Pyocyanin is a virulence factor uniquely produced by the pathogen Pseudomonas aeruginosa. The fast and selective detection of pyocyanin in clinical samples can reveal important information about the presence of this microorganism in patients. Electrochemical sensing of the redox-active pyocyanin is a route to directly quantify pyocyanin in real time and in situ in hospitals and clinics. The selective quantification of pyocyanin is, however, limited by other redox-active compounds existing in human fluids and by other metabolites produced by pathogenic bacteria. Here we present a direct selective method to detect pyocyanin in a complex electroactive environment using commercially available electrodes. It is shown that cyclic voltammetry measurements between –1.0 V to 1.0 V reveal a potential detection window of pyocyanin of 0.58–0.82 V that is unaffected by other redox-active interferents. The linear quantification of pyocyanin has an R² value of 0.991 across the clinically relevant concentration range of 2–100 nM. The proposed method was tested on human saliva showing a standard deviation of 2.5% ±1% (n = 5) from the known added pyocyanin concentration to the samples. This inexpensive procedure is suggested for clinical use in monitoring the presence and state of P. aeruginosa infection in patients.