. Totally, the best-synthesized nanoparticles were found to be by mixed in a ratio of (0.1g) leaf extract to 0.1M (AgNO3) (5 mM) at 60 °C.

a. Scanning electron microscopy (SEM)

Scanning electron microscopy (SEM) operated at an accelerating voltage of (200) kV. The samples were done using (Zeiss instrument). Figure 3 shows the shape and size of the silver nanoparticles. The result indicates that the silver nanoparticles were just about spherical in shape, and with an average diameter of 10 ± 46 nm.

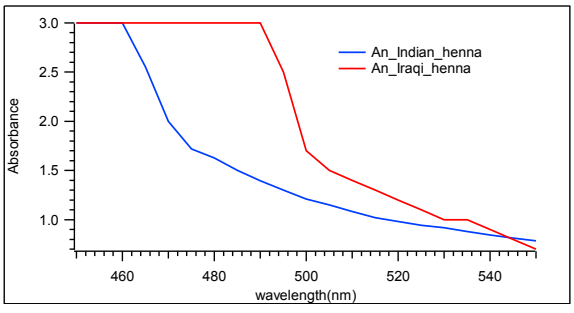
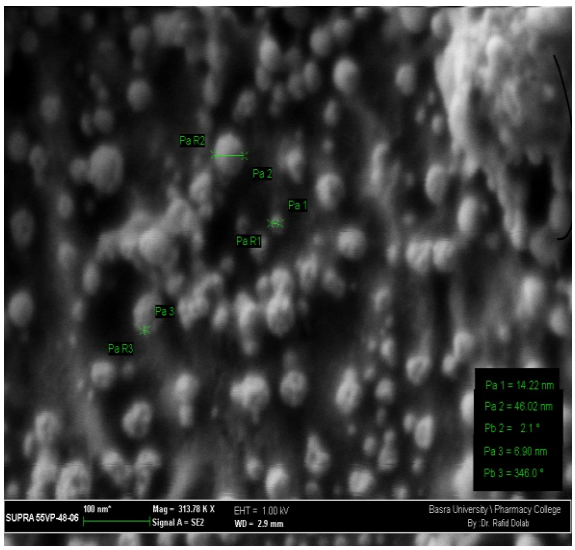


Figure 2: UV-visible absorption spectra of silver nanoparticles, which prepared from Indian and Iraqi henna



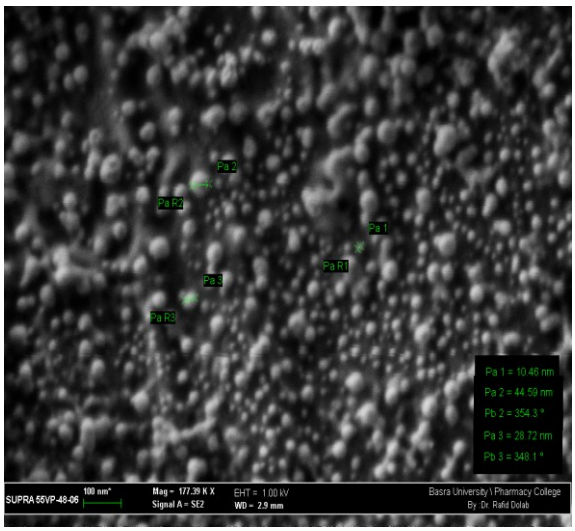


Figure 3: Demonstrations the shape and size of silver nanoparticles prepared by using Indian and Iraqi henna.

b. Energy Dispersive X-ray(EDS)

The elemental analysis of silver nanoparticles was evaluated by using (EDS).As seen in Figure 4 the silver peak appeared at 3 Kev

