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Green Synthesis of Bovine Serum Albumin Nanoballs by Using Olive Oil

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Abstract: **Synthesis of various nanostructures is under many scientific considerations to prepare and characteriza tion of the bionanostructures and nanobiocrystals of controllable geometry with the ease of their smallest size at nanoscale. Many chemical and green modification of nanoparticles such as nanocrystals, nanosphere, nanodiscs, nanocubes, nanowires, nanoballs and nanorods are going to be formulated with many biocompatible and nontoxic biomaterials (carbon nanotubes, chitosan, albumin and lipopolysaccharides and polysaccharides) or metals ions (gold, silver, iron and copper). These formulated nanobiomaterials along with fabricated metal ions were found to improve the oxidative etching effect in nanostructures/nanocrystals that play very implicative role in fabrication of nanostructures geometry and their characterization. Bovine serum albumin was used as a cost effective matrix for preparing the nanoparticles due to having couple of exploitable characteristics e.g. biocompatibility, non-antigenicity, easily biodegraded and non-toxicity. Hence, present study can provide a potential approach of green synthesis of nano-crystals that find to be control shape of bovine serum albumin nanoballs at their least nanoscale by using olive oil which naturally occurring and antibactericidal bioemulsifier. Characterization of prepared bovine serum albumin nanoballs was done with Scanning Electron Microscopy (SEM) to observe the exhibited size and shape of prepared nanoballs. And, this proposed study can be proved a cost effective technology to prepare non-toxic and biocompatible bovine serum albumin nanoballs to explore their therapeutic applications in regenerative medicine and nanomedicine being as nonviral gene or drug nanoframes to carry out the site specific delivery.**

Keywords: **Bovine serum albumin; Oilve oil; Nanoballs; Nanocubes; Nanodiscs, Nanocsystals, Scanning Electron Microscopy.**

1. INTRODUCTION

Nanocrystals have found to be reported the potential for delivering the loaded drugs with low aqueous solubility. And, low energy anti-solvent precipitation method was investigated for producing nanocrystals and stable nanocrystals with uniform particle size were synthesized packed with glyburide, ibuprofen, and artemisinin. The dissolution of the nanocrystals in aqueous media was also studied under physiological conditions and it was found more rapid and instant as compared to other micronized suspensions of the model drugs or in their marketed tablet formulations.[1] Preparation of drug nanocrystals of lipophilic drugs was also designed based on bottom-up the market along with available promising technologies such as hot melt extrusion, supercritical fluid technologies and CCDF. The production of drug loaded nanocrystals was successful with significant outcomes at lab-scale development.[2] Poorly water-soluble drugs such as nifedipine was also formulated as nifedipine nanoparticles/nanocrystals with high pressure homogenization. Crystalline state evaluation before and following particle size reduction was also observed through differential scanning calorimetry (DSC) and powder X-ray diffraction (PXRD) to assigned various participating eventual transformation to amorphous state during the homogenization process. From this study, it had been noted that this method can be used simple and easily scaled up to explore their general applicability to many poorly water-soluble drug entities.[3] New advanced ultrasonic spray-assisted electrostatic adsorption technique was also proposed to prepare poor water-soluble drugs-nanostructures and found to be quite effective and continuous method.[4] Moreover, due to defined nanostructure of protein-based bionanoparticles/nanocrystals are offered various possibilities for safe and cost-effective surface approach

