Development of Bio-lab-on-a-chip to Detect Toxic Components Based on Optical Enzyme-sensor Microparticles

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This study describes the fabrication of bio-lab-on-a chip devices used for the detection of organophosphorus compounds. The lab-on-a chip devices were composed of two part, one is microchannel made from poly(dimethyl siloxane)(PDMS) for the transport of analytes and the other is hydrogel microbeads entrapping acetylcholinesterase (AChE) conjugated with pH-sensitive dye for the detection of analytes. Hydrogel microbeads ranged from 50μm to 100μm were prepared with poly(ethylene glycol)(PEG) through either dispersion or emulsion polymerization and incorporated into microfluidic devices. When AChE entrapped in hydrogel microbead were exposed to acetycholin as a substrate, acetic acid was produced inside the microbead by enzyme-catalyzed reaction and subsequently decrease the microenvironment pH, which could be easily detected by change in emission intensity ratio before and after exposure to substrate. Furthermore, different reactions were detected simultaneously by using multiple microchannels immobilizing hydrogel-entrapped enzymes.