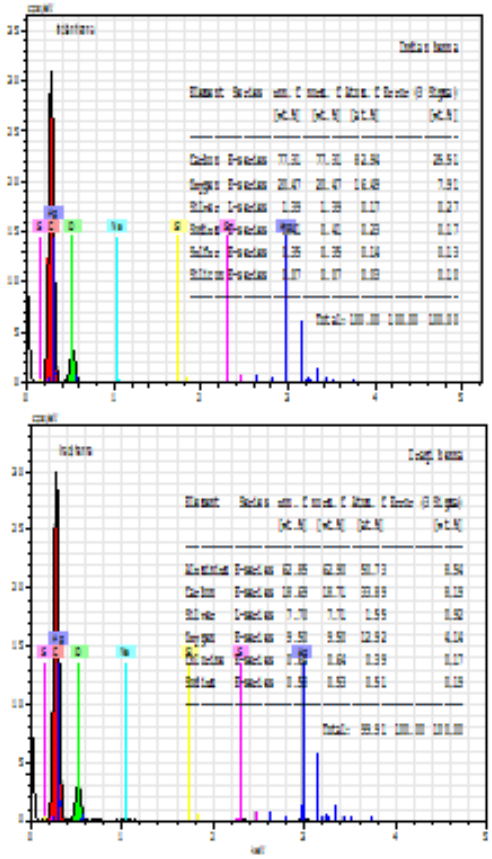


Figure 4: EDS analysis of prepared silver nanoparticles from Indian and Iraqi henna

c. **b. Zata sizer analysis**

d. The size distribution of nanoparticles also examine using Zata sizer and zeta potential; zeta sizer Figure 5 and Figure 6 show the intensity and size distribution of silver nanoparticles. Zeta distribution by intensity shows the high intensity of silver nanoparticles prepared by Iraqi henna, especially the particles in 100 nm size.

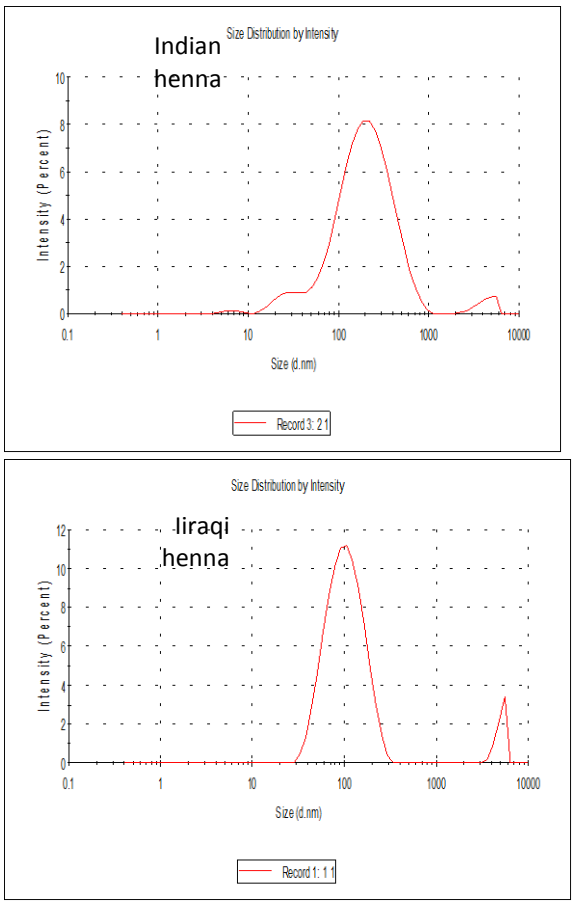


Figure 4: Zeta sizer by intensity for distribution of silver nanoparticles by their intensity.

The zeta sizer of the volume shows the volume of silver nanoparticles which prepared from Indian henna was less than 10 nm; however, the volume of Indian henna was more than 10 nm and with small quantity. The reason for that might be depending on the particle size of henna in original powder. Figure 5 shows zeta sizer; hence, the particles size less than 10 nm appears by Indian henna; however, the particles size average for Iraqi henna was more than 10 nm.

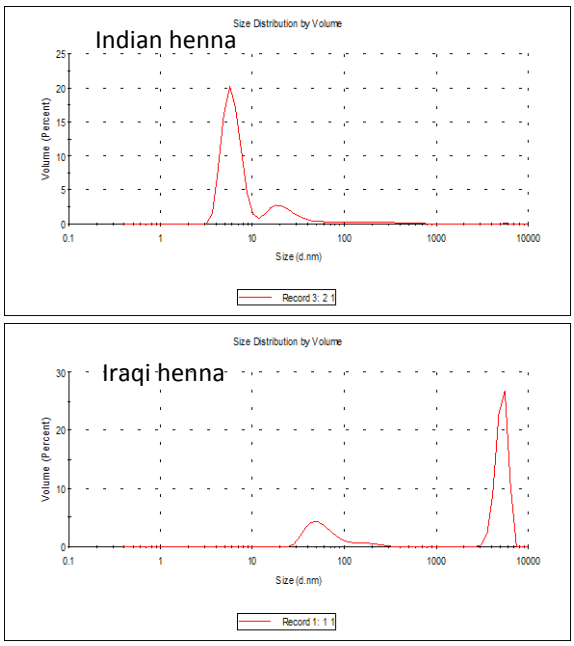


Figure 5: shows the size distribution of silver nanoparticles prepared by different types of henna.

