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Bioelectronic Sniffer (Biosniffer) Based on Enzyme Inhibition of Butyrylcholinesterase for Toluene Detection

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A new bioelectronic sniffer (biosniffer) for toluene was developed with butyrylcholinesterase (BuChE) and choline oxidase (COD), and evaluated for its performance. The toluene was measured as the effect of inhibitor on the enzyme activity of BuChE. The biosniffer device consisted of an enzyme-immobilized biosensor and a flow cell for the measurement of gaseous substances. The biosensor for toluene in the liquid phase was constructed using a Clark-type dissolved oxygen electrode and a BuChE and COD coimmobilized membrane. After evaluating the biosensor's performances with choline and butyrylcholine, the characteristics of the biosniffer for toluene were evaluated in the gas phase. As a result, the signal intensity of the biosniffer with 750 μmol/l butyrylcholine decreased upon application of toluene vapor and reached a steady-state current, thus revealing the concentration of toluene in the gas phase. The changes in output current of the biosniffer were found to be related to the toluene concentration over the range from 5 to 100 ppm with a correlation coefficient of 0.997 (n = 5). The calibration range of the biosniffer for gaseous toluene covered the permissible concentration of toluene (50 ppm) as the threshold limit value (TLV) prescribed by the American Conference of Governmental Industrial Hygienists (ACGIH). The biosniffer (gas-phase biosensor) based on enzyme inhibition was effectively used for the measurement of toluene vapor.

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