including covalent attachment of drugs and tagging ligands to be considered as effective site specific nonviral tagted loading vehicle used in cancer gene/drug therapy.[5] The geometry and shape of nanostructures are found to be affected by varying the concentration of catalysts such as metals ions, polymers and albumin that directly affects the properties of the localized surface plasmon resonance and surface-enhanced Raman scattering. The process of development of facial synthetic routes for formulation of multimetallic/nonmetallic/polymeric nanostructures such as nanocrystlas, nanoballs, nanocubes, nanodiscs, nanobricks, nanowires and nanorodes are found to be big challenge to optimize them at nanoscale with desired geometry.[6,7] Other polymeric nanoparticles/nanocrystals were also selected for loading of desired enzymes or drugs into biocompatible and cost effective matrix e.g. chitosan, gelatin, sodium alginate, ficoll, sepharose and albumin which are proposed to be used for nano-therapeutic approaches as suitable targeted nonviral delivery tool.[7-8] Cationic bovine serum albumin based self-assembled nanoparticles as siRNA delivery vector was also prepared and had been used for treating lung metastatic cancer as low cost and nontoxic nonviral gene delivery vehicle.[8] Various drug delivery nanovehicles had been proposed previously used as most potential site specific delivery of loading ingredients. It was found to be expected good biodegradability with high loading capacity for prolonged circulation at specific target sites in host cell.[7-10] Carbon nanoballs were also synthesized by using acetylene with coke powder as carbon source by arc discharge technique that was observed *in situ* by optical emission spectroscopy (OES), Field emission scanning electron microscopy (FE-SEM), field emission scanning and transmission electron microscope (STEM) equipped with energy dispersive X-ray (EDX), X-ray diffraction (XRD), and Raman spectroscopy. Many carbon nanoballs are found to be sintered together with a few carbon nanotubes (CNTs) inserted into the sintered carbon nanoballs except for a few carbon nanoballs that exist as a single ball. The STEM results was showed that the diameter of carbon nanoball were found mainly in the range of 50–100 nm.[11] Various green and chemical methods had been used to synthesize bioactive stable enzyme or drug loaded nano-bovine serum albumin and Egg nanoparticles that can be successfully used as eco-friendly preservative, non-toxic drug delivery trigger to deliver the loaded biological and chemical materials at targeted sites.[12-18]

Hence, present study was proposed to develop the cost effective and non-toxic green synthetic method used for the synthesis of bovine serum albumin nanoballs by using olive oil as low-cost, easily available, non-allergic, antioxidative and antibactericidal biocatalyst. Characterization of synthesized jasmine oil mediated bovine serum albumin nanoballs was performed by using Scanning electron Microscopy (SEM) for the observation of their shape and size. These bovine serum albumin nanocrystals were prepared by proposed eco-friendly and low-cost green method that can be used as non-toxic drug and gene delivery nonviral nanocages or nanoframes when any desired drugs/biological/formulated chemical materials/gene might be bind into them. These fabricated bovine serum albumin nanoballs can be used as safe and potent targeted drug/gene delivery nonviral vehicle that can be used in desired clinical therapeutic approaches in field of regenerative medicine and nanomedicine.

2. MATERIALS AND METHODS

Green synthesis of olive oil driven bovine serum albumin nanoballs:

Olive oil bath was prepared with slight modification of previous methods used by Rani, K and Chauhan, C., 2015[16]; Rani, K and Chauhan, C., 2015[17]; Rani, K, 2015[18]. For preparing oil bath, 8-10 ml of bovine serum albumin was taken in 10 gauge syringe and added into the prepared 50 ml of olive oil. Then, it was incubated overnight with constant stirring. Next day, it was further subjected to sonication for 25 minutes with 2.6 ml of n-butanol with slight modification to minimized the size and structure of nanostructures.[16-18]

Characterization of olive oil driven bovine serum albumin nanoballs by Scanning Electron Microscopy (SEM):

The prepared bovine serum albumin nanoballs were subjected to Scanning Electron Microscopy (SEM) for the interpretation of their particle size and exhibited shape.[11,16-18]

3. RESULT AND DISCUSSION

Characterization of olive oil driven bovine serum albumin nanoballs by Scanning Electron Microscopy (SEM)

Characterization of olive oil driven bovine serum albumin nanoballs was carried out by using Scanning Electron Microscopy (SEM) for assigning their size and exhibited shapes (Fig 1). Scanning Electron Microscopy (SEM) result of prepared bovine serum albumin nanoballs was found their observed size in the range of up to 108.1 nm and exhibited perfect uniformed round shape of prepared bovine serum albumin nanoballs (Fig 1). Their SEM observations for their sizes are very much similar with previous SEM studies.[7,11,13,14]

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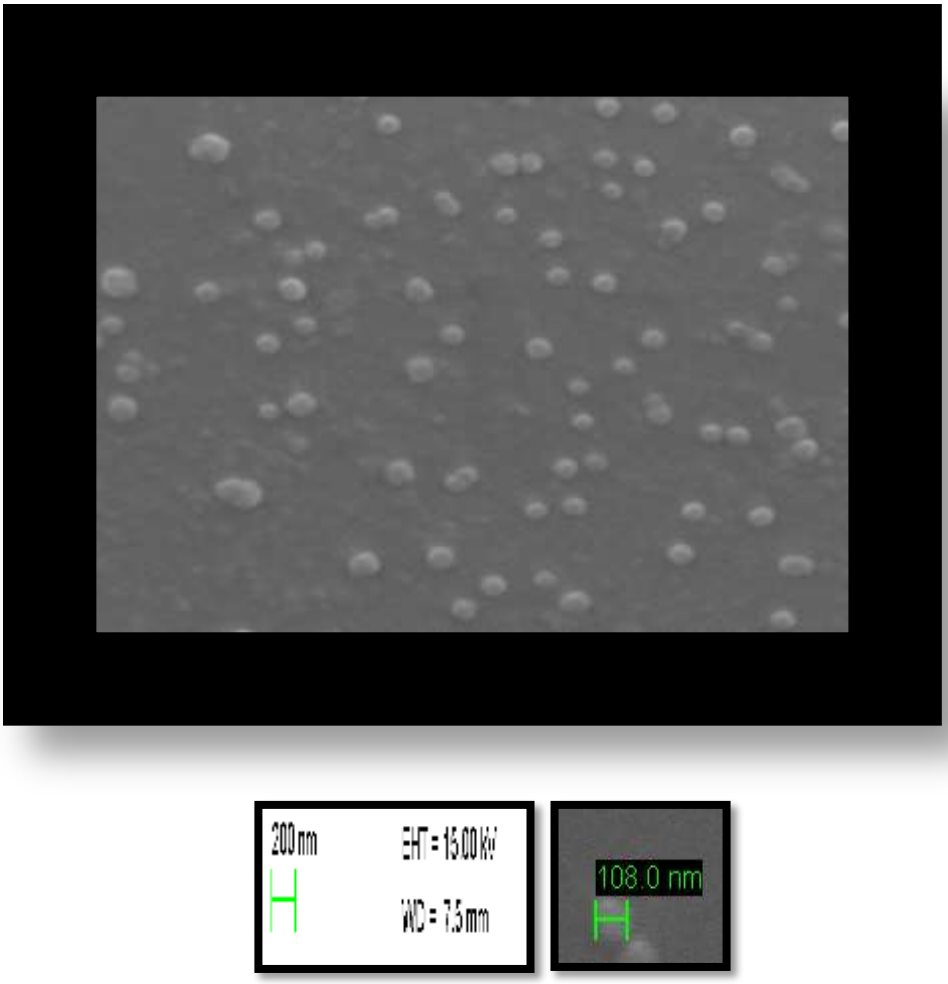

Fig. 1: SEM result of olive oil driven bovine serum albumin nanoballs

4. CONCLUSION

In this proposed work, green synthesis of bovine serum albumin nanoballs was proposed by using olive oil which is antibactericidal, safe and natural biocatalyst for this method. And, their characterization analysis was done with SEM that was confirmed the size range up to 108 nm and perfect uniform round shaped geometry of nanoballs. Hence, it was concluded that this proposed green synthesis of bovine serum albumin nanoballs is found to be easy, eco-friendly, non-toxic, non-allergic and low-cost green method over other available chemical methods of preparing various nanostructures. As well as, this green method can be employed for the preparation of more advanced bovine serum albumin nanostructures that might be further used for various clinical and therapeutic applications by employing advanced formulations/fabrications and characterizations methodologies with nanostructures geometry optimizations with ease of loading of desired payloads such as drugs, enzymes, antibiotics, spliced gene respectively. And, these hybrid olive oil driven bovine serum albumin nanoballs can be used as safe and potent nonviral gene and drug delivery vehicle for site specific delivery.

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