Zeta potential of silver nanoparticles shows negative charges of silver nanoparticles Figure 6.

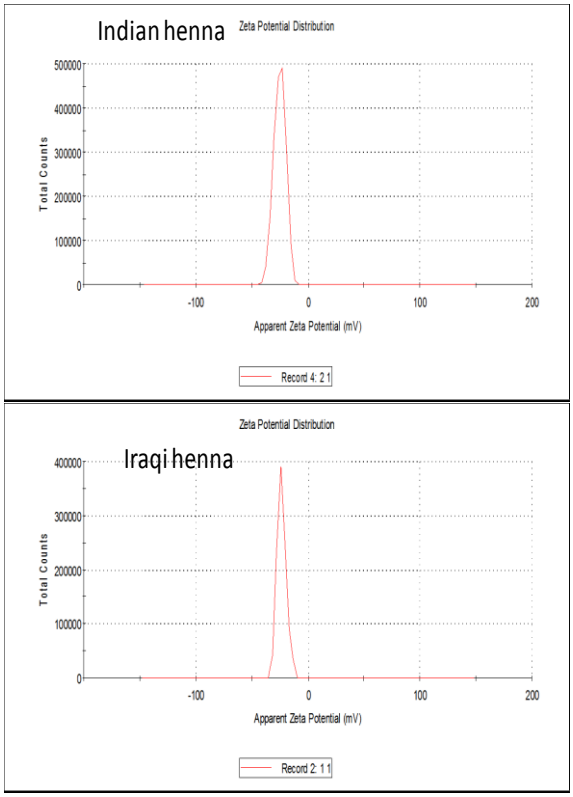


Figure 6: shows the zeta potential of silver nanoparticles prepared by different types of henna.

4. Degradation of methylene blue by using silver nanoparticles as a photocatalyst

The initial concentration of methylene blue is (5 ppm). The photocatalytic was done without the use of any kind of stirring. The concentration of

methylene blue in the presence of silver nanoparticles gradually decreased as a function of LED exposure time. After a 300-min exposure of the nanoparticles to LED light (30 watts), the concentration of methylene blue was continually decreased to reach values lower in comparison with photo degradation of methylene blue without the presence of silver nanoparticles. Figure 7 shows these effects.

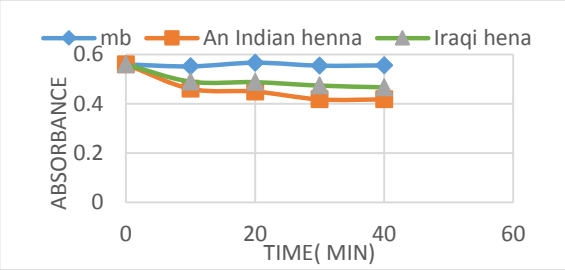


Figure 7: graph shows the degradation of methylene blue by using silver nanoparticles as a photocatalyst

Furthermore, it is clear that the rate of degradation is more when using silver nanoparticles. The reason is that using silver nanoparticles with high surface area to volume ration enhances the surface of degradation. Therefore, silver nanoparticles function in a beneficial rule as a photocatalyst. The degradation of methylene blue dye more when silver nanoparticles, which prepared from Indian henna, were used because the small particle size of prepared nanoparticles compared with Iraqi henna.

5. Conclusion

The current work shows the preparation of silver nanoparticles using different types of henna Indian and Iraqi henna. The prepared silver nanoparticles were almost spherical in shape, and with an average diameter of (10-14) nm. The prepared solution shows the capability of degradation of methylene blue dye in water using LED light (30 watts) confirmed the good catalytic activity of the prepared nanoparticles of silver on the reduction of methylene blue dye at ambient conditions. The methylene blue dye totally degraded within 40 min, and Indian henna produced better catalytic activity because of the smaller particle size of silver, which is less than (10) nm, which proved by Figure 5.

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