Nanotechnology: Preparation of Selenium nanoparticles

ABSTRACT: Nanomedicine has tremendous prospects for the improvement of the diagnosis and treatment of human diseases. Nanotechnology has potential to revolutionize a wide array of tools in biotechnology so that they are more personalized, cheaper, safer, and easier to administer.

Keywords: Nanotechnology, Selenium Nanoparticles

1. Nanotechnology

Nanotechnology deals with production, manipulation and use of material ranging in nanometres [1]. Nanoparticles (NPs) have unusual physical, chemical and optoelectronic properties. The properties of nanoparticles are determined by their huge surface-to-volume ratio, great surface energy and geometrical constraints [2]. Nanomedicine has tremendous prospects for the improvement of the diagnosis and treatment of human diseases[3].

1.2. Synthesis of Nanoparticles

Generally metal nanoparticles can be prepared and stabilized by physical, chemical and biological methods [4][5]. physical and chemical methods for nanoparticle synthesis are essentially based on top – down and bottom – up techniques [6].

I. **Laser Ablation**

Laser ablation of nanoparticles in liquid has attracted great interest due to its simplicity [7]. Laser beam is a technique that used for removing materials from a solid surface.

II. **Chemical Reduction**

This method employs reduction of salt using a variety of reducing agents such as surfactants and biocompatible chemicals to obtain stabilized colloidal suspensions of nanoparticles [8].

III. **Solvothermal Synthesis**

This is a versatile high temperature route in which polar solvents under pressure at temperatures above their building points are used [9].

1.3. Selenium Nanoparticles

selenium nanoparticles contain properties that make it a unique element relative to other metals and metalloids. For several reasons, researchers chose Se NPs because of its application in various industries such as medicinal, chemical [10]. Selenium is one of the essential trace elements in the body in due to its antioxidative as well as prooxidative effect and has great importance in nourishment and medicine [11].

2. MATERIALS AND METHODS

2.1 Preparation of selenium (Se) nanoparticles

Selenium nanoparticles were produced by laser ablation using Se pressed pellet with a diameter of 1cm2 in distilled water at room temperature. The Se target was placed at the bottom of glass vessel filled with 5ml of solution above the target. The colloidal solutions are synthesized by irradiating of Se pellet with pulsed Nd: YAG laser (type HUAFEI) operated of wavelength 532 nm, 7ns pulse width and 1Hz repetition. The laser energy used for ablation 500mJ/pulse).The laser beam was focused at the target surface by using converging lens of 10cm focal length. The diameter of the laser beam on the pellet 2.3mm. The solution was changed from colorless to colored with the increase of the number of laser pulses [12].

2.2 Characterization of nanoparticles

Selenium nanoparticles (NPs) have been prepared by utilizing the pulsed laser ablation in liquid. The measurements of tunneling microscopy, X-ray direction (XRD), atomic force micros- copy (AFE) and Field Emission Scanning Electron Microscope (FESEM). The crystallite size was calculated by using the Debye-Scherer's relation [13].

3. Results & Discussion

The XRD diffraction patterns of synthesized Se nanoparticles films ablated in DDW and deposited on glass are shown in Figure (1).The XRD patterns of Se contain three main peaks at diffraction angles :23.2, 29.5, 43.2 deg. corresponding to (100), (101), (110) respectively.

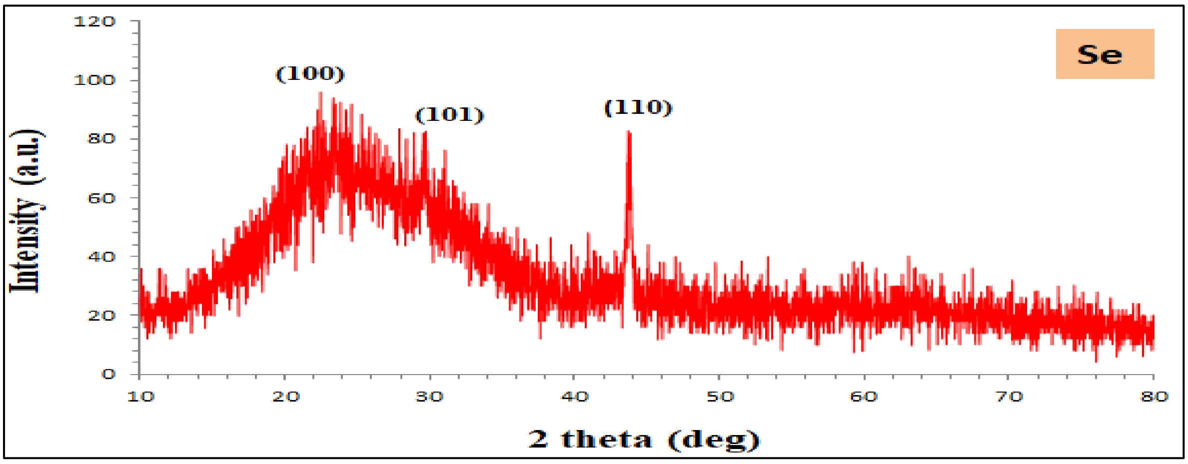

Figure 1: XRD patterns of the Se nanostructures formed by 100pulses

Field emission scanning electron microscope is one of the best to study the surface quality cross section of the nanostructure. The FESEM micrographs result demonstrate a smooth homogenous surface as shows in top view image and cross section as in Figure (2), which made both them suitable substrate for depositing the nanostructure according to both the surface nature , conductivity and stability during synthesis procedures. The figure showed rod-shaped structures with the average size 70 – 90 nm.

