Field effect transistor sensor based on Fe-Ni co-doped ZnO nanoparticles for the detection of hexahydropyridine chemical

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An effective chemical sensor based on field-effect transistor (FET) was fabricated for the detection of hexahydropyridine chemical. In this work, Fe-Ni co-doped zinc oxide (Zn0.97Fe0.01Ni0.02) nanoparticles (NPs) were successful synthesized by the hydrothermal technique. The morphological characterizations revealed the spherical and hexagonal NPs of average size of ~40-60 nm whereas, the EDS and XPS analysis confirmed the element compositions and doping of Zn0.97Fe0.01Ni0.02O NPs with Fe2+ and Ni2+ ions. Well-defined crystalline structure with typical wurtzite hexagonal phase of Zn0.97Fe0.01Ni0.02 NPs was supported from the XRD analysis. The fabricated FET was used for the detection of different concentrations of hexahydropyridine chemical through an electrochemical analysis. Zn0.97Fe0.01Ni0.02O NPs modified FET-sensor displayed a high sensitivity of ~62.28 μA.μM-1.cm-2, a good detection limit of ~79 μM and short response time of 10 s with correlation coefficient (R) of ~0.96405.