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Phosphinic acid derivative doped polyaniline for heavy metal sensing

Sanjeev K Bhardwaj, Neha, Atal Gill, Jyotsana Mehta, Amit L Sharma and **Akash Deep**
CSIR-Central Scientific Instruments Organization, India

Poly-aniline (PANI) is among the most exploited conducting polymers by the researchers. It has outstanding electrical conductivity, stability and redox properties which facilitate its usage in sensing applications. PANI also offers ease of preparation, uniform film formation and can be easily coated on different substrates like plastic, glass, metal, etc., through chemical or electrochemical routes. A phosphonic acid derivative more commonly known as CYANEX 923; is a useful reagent in the liquid-liquid extraction and separation of various metals. In the present work, phosphonic acid doped poly-aniline films have been grown on plastic substrate as a robust sensing platform. The designed patterns were developed on plastic substrates by masking the remaining area with adhesive tape. The prepared substrates were immersed in aniline solution in which ethanolic solution of phosphonic acid derivative was added. The solution was kept under ice cold conditions under continuous stirring. Next, ammonium persulfate solution was added drop wise in order to initiate polymerization of aniline. The solution was kept overnight and the substrates were washed and dried next day to obtain the desired films. The topological studies of as-grown films were carried out using field emission scanning electron microscope (FE-SEM). The synthesized composite was also characterized using UV-Vis spectroscopy, FTIR, XRD and FE-SEM. The developed sensor can be explored further for the impedometric sensing of heavy metals by measuring change in charge transfer resistance (RCT) of doped film against varying frequency.

dr.akashdeep@gmail.com

Exploring the role of *Anopheles stephensi* heme peroxidase in mosquito innate immunity

Tania Pal Choudhary, Mithilesh Kajla, Parik Kakani, Kuldeep Gupta, Rini Dhawan, Lalita Gupta and **Sanjeev Kumar**
Birla Institute of Technology and Sciences Pilani, India

Malaria is a tropical disease that takes a huge toll on lives as well as causes massive economic loss is one of the four deadliest vector-borne diseases caused by the obnoxious mosquitoes. Insecticide resistance and lack of effective vaccines have led to alternative strategies to control this disease. Blocking the *Plasmodium* in the *Anopheles* itself i.e., transmission-blocking can prove to be an effective approach. Studies reveal that insect peroxidases are involved in detoxification, stabilization of extracellular matrices, development and the immunity. Our study focuses on the immunobiology of *Anopheles stephensi,* the Indian urban malaria vector. Heme peroxidases, a large group of immune proteins are involved in regulation of major immune pathways. We have characterized DBLOX-double peroxidase, a mysterious *Anopheles stephensi* heme peroxidase which contains two peroxidase domains which apparently are a result of domain duplication. Sequencing of the two domains followed by expression analysis of immune challenged mosquitoes with pathogens reveals that this gene is probably getting modulated by the pathogens. Also, it shows a heightened expression in the pupa stage of the mosquito development indicating its probable role in pupa-adult metamorphosis. The *in silico* prediction analysis N- terminal signal peptide, conserved motifs (active site, heme binding site), protein modeling etc., have also been carried out implicating it to be a secreted protein. We hypothesize that this gene might have some crucial role to play in the mosquito innate immunity and further gene silencing analysis can clear its probable role in immunity. Hence, it can prove as an effective candidate for transmission-blocking strategies.

tania.pal.choudhury@gmail.com