

Xenoassay-metal™— a heavy metal bioassay system


 Award Winner


Rapid and sensitive measurements of heavy metals are required in various fields such as environment, food industry and medicine. Classical methods such as atomic absorption spectroscopy, inductively coupled plasma optical emission spectrometry, inductively coupled plasma mass spectrometry and their combination with chromatographic techniques need sophisticated instrumentation, skilled personnel, complicated sample pre-treatment and sometimes a long measuring period thus simple and fast procedures used as screening tests for industrial process water or foodstuffs to indicate the presence of toxic heavy metals are especially important (Han et al., 2001). There is also a need for an inexpensive, simple and rapid enzymatic assay for heavy metals. We have therefore explored the potential of papain, a protease, as a sensitive assay for heavy metals.

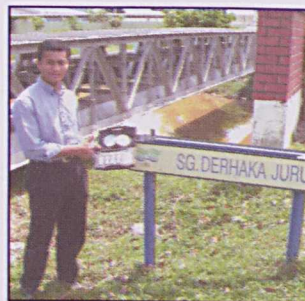


Xenoassay Kit

An enzymatic bioassay of heavy metals has been designed at UPM based on the inhibitive properties of protease by heavy metals and the sensitive assay of this inhibition by the casein-Coomassie Blue proteolytic assay. Among the various proteases tested, bromelain and papain offers the best system in terms of sensitivity, accuracy and precision as well as it is simple, rapid and economical. The calculated bromelain IC_{50} for mercury, and copper is 0.20 and 0.12 For the purpose of quantification, the limits of quantitation (LOQ) of the heavy metals, which is sometimes assigned as ten times the baseline signal, the LOQ for mercury and copper are 0.1 mg/l and 0.1

mg/l for bromelain. The LOQ values for mercury are twice the maximum permissible limit allowed in industrial effluent in Malaysia whilst the LOQ and IC_{50} values for copper is below the maximum permissible limit (Malaysian Environmental Quality Act 1974). Thus the assay system could detect levels of toxic heavy metals at the level of the maximum permissible level of toxic metals in Environmental quality act 1974 (environmental quality (sewage and industrial effluents) regulations 1978). This suggest that the papain inhibitive assay is best suited to monitor at the large-scale level; industrial effluents, sewage outlets and rivers in Malaysia specifically and globally in general for toxic level of mercury and copