Nickel nanoparticles-modified electrode for the electrochemical sensory detection of Penicillin G in bovine milk samples

ABSTRACT

The monitoring of chemical and antibiotic residues like amoxicillin, penicillin, tetracycline, and vancomycin in the food originating from the animal and plant sources can prevent the humans from getting exposed to the antibiotic-induced allergic reactions and also decreased immunity towards the microbial population. By taking into consideration the necessity of developing effective and sensitive techniques for milk containing Penicillin G antibiotics in an easy and cost-effective mode, the present work deals with the electrochemical sensor made up of nickel nanoparticles (NiNPs). In order to enhance the chemical stability and biocompatibility, the NiNPs were crosslinked with (3 aminopropyl)triethoxysilane (APTES) and the formed composite was thoroughly characterized using the physical characterization techniques. In addition, the qualitative analysis results confirmed the nanocomposite's synergetic effect towards the oxidation of Penicillin G. Further, the quantitative analysis towards the use of a nanocomposite electrode due to the changes in pH, scan rate, accumulation time and potential, nanoparticle (NP) amount, etc. was optimized. The limit of detection and limit of quantitation of Penicillin G with this composite were detected to be 0.00031 μM and 0.00100 μM, respectively. Overall, from the results, it can be indicated that the fabricated NiNP sensor can find its applications as a potential electrode material for the qualitative and quantitative analysis of Penicillin G in liquid samples.

Keyword: Antibiotic; Amoxicillin; Immunity; Nickel nanoparticles