**ABSTRACT**

Precise estimation of Creatinine (CRE) is an indispensable analysis used in the clinical settings for early stage detection of kidney dysfunction. In the present work, we described the non-enzymatic detection of [serum CRE](https://www.sciencedirect.com/topics/biochemistry-genetics-and-molecular-biology/creatinine-blood-level) using ellipsoidal nanostructured Fe2O3 integrated polyaniline (PANI) nanocomposite sensor platform. Hydrothermally derived Fe2O3 was distributed on the PANI matrices to form supramolecular nanocomposite via simple oxidative polymerization method. The Fe2O3 coordinated PANI composite showed better complex formation ability towards CRE with improved active surface area and charge transfer efficiency compared to pristine Fe2O3 and PANI. Further, the scan rate analysis confirmed the quasi-reversible diffusion controlled electrochemical kinetics of the reaction. The [differential pulse voltammetry](https://www.sciencedirect.com/topics/chemistry/differential-pulse-voltammetry) (DPV) outcomes evidenced the higher sensitivity with wide linear detection range (1 μM −13 mM), lower detection limit (144 nM) and enhanced [selectivity](https://www.sciencedirect.com/topics/chemistry/reaction-selectivity). The [blood serum](https://www.sciencedirect.com/topics/earth-and-planetary-sciences/blood-serum) sample analysis of pre and post dialysis patients ensured that our prepared Fe2O3/PANI-1 composite exhibited better recovery percentage (91.9%) and Bland-Altman plot showed statistical bias is laid within the 95% confidence interval (CI). The [glomerular filtration](https://www.sciencedirect.com/topics/biochemistry-genetics-and-molecular-biology/glomerulus-filtration) rate (GFR) index calculated from Modification of Diet in Renal Disease (MDRD) equation from our experimental results and the values have been validated with the commercial Jafee’s method. The overall analysis confirmed that the prepared Fe2O3/PANI nanocomposite [modified electrode](https://www.sciencedirect.com/topics/chemistry/modified-electrodes) has improved sensitivity and [selectivity](https://www.sciencedirect.com/topics/chemistry/reaction-selectivity) towards target molecule without the aid of any bio receptors and binders in real time CRE quantification with better accuracy.