J Nanomed Nanotechnol 2016, 7:4 (Suppl)
http://dx.doi.org/10.4172/2157-7439.C1.041

9th Nano Congress for Next Generation

August 01-02, 2016 Manchester, UK

Fabrication of high performance electron beam with carbon nanotube cold cathode and its applications

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We developed novel carbon nanotube electron beams with Carbon Nanotube (CNT) cold cathodes. The electron beam shows more than 90% electron transmission ratio through gate electrode, resulting higher anode current and lower thermal damage on gate electrode. The electron beam shows anode current more than 100 mA with DC pulse driving at less than 1 cm2 area. Also, life time of the beam shows more than 300 hrs in DC driving. We fabricated electron beam modules with the CNT cold cathode and applied for medical and solid state devices. For medical devices, we fabricated glass sealed x-ray tubes with the electron beam and evaluated its performances, resulting high resolution x-ray. For solid state devices, we irradiated the electron beam on semiconducting, and insulating thin films. Then, we observed phase changes on those thin films and generation of luminescence from those films by phase changes. Detail of electron beam fabrication process with CNT cold cathode, performance of electron beam, characteristics of x-ray tubes with the beams and beam irradiation will be presented.

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Fabrication of silver nanoparticles from mycological flora and their importance against agro-pathogens: Towards green nano-pesticides

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The synthesis of nanomaterials has received more attention due to the increasing need to develop safe, cost-effective and environment friendly technologies for nano-material synthesis. Herein, we report the fabrication of silver nanoparticles (AgNPs) via green synthetic approach using aqueous extract of mycological flora *including Aspergillus Niger, Aspergillus flavus, Fusarium oxysporum, Penicillium, Acremonium, Rhizoctonia solani, Pythium, Rhizopus stolonifera* and *Trichoderma harzianum*) isolated from different soil samples. Their aqueous extract was treated with different concentrations of silver nitrate ($AgNO_3$) solution at various pH levels. Generally the reaction was carried out for 72 hours and a visible change in color of reaction mixture from clear to dark brown was considered a positive indication. The synthesis of AgNPs was confirmed by UV-Vis spectrum which showed distinct peak around 420 nm -430 nm regions. Scanning electron microscopic imaging confirmed the size and shape of AgNPs, size ranged from 18 nm–69 nm. We found that the concentration of silver salt plays vital role in controlling the size of nano particles while the aqueous extract from different fungal strains is responsible for the difference in shape of NPs. Each fungi is known to produce different metabolites that act as reducing as well as capping agents during the synthesis of AgNPs hence giving them different shapes. Furthermore, the synthesized AgNPs were tested for their antimicrobial potential against pathogenic bacterial strains including *Xanthomonas, Clavibacter, Agrobacterium, E Coli, Staphylococcus aureus, Baccilus* and *Klebsiella.* The *in vitro* antibiotic activity was carried out using disk diffusion assay and was compared against standard known antibiotic as positive control and aqueous $AgNO_3$ and mycelial extract as negative control. We found some of our synthesized AgNPs even more potent than known antibiotics. The results from our lab clearly open a new avenue for the green synthesis of nanoparticles using fungal extract and their importance against agricultural pathogens.

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