Growth Cinnamon Nanoparticles in Different Liquid by Pulsed Laser Ablation in Liquid PLAL

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Abstract: Exact synthesis and characterization of different nanoparticles is needed for a broad range of biomedical applications. Traditionally, cinnamon has been used in food preparations and as a medicinal Medicine for the prevention and symptoms of a number of illnesses. It's established that cinnamon has antioxidants,Antibacterial, anti-inflammatory, therapeutic and other properties. The characterization of "cinnamon nanoparticles" (CNPs) cultivated in liquid by "pulsed laser ablation" is recorded. The effect of various liquid media (ethanol and methanol) on CNP growth "morphology, structure and optical" properties is determined. " laser Q-switched Nd: YAG " 10 ns pulse length, 1 Hz wavelength 1064 nm and energy ablation laser (500 mJ) fluence of 15.92 J/cm^2 . Using the measurements FESEM, Uv-Vis and FTIR, FESEM images, nucleation with CNPs of an average size of 18.39 nm (in ethanol) and 45.43 nm (in methanol) were detected. CNP morphology has been found to be susceptible to liquid media. Our easy and creative approach will provide a basis for generating "CNPs" Determined size delivery potential for growth It was shown that by intuitively choosing the liquid growth media, "the structural , morphological, physical, optical properties" of such CNPs can be customized. This disclosure claimed that the current structured methodology could provide a basis for the efficient large-scale processing of CNPs for widespread applications.

***Keywords*:** Laser, , Ablation , CNPs, medium , Ethanol , Methanol ,

1. Introduction

Nanotechnology has been a well-known research field since the last century. At his well-known 1959 speech, Nobel laureate Richard P. Feyn-man introduced "nanotechnology". In the world of nanotechnology, there have been numerous groundbreaking advances. Nanotechnology developed at nanoscale level materials of different kinds. Nanoparticles (NPs) are a broad class of materials containing particulate substances with a minimum diameter of less than 100 nm. [1] In order to satisfy the need for biomedical and biophotonic use, smaller organic nanoparticles (ONPs) and nanostructures with various morphology are feasible [2,3] Organic nanoparticles can be distinguished from metallic nanoparticles with many advantages, including purity, non-toxicity, biocompatibility and low cost. Salim et al [4] Cinnamon is used in food preparations and conventional food preparations.Medicine since ancient times by the Egyptians and the chinese.in addition , it was observed that this spice has good antioxidants,Properties of antibacterial, antipyretic and anti-inflammatory substances they play a major part in the rehabilitation of tissues and Cinnamon has been found to slow down food spoilage and show Antifungal features Cinnamon is rich in polyphenolic and cinnamaldehyde components Hamidpour et al [5] For the physical , chemical and biological synthesis of nanoparticles, approaches are taken. that include laser ablation, phasetransport, chemical etching, sputtering, ball milling, sol-gel, vapor deposition, molecular condensation, enzymes, microorganism, etc., to name a few[6,7]. In accordance with solid ion implantation [8] And other chemical methods [9,10] "pulse laser ablation in Liquid" (PLAL) has become a popular procedure for the production of "organic nanoparticles", due to its many fascinating characteristics such as durability, variability, economic and contamination-free. [8,11] by adjusting the laser parameters such as "laser fluence, wavelength, pulse number and solvent" [8,12]. Connect between the laser beam and the substance of the target It contributes to the formation of a plasma and a cavitation bubble that condenses the ablated matter.[8] In this study, "CNPs" of different "morphologies" were preparation using PLAL technique to synthesize indifferent liquid media and subsequently analyzed through different analytical tools. The effect of differentiating liquid media ("ethanol and methanol") on the Morphology of Development , scale, durability, composition and optical properties of the prepared CNPs has been evaluated. Outcomes have been checked

2. Methodology (Experimental)

2.1 Raw materials

Cinnamon sticks commercially available (cinnamon cassia type) with dimensions of 60 mm x25 mm x 2 mm are bought from the local store (Baquba Diyala Iraq) as a target content, cut with dimensions of 10 mm x 10 mm x 2 mm and thoroughly washed with acetone using an ultrasonic bath for 60 minute before rinsing with clean water to prevent any organic contamination. And the use of analytical grade "ethanol" (98% purity) and "methanol" (98% purity) growth media.

2-2 Synthesis CNP in PLAL Method

In the PLAL strategy, a "Q-switched pulsed Nd:YAG" laser (repetition rate of "1 Hz, pulse period of 10 ns, wavelength" of 1064 nm, number pulses (1000 pulse /sec) and ablation energy (500 mJ) laser fluence of 15.92 J/cm^2) was utilized to ablation the bulk cinnamon stick (as target material for CNPs growth) . in the First instance , The "cinnamon stick" (target) was drenched at the bottom of the beaker filled with 5 ml of liquid media ("ethanol and methanol") , and then the laser pulse was fired straight through a focusing lens on the target surface (at average of 1000 pulse / sec). The interaction between the energetic laser photon (laser fluence of 15.92 J / cm^2) and the target surrounded by the liquid media allowed ultrafine cinnamon particles (so-called plasma plume) to be extracted. In the type of CNPs, and eventual nucleation As in Fig (1) [13]. on the target surface, the formed plasma plume was cooled down, where the liquid media (ethanol and methanol) played a major part. The target was heated during ablation through dynamic containment of liquid media at the surface. A cavitation bubble was created by the development of plasma in the medium, which gradually expanded and collapsed, pushing highly energetic organisms and extracting cinnamon hydroxide materials from the target surface[8,13].

