Mussel adhesive protein-based whole cell array biosensor for environmental monitoring of organophosphorus compound

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A novel whole cell-based array biosensor for detection of neurotoxic paraoxon was developed by immobilizing *Escherichia coli* expressing organophosphorus hydrolase in periplasmic space on mussel adhesive protein (MAP)-coated 96-well microplate. The effect of MAP as a cell immobilizing agent was evaluated by comparing with simple physical adsorption mehtod. Paraoxon-degradable activity and fluorescence microscopy studies revealed that the use of MAP has advantages of increasing cell immobilizing efficiency and enhancing stability of immobilized cells compared to simple physical adsorption-based whole cell biosensor. Scanning electron microscopy analysis also showed that MAP effectively immobilized cells on surface without pretreatment steps. The whole cell-based array biosensor could detect as low as 5 μM paraoxon with high reproducibility and the detection range of the biosensor was 5–320 μM. In addition, the whole cell biosensor showed good long-term storage and multiple-use stability. Collectively, our proposed whole cell array biosensor is suitable tool for rapid and sensitive detection of harmful organophosphorus compounds.