Acetylcholinesterase (AChE) of Diodon hystrix brain as an alternative biomolecule in heavy metals biosensing

ABSTRACT

The continuous discharge of toxic materials into the environment has been an alarming issue faces around the globe. Hence, matching effort of monitoring activity is vital to coping with the overwhelming amount of metal ions. Along with the significant current research being conducted, this study aims to investigate the sensitivity of acetylcholinesterase (AChE) of Sabah porcupine fish, Diodon hystrix as an alternative biosensor in the detection of heavy metals. The enzyme was precipitated followed by the purification using ammonium sulfate precipitation and procainamide-affinity chromatography, respectively, with a total recovery of 66.67% with the specific activity of 2297.50 U/mg. The enzyme works optimally at pH 9 with the best incubation temperature of 30°C. The Michaelis constant (Km) and maximal velocity (Vmax) of 1.171 mM and 879257 mol/min/mg denotes the highest catalytic efficiency (Vmax/Km) of acetylthiocholine iodide (ATC) as its preferable substrate. Inhibition study tested on 10 metal ions resulted in increasing toxicity order of Cr^{6+} < Co^{2+} < Ag^{2+} < Cu^{2+} < Pb^{2+} < As^{5+} < Cd^{2+} < Zn^{2+} < Ni^{2+} < Hg^{2+}, with only Hg^{2+} exhibited the half-maximal inhibitory concentration (IC50) of 0.48 mg/L. From the study, it suggests that the D. hystrix AChE as the potential conventional biosensor for heavy metals detection.