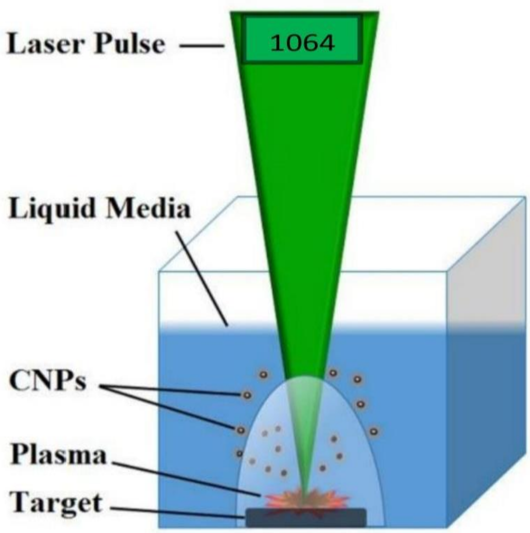

Fig 1 : An illustrative diagram of the process of laser ablation in different liquid media

3. Results and Discussion

The FESEM photographs of CNPs synthesized in various liquid mediums by 1064 nm laser irradiation are seen. It is apparent that the variability of liquid media role play an significant cycle in the size and type of the expansion morphology of "CNPs". In addition, the particle size steadily grew and, with increasing liquid content, became more stable. Two morphologies of CNP, such as nanoparticle (in ethanol) and nanoparticle aspherical (in methanol), are obtained fig 2 (a,b) . CNPs grown within ethanol showed a large distribution of Gaussian size with a mean particle diameter of (17.06) nm with size distribution ranged from 6.45 nm to 43.7 nm fig 2 (c). And Particles that are grown in the form of nanoparticles with an mean particle size of (~45.43 nm) in the methanol medium with size distribution ranged from 15.7 nm to 73.71 nm fig 2 (d) .[13]

