An electrochemical sensor based on gold nanoparticles-functionalized reduced graphene oxide screen printed electrode for the detection of pyocyanin biomarker in Pseudomonas aeruginosa infection

ABSTRACT

Multidrug resistant Pseudomonas aeruginosa (P. aeruginosa) is known to be a problematic bacterium for being a major cause of opportunistic and nosocomial infections. In this study, reduced graphene oxide decorated with gold nanoparticles (AuNPs/rGO) was utilized as a new sensing material for a fast and direct electrochemical detection of pyocyanin as a biomarker of P. aeruginosa infections. Under optimal condition, the developed electrochemical pyocyanin sensor exhibited a good linear range for the determination of pyocyanin in phosphate-buffered saline (PBS), human saliva and urine at a clinically relevant concentration range of 1–100 μM, achieving a detection limit of 0.27 μM, 1.34 μM, and 2.3 μM, respectively. Our developed sensor demonstrated good selectivity towards pyocyanin in the presence of interfering molecule such as ascorbic acid, uric acid, NADH, glucose, and acetylsalicylic acid, which are commonly found in human fluids. Furthermore, the developed sensor was able to discriminate the signal with and without the presence of pyocyanin directly in P. aeruginosa culture. This proposed technique demonstrates its potential application in monitoring the presence of P. aeruginosa infection in patients.

Keyword: Electrochemical sensor; Reduced graphene oxide; Pyocyanin; Pseudomonas aeruginosa