Preliminary detection method for heavy metals Biomonitoring via inhibitive assay of brain Acetylcholinesterase from diodon hystrix

ABSTRACT

Acetylcholinesterase (AChE) is a well-known enzyme sensitive to pesticide exposure, but heavy metal sensitivity is rarely reported. Here, AChE extracted from the brain tissue of Diodon hystrix was exploited and used in a fast and economical way to sensitively detect the existence of heavy metals in a water sample. An inhibitive enzyme assay was conducted, and the activity of AChE was found to be sensitive (> 20% inhibition) to submillion levels of arsenic, cadmium, nickel, and zinc and less sensitive (< 20% inhibition) to copper and lead. While exposure to argentum, cobalt, and chromium shows no significant inhibition, AChE is not sensitive to those metal ions ($p < 0.05$). Field test work has proved that the assay is suitable for preliminary detecting heavy metal contamination in the river, especially near industrial and mining sites. Secondary validation was performed using ICPOES to identify and measure the number of elements in the sample and compare them to the inhibition level of AChE activity..