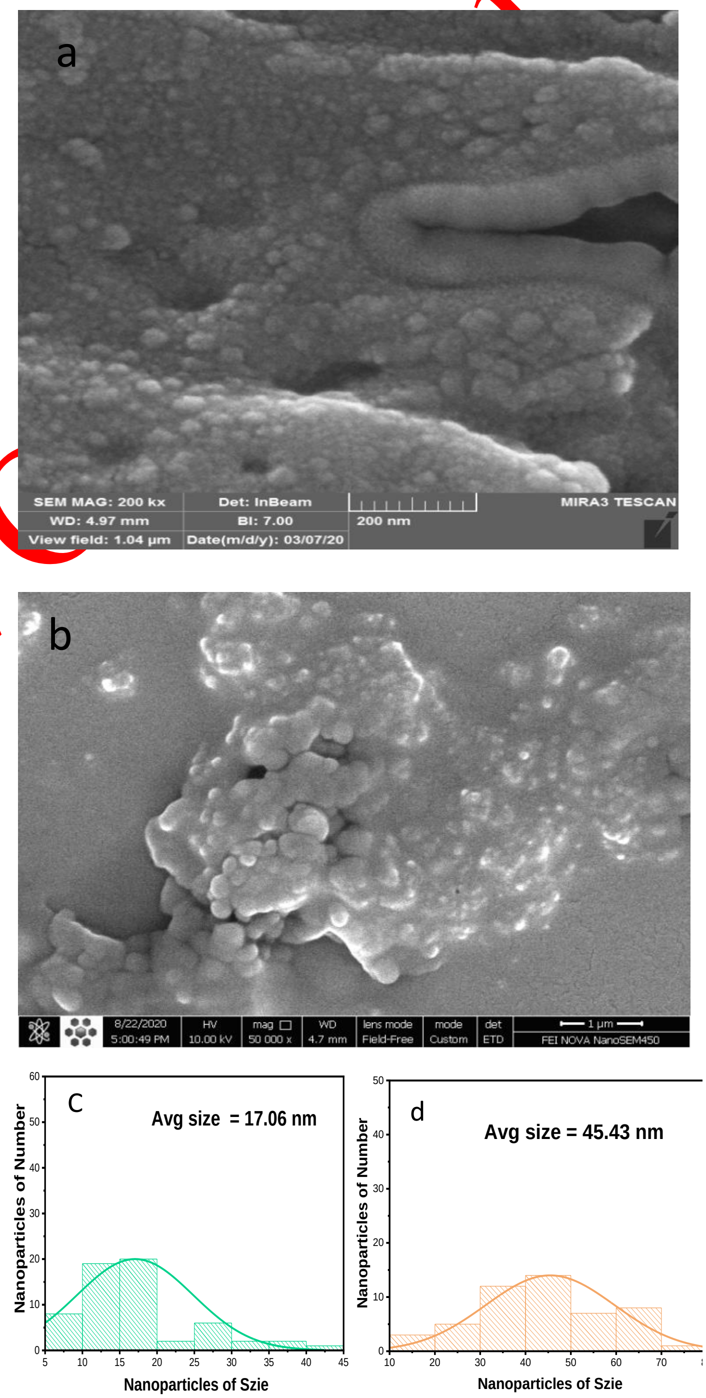

Fig 2: FESEM photos of synthesized CNPs morphologies of medium development (a)ethanol (b) methanol. Gaussian volume distribution CNP (c) with respect to ethanol (d) with respect to methanol

Figure 3 : displays the absorption spectra of CNPs prepared in liquid ethanol and methanol media at (15.92 J / cm^2 maximum laser fluence) and mean number pulses (1000 pulse /sec). The peak absorption locations in the wavelength spectrum were significantly altered from 318 nm for ethanol and 324 nm for methanol, as well as the strength of CNPs, suggesting that dependent nanomorphology (size and shape) were the difference in their growth media [8] They are the same results he obtained Salim et al [4,] . In contrast with CNPs obtained within methanol, the size of CNPs grown within ethanol was smaller and mono dispersed. It has verified that the presence of liquid media and laser parameters (pulse number and wavelength) is determined by the composition and morphology of the CNPs. Besides, the difference of the color of the solution . As the FWHM was calculated below the CNP peaks, it was 79 nm for ethanol and 91 nm for methanol, respectively . in Figure (3) this increase in FWHM is attributed to a decrease in the size of (CNP)[3,13]

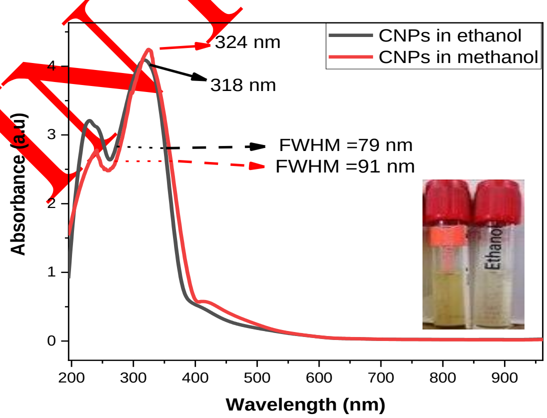

Fig 3: liquid Different CNPs-dependent optical absorption range (Inset: color change)

Figuer 4: shows FTIR spectra the synthesized CNPs formed in ethanol and methanol growth media. The spectrum FTIR of the existence of different functional groups is seen. Wavenumbers were tested for the compound form present in the CNPs and for the purity of the liquid medium (ethanol and methanol). With a transition in the absorption band strength, the FTIR The position of the absorption band spectra of the "CNPs" samples indicated a marginal change. And as shown in Table 1 [8,13,14]

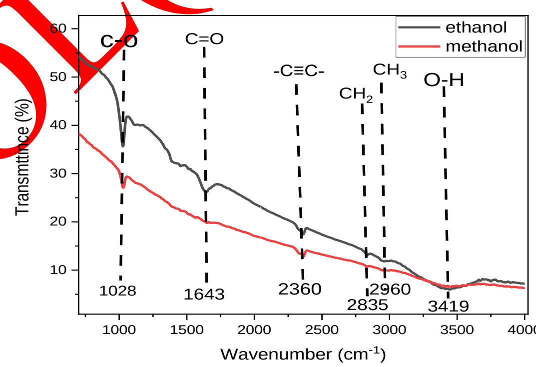

Fig 4: .FTIR spectra of liquid Different

4.Conclusion

In order to Synthesize CNPs in various growth media, we used a simple, inexpensive, but accurate process. This "Q-switched Nd: YAG" funded "PLAL" approach is shown to be highly reliable and sufficient for the efficient synthesis of morphologies of CNPs with differing size and shape distribution. FESEM, Uv-Vis and FTIR are characterized by Synthesized

CNPs . It is possible to control the morphology of CNPs in a manner that is useful for formational applications by adjusting the composition of liquid media and ethanol is the best solution.medium for preparing cinnamon nanoparticles . These prepared particles are good and effective in biological applications .

Table 1 : FTIR unit CNPs assignments

Wavenumber (cm^{-1})	Vibrational band assignments	Vibrationmodes
1028	C-O	aliphatic amines
1643	**C=O**	aldehyde carbonyl
2360	**-C≡C-**	aldehyde and alkyne
2835	**CH_2**	carbon hydroxyl
2960	**CH_3**	Alkane
3413	**O-H**	Hydroxyl

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