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Electrochemical immunosensor based on graphene quantum dots@carbon nanotubes composite for foodborne mycotoxin detection

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Since the last decades, food borne pathogen affect the humans and animals lives gradually, where 40% of the approximately 50 million people died annually worldwide. Infectious disease naturally occurs in food and cannot be removed once infected. Among the various food borne toxins, aflatoxin B1 is one of the most affected toxic chemical which is mainly produced by secondary metabolite mold such as Aspergillus parasiticus and Aspergillus flavus. These fungi usually infect the crops such as wheat, cereals, pulses, walnut, almond, flour, etc. and lead to serious health complication for humans and animals such as teratogenicity, immunotoxicity, and hepatotoxicity. It has been reported that, in the developing countries, 4.5 billion people are affected because of the chronic exposure of aflatoxin in infected foods. However, there is urgent need of some accurate, fast, reliable and specific tool for the detection in food contents. The biosensor is one of the most suitable and appropriate technique which involve specificity, sensitivity, reliability and selectivity for quantification and determination of food borne pathogen. We report results of studies in the design of electrochemical immunosensor using graphene quantum dots integrated carbon nanotubes for the determination of aflatoxin B1 in daily usage food contents. The chemically synthesized graphene quantum dots integrated onto multiwalled carbon nanotubes which is further deposited onto ITO coated glass electrode using electrophoretic deposition process. The monoclonal antibodies of aflatoxin B1 immobilized further onto the deposited substrate matrix using cross linkers. Various characterization techniques have been utilized for the structural, morphological and electrochemical studies such as Transmission Electron Microscopy, Scanning Electron Microscopy, UV-visible spectroscopy, X-ray Diffraction, Fourier Transform Infrared spectroscopy, etc. Moreover, biosensing characteristics have been investigated using electrochemical impedance spectroscopy and cyclic voltammetry techniques. The results of this studies demonstrate the potential of this platform for the determination of aflatoxin B1 in food contents.

Recent Publications:

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2. Smith L E et al. (2016) Examining environmental drivers of spatial variability in aflatoxin accumulation in Kenyan maize: potential utility in risk prediction models. African Journal of Food, Agriculture, Nutrition and Development. 16(3):11086-11105.
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4. Hou L et al. (2018) Immunotoxicity of ochratoxin A and aflatoxin B1 in combination is associated with the nuclear factor kappa B signaling pathway in 3D4/21 cells. Chemosphere. 199:718-727.
5. Songa E A and Okonkwo J O (2016) Recent approaches to improving selectivity and sensitivity of enzyme-based biosensors for organophosphorus pesticides: a review. Talanta. 155:289-304.

Biography

Hema Bhardwaj received her MSc Degree in Chemistry from Amity University, Noida, U.P, in 2014. She is currently working as a Doctoral Candidate at Biomedical Instrumentation Section, CSIR-National Physical Laboratory, New Delhi, India in collaboration with Supramoleculaires University Lyon 1, ICBMS, Villeurbanne, France. Her focuses on fabrication of immunosensor using nanomaterials for the detection of food borne mycotoxin like aflatoxin B1.

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