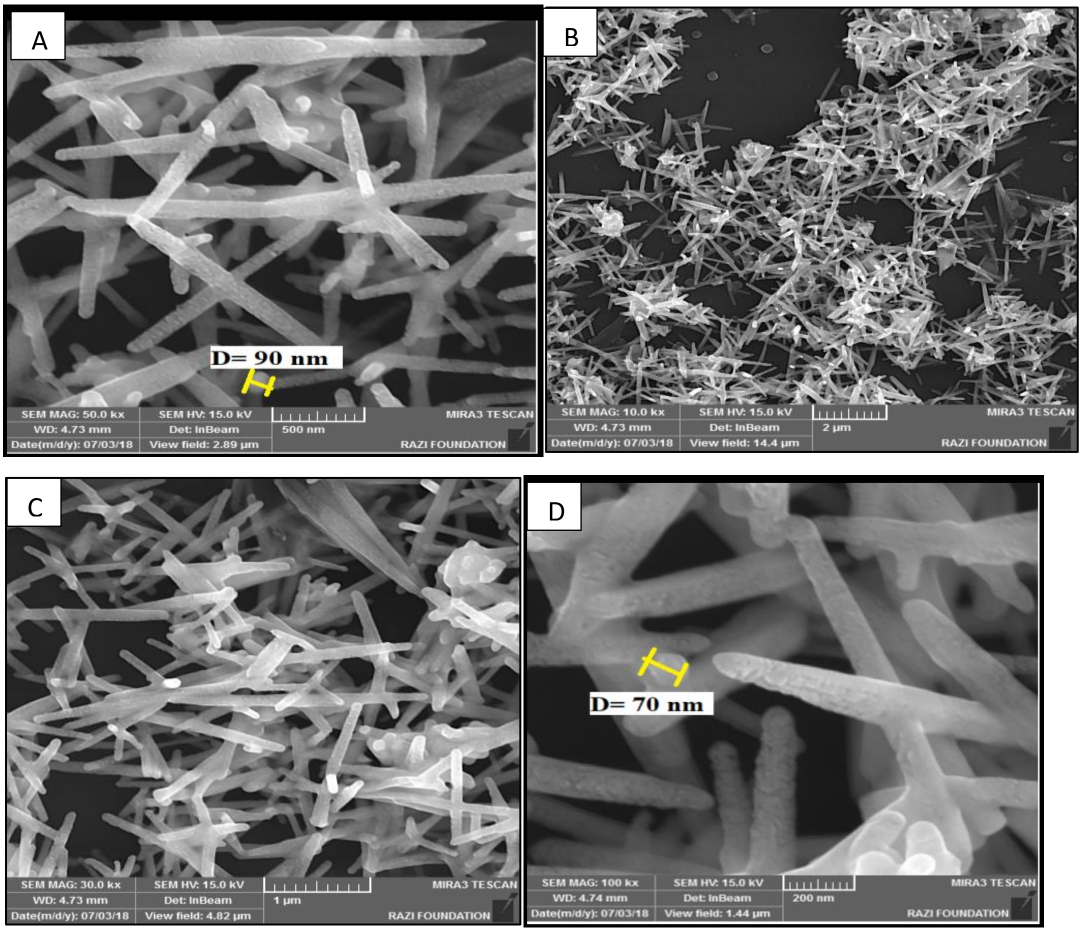

Figure (2): Field Emission Scanning Electron Microscope of Se nanostructures. a-10 kx, b-30 kx, c-50 kx, d-100 kx

Figure (3)show the three dimensions of AFM images of Se NPs, by laser ablation of metal immersed in DDW at 100, pulses for Se NPs. Topological analysis is carried out using AFM, which produces topological images of surfaces at a very high magnification and facilitates the observation of the atomic structure of crystals.

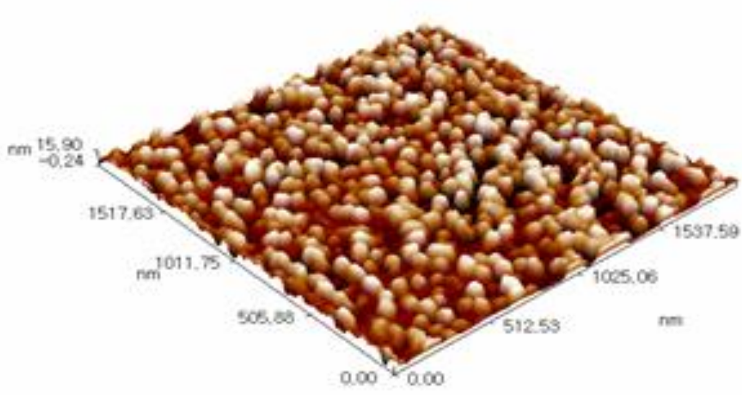

Figure (3): three dimensions AFM images

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