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SILVER NANO DOTS AS EFFECTIVE BIOSENSORS IN THE FIELD OF MEDICINE

Ms .A.G.J.PATRICIA[1], DR.UMADEVI MAHALINGAM[2]

[1]RESEARCH SCHOLAR, DEPT.OF PHYSICS.MOTHER TERESA WOMEN'S UNIVERSITY.KODAIKANAL.
[2]DR.M.UMADEVI MAHALINGAM.ASSOCIATE PROFESSOR .DEPT.OF PHYSICS.MOTHER TERESA WOMEN'S UNIVERSITY.KODAIKANAL.

Abstract – Silver nano dots have unique nano-dimensions that match the size of biological molecules and structures so these nano dots can be used for in vivo and in vitro medical applications. Conventional nano sensors have side effects whereas enhanced effectiveness and efficiency of silver nano dots finds wide array of applications as biosensors for therapeutic purposes, disease diagnosis and preventive health care .New biosensor applications are emerging as smaller and smaller silver nano dots are developed for molecular profiling and multiplexed biological assays.

Key Words: Silver nano dots, biosensors, bio cell targeting, drug delivery, diagnostics.

1.INTRODUCTION

A biosensor system consists of the following components. 1)bio-Receptor,2)transducers,3)detectors. The bio receptor is a biological molecule like DNA strand, protein molecule, enzyme, antigen, antibody or cells or tissues. The transducer transforms the recognition event to a measurable electric signal which can be used for the quantification of the analytic. The detector system receives the electrical signal which can be used from the transducer component and amplifies it suitably so that the corresponding response can be read and studied properly, perform more accurate forecasts and more robust studies of the situation of the critically ill patients and their survival rates. These silver nano dots are cross linked to small ligands, peptides, aptamer , inhibitors that can bind with high specificity to many different cellular receptors and targets. The nano dots are adapted to sense fat-soluble retinoids that is vitamin A target delivery in delicate human tissues. The silver nano dots can be sensors for specific DNA sequences. This can be achieved by mixing the targeted single-stranded DNA with bio tinylated DNA fragments.

2. EXPERIMENTAL METHODS

Uniform sized silver nano particles were fabricated through the reduction of silver ions by fructose. In this process, a chemical solution was prepared by mixing .050 gms of fructose sugar in 50 ml of de-ionized water taken in a conical flask. Minimal amount o f0.001 PVA was added to the above solution regularly and stirred by keeping the flask on a magnetic stirrer.Another solution of .0010 gms of silver nitrate was added to the above mixture drop by drop. This addition turned the solution to dark brown within half an hour. Thus chemical reduction of silver nitrate has taken place. The solution was stable for days together.

2. RESULTS AND DISCUSSIONS

The UV-VIS absorption spectra of the silver nano particle was examined. The absorption peak was obtained at 446 nm. The XRD patterns were studied. The diffraction peaks were observed at 2 theta values of 38.3,44.3 and 64.6 corresponding to the (111),(200) and (220) crystalline planes of cubic silver. The XRD peaks were found to be broad in nature and this can be attributed to the nano size of the particles. The average particle size has been by estimated by using Debye-Scherrer formula. The average particle size was found to be <20 nm. The transmission electron microscopy analysis was done to study the physical characteristics. Silver nano particles are formed with fairly even sized

distribution. The particle diameter was well within < 20 nm.

The FTIR studies showed the band stretching and deformation of Ag-O molecules and well confirmed that pure silver nano dots were harvested in the process The HRTEM analysis also confirmed that the dimensions of silver nano dots were <20 nm.

2.1 APPLICATIONS

SILVER NANO DOTS AS BIO SENSORS.

Silver nano dots with sizes in the range <20 nm were functionalized with thiol oligo nucleoids and salted in a 0.5 ml Na cl solution,10 ml phosphate,0.02%SDS.PH=7 OVER 12 hours. DNA sequence was 5'-HS-AAA AAA AAA AAA AAA AAA AA -4'.Then the silver nano dots were then purified from excess DNA with centrifugations at 23 C for 40 minutes. The silver nano dots were washed and finally re suspended in the Nacl, phosphate buffer at concentration of -19.Such silver nano dots were created to act as probes.

BIO-BAR CODE ASSAYS

Oligo nucleotide probes for nucleic acid detection are generated using the NCBI blast nucleotide search function with DNA sequence. PCR primer design software can be used to generate probe sequences. These sequences are 25-35 base pairs in length. The bar code is 15mer sequence assigned to each specific protein of interest. Also a universal sequence is included if scano metric assay read out is to be read. This universal sequence is 5'-AGC TAC GAA TAA -3'.A PEG 9 mer is used between the universal sequence and the probe sequence to separate the two. If using the fluorescence methods an Oligo(da)10 sequence is used to space the recognition element away from the nano dot surface. In either case, the universal sequence or the oligo(Da)10 is, the universal sequence or the oligo(dA)10 is paced between the trial linkage and the recognition element—barcode sequence. Silver nano dots were used for this purpose as each dot can be tagged to individual bio molecules.

ARTIFICIAL IMPLANTS

Silver ions have very high anti-bacterial activity even at very low concentrations. Silver dot biosensors can prolong drug delivery, increase tissue growth decrease inflammation and inhibit infection. Thus all the criteria critical for the long term implantable sensor detecting biochemical and cellular responses in an individual with controlled drug delivery was developed using silver nano dots of dimensions<20nm

3. CONCLUSIONS

Thus Silver nano dot biosensors have shown immense potential for application in regenerative medicine and tissues engineering. For such tissues engineered constructs can be used for restoring the functions of diseased or damaged organs or tissues. Man- made silver nano structured materials such as nano dots are globally produced in large quantities due to their potential applications in electronics, photonics, bio-technology, health care and medicine and consumer products. The applications of silver nano dots is not limited to wound dressings, surgical instruments, masks and bone cement alone. This is not the end, a lot more is expected from nano dots in the days to come to serve as effective nano sensors in the field of medicine today.

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