

# Nano silver and its application on burn wound

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**Abstract-** Nanotechnology is a well known field of science that utilizes nanoparticle in order of 1-100nm range. These size is very effective and produces faster reaction. Silver is a metal and it has been used as a healthcare products and shows commercial importance. Nano-silver basically in order of 20nm in diameter is commonly used as a wound healer. It shows very good properties to fight against microbial on wound, especially burn wound. The prepared nano material is modeled in 3d system, and its application is analyzed over different burn wounds.

**Keywords-** Surface morphology, Nanosilver, Burn Wound

## I. INTRODUCTION

Bio-nanotechnology provides several approaches of researches. Nano ranging enhance the scope of study due to its extensive surface structure. The nano silver application on wound gives a hazard less result. Ultrafine particles' probability to spread over a deformation like wound is excellent than any conventional method. The preliminary target is to achieve the successful production of nano silver in a gel base. Burn wound cannot be free from granulation tissues<sup>[10]</sup>. Wound healing can be done by complicated mechanism of biochemical and biomechanical process.

For deep of higher dermal and higher degree burn wound the formation of wound can be observed after the application of nano silver, the action of cell contraction and wound contraction model on the extracellular matrix can be observed.

## II. PREPARATION AND STANDARDIZATION OF NANOPARTICLE

The simple chemical reduction method is used to prepare the nano particle. The results into the formation of particle ranging 50-60 nm in diameter. Different concentration aqua solution of silver nitrate, glucose and amine were used to prepare the nano particle<sup>7</sup>. Silver nano particle are prepared by chemical reduction methodology. Silver nitrate used as precursor. and D -glucose as a reducing agent. The prepared nano particle was monitored using Transmission electron microscopy (TEM), UV-vis absorption spectroscopy. That shows formation of nano particle by revealing the typical surface Plasmon absorption at 418-320 nm from UV-vis spectrum. TEM photographs indicate that the nano particle feasibly shows well dispersed grains along with crystal structure.

### III.RESULT OBTAINED

The formed nano particle will interact with electromagnetic radiation due to the Plasmon resonance. They may have a very interesting spectrum .The nano particle blocks some specific wavelength of light .and it produces distinctive colour .The optical properties of prepared nano silver is pronounced at 10 nm range .

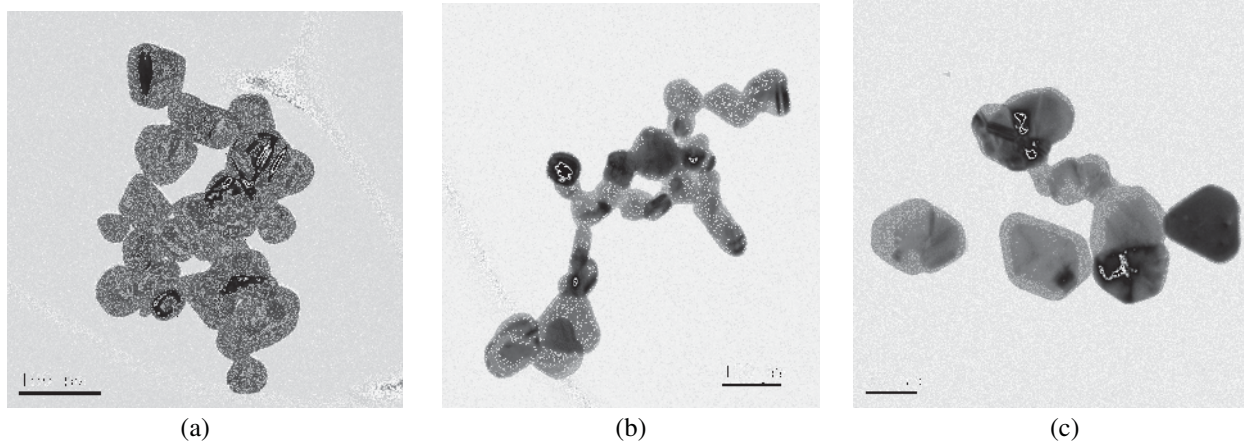


Fig 1. Transmission electron microscopic image of prepared nano silver (a),(b),(c)

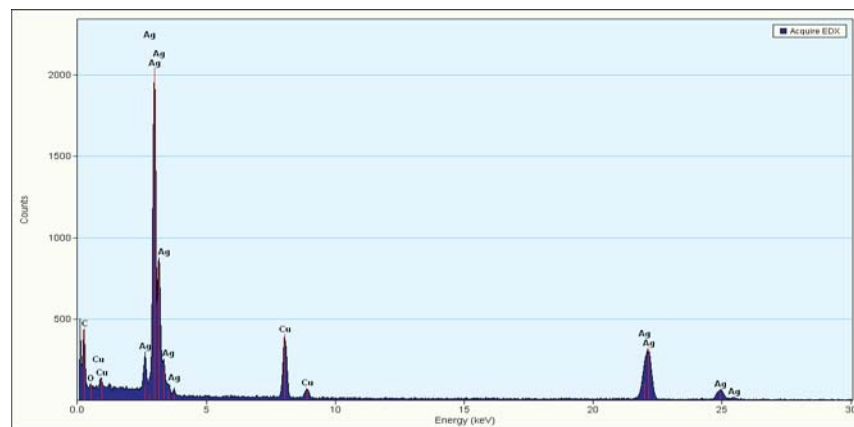
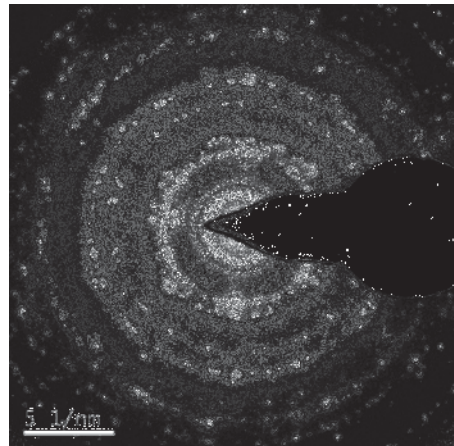
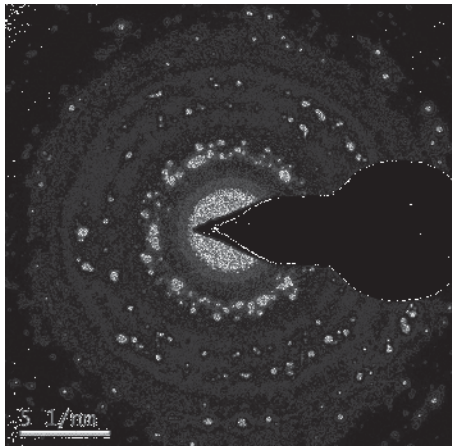


Fig 2. Energy –Dispersive Spectroscopic image of prepared nano silver



(d)

(e)

Fig.3.TEM(Transmission electron microscopy) image –crystal structure of prepared nano silver (d),(e)

#### IV.MORPHOLOGICAL CRYSTALLOGRAPHY MODEL FROM 2D TEM IMAGE

This approach is to design a three dimensional surface from the two dimensional TEM image<sup>[1]</sup>. Each point in the diffraction pattern represents a particular plane. Diffraction pattern can be changed by tilting the electron beam. This approach is introduced to design and indexing a crystallographic model by knowing the wavelength of the incident electron beam which is related to the accelerating voltage. Finding the distance of two diffraction spots reveals two different planes. From the TEM image an observation reference point is chosen. This is considered to be base crystal plane. With respect to that particular point another two planes can be determined by finding the Eulerian Eulerin angles and the projection direction of two planes created by neighbor atoms<sup>[2,5]</sup>. Three diffracted spot is chosen. The Equation for this approach is, defining the Eulerian angle  $\varphi, \theta, \psi$ .<sup>[6]</sup>

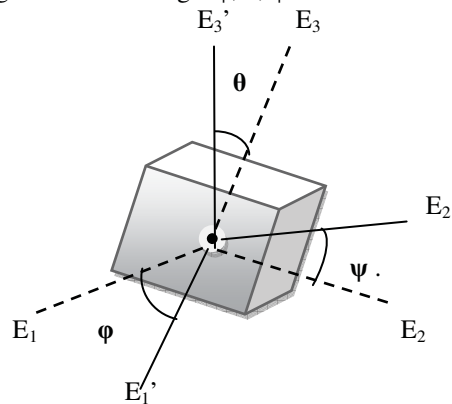


Fig.4 :Approach for finding the diffraction point's magnitude and value using Euler's method.

$$S_{\varphi} = \begin{bmatrix} \cos \varphi & \sin \varphi & 0 \\ -\sin \varphi & \cos \varphi & 0 \\ 0 & 0 & 1 \end{bmatrix}$$

$$S_{\theta} = \begin{bmatrix} 1 & 0 & 0 \\ 0 & \cos \theta & \sin \theta \\ 0 & -\sin \theta & \cos \theta \end{bmatrix}$$

$$S_{\psi} = \begin{bmatrix} \cos \psi & \sin \psi & 0 \\ -\sin \psi & \cos \psi & 0 \\ 0 & 0 & 1 \end{bmatrix}$$

The incident and diffracted wave vectors lead to a diffraction spot. Considering vector difference between the two is equal to a reciprocal lattice vector. In this approach the miller indices of diffracted spot has been calculated from Euclidian coordinate approach. After finding the point vectors the distribution of planes<sup>[5,8]</sup> is designed using MATLAB. After having the rotational vector the miller indices of particular basis is calculated. And crystal plane is designed by implementing the crystal planes angular difference which is prominent from rotational vector calculation<sup>[3]</sup>. As because the inter planer spacing are inversely proportional to each other. The angle between two vectors R1, R2 can be determined by the miller indices of those diffraction points.  $A(h_1, k_1, l_1)$  and  $B(h_2, k_2, l_2)$  respectively.  $\cos \varphi = (h_1 h_2 k_1 k_2 + l_1 l_2) / (h_1^2 + k_1^2 + l_1^2)^{0.5} (h_2^2 + k_2^2 + l_2^2)^{0.5}$ . The angle can be calculated similarly from different plane. The Zone of the axis is calculated by forming the cross product of two vectors R1 and R2. MB ruler software is used to determine the exact line and length in appropriate unit.

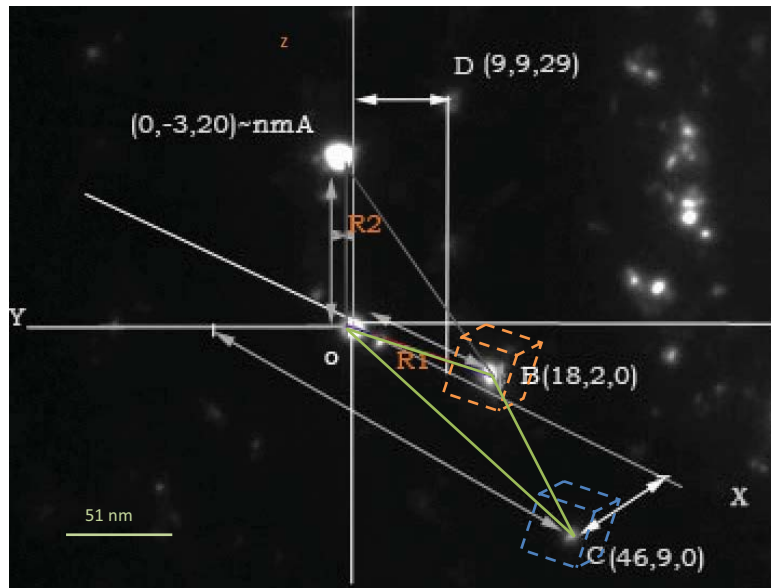
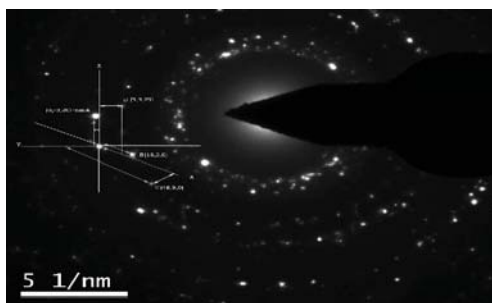
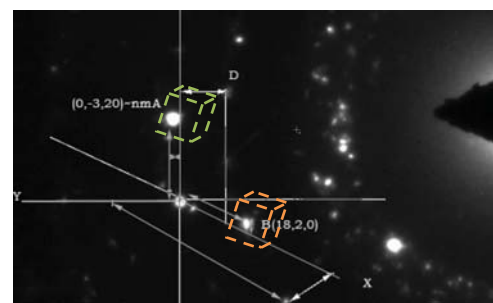


Fig.4.Understanding the diffraction pattern produces by TEM

#### V.RESULT OF INDEXING THE DIFFRACTION PATTERN



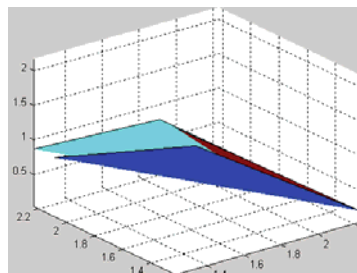
(f)



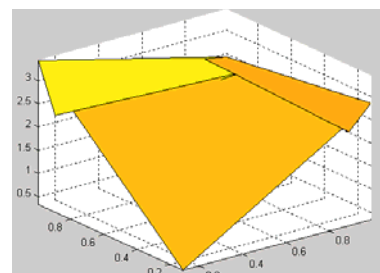
(g)

Fig.5. Implementation and indexing the diffraction spot of TEM image

#### VI.3D VISUALIZATION AFTER INDEXING A DIFFRACTION PATTERN



(h)



(i)

Fig.6. 3D visualization after rendering the crystal planes crated by diffraction point AOB produces fig.(h) and BOC produces fig.(i)

## VII.APPLICATION OF NANO SILVER ON BURN WOUND & ASSESSMENT OF WOUND HEALING

Comparing success and failure of the treatment <sup>[11, 12]</sup> it is evident that nano silver success rate is much higher than silver sulfadiazine. The data are analyzed. The result is given below on the table.

Table.1. Percentage of recovery

Percentage of case observed	Percentage of wound healed by 4 <sup>th</sup> post burn week
7.41%	14%
33%	56%
37%	70%
4%	98%

Table 1. Shows case study which is observed ,depending on percentage of wound healed after applying of nano silver by fourth post burn week.

Table.2.Types of treatment and outcomes

Type of treatment	% of outcome of treatment		Statistical Significance			
	Success	Failure	N	Mean	St.Dev	Fisher's exact test
silver sulfadiazine(SSD)	57%	43%	2	57%	0.148492424	P=0.317358
Nano-Silver	78%	23%	2	23%	0.141421356	

Table.2. Outcome of the treatment by comparing results in between SSD and NanoSilver ,with P Value(Statistically significance)

## VIII. WOUND HEALING BY NANO SILVER :CASE STUDY



(j)



(k)



Fig.7.(j) Before and (k) after 10 days of application of Nano silver



Fig.8.Second Degree deep dermal burn .(l) before (m) After 4 weeks of application of nano silver

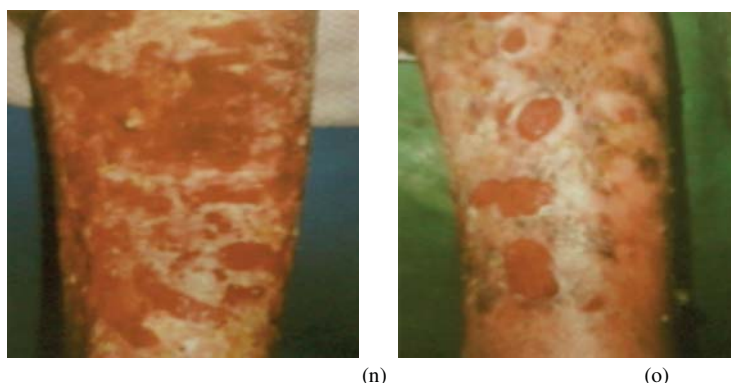


Fig.9.Third degree thermal Burn with unhealthy granulation tissue and loss of skin graft.(n) before and (o) after 3rd week of nano silver application

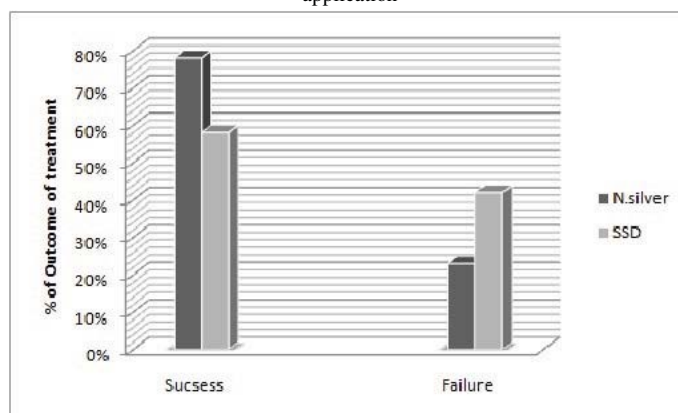


Fig.10. Graphical approach of percentage of recovery, comparing conventional method and Nano-silver

## IX. CONCLUSION

Silver nano particle are prepared by chemical reduction process. Silver nitrate is used as precursor. Formed particle is monitored by energy dispersive spectroscopy (Fig.2).Transmission electron microscopic study (Fig.3) Shows there was no peaks of other impurity has been detected. Finally comparative study on wound healing in between nano silver and silver sulfadiazine (SSD) is given. The result (Fig.7,8,9,10),is prominent that the healing rate is much faster by nano silver gel than conventional silver sulfadiazine (SSD) method.

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