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MOF a unique topological architecture for detection of total organo phosphate pesticides

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Metal organic frameworks (MOFs) are advanced class of supra-molecular hybrid network built from metal ions and organic bridging ligands with well-defined coordination geometry. Despite of various exclusive properties, MOF has less conductivity attributed by the organic linker molecules which is making it unsuitable to act as an efficient electrochemical sensing bed. In the present investigation, chemically synthesized MOF 5 was modified either by integrating with anisotropic gold nano-rod (AuNR) or gold nano-particle (AuNP) tagged receptor biomolecule (IgG) to lower down over all resistance of the sensor. Spin coated MOF 5 on indium tin oxide coated (ITO) electrode was decorated with electrochemically deposited anisotropic gold nano rod (AuNR) and later functionalized with esterase enzyme to fabricate electrochemical enzymatic sensor [AchE (acetylcholinesterase)/Cys (cysteamine)/AuNR/ MOF/ITO] for sensing of Op and carbamates. The synthesized AuNP-IgG nano bio hybrid was immobilized on spin coated MOF 5 on ITO electrode to develop immunosensor [BSA (bovine serum albumin)/AuNP-IgG/MOF 5/ITO] for ultra-low sensing of total Op. The modulation of current value with change in pesticide (chloropyrofos) concentration shows a broad dynamic range of 0.03-0.6 ppb with linearity (R2=0.91) and a sensitivity of 2.04 μA ppb-1cm-2. In the second case, the interaction between Op and AuNP- IgG is due to antigen and antibody interaction enhances the conductivity of the electrode developed and causes a gradual increase in current with increase in concentration of Op (chloropyrofos) and demonstrates a dynamic range of 0.004 ppb to 0.1 ppb and a sensitivity of 0.0254 μA ppb-1cm-2. Interference study in presence of heavy metal ions including Ni^{2+}, Cu^{2+}, Zn^{2+}, Pb^{2+}, reveals that minimum interference is observed by both electrodes excluding Ni^{2+} showing an interference of 23.86 % for immunosensor. Both the electrodes are stable up to 30 days. Both the sensors are successfully exploited to determine the total Op levels in mixture of various Op and spiked vegetable extract. However, the enzymatic sensors also showed satisfactory results when exhaustively used to detect Op in the field sample at a regular interval. In future, MOF- mono clonal antibody conjugate will be explored for specific detection parathion, methyl parathion and paraoxonon etc.

Biography

Tinku Basu is the Deputy Director in Amity Institute of Nanotechnology. She had pursued her PhD from IIT, Kharagpur. She has 50 national and international publications. She has filed 12 complete patents. Her area of research is biosensors, polymer science and technology, functionalization of nano materials, metal organic frame work, self-assembly and nanocomposites etc.

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