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An acetylcholinesterase (AChE) biosensor with enhanced solvent resistance based on chitosan for the detection of pesticides

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Abstract

Solvent tolerance of immobilized enzymes is important for many biosensing and biotechnological applications. In this paper we report an acetylcholinesterase (AChE) biosensor based on chitosan that exhibits high solvent resistance and enables sensitive detection of pesticides in presence of a high content of organic solvents. The solvent effect was established comparatively for the enzyme immobilized in chitosan and covalently cross-linked with glutaraldehyde. The activity of the immobilized AChE was dependent on the immobilization method and solvent type. The enzyme entrapped in chitosan fully conserved its activity in up to 25% methanol, 15% acetonitrile and 100% cyclohexane while the enzyme cross-linked with glutaraldehyde gradually lost its activity starting at 5% acetonitrile and methanol, and showed variable levels in cyclohexane. The detection limits of the biosensor for paraoxon were: 7.5 nM in 25% methanol, 100 nM in 15% acetonitrile and 2.5 μ M in 100% cyclohexane. This study demonstrates that chitosan provides an excellent immobilization environment for AChE biosensors designed to operate in environments containing high amounts of organic solvents. It also highlights the effect of the immobilization material and solvent type on enzyme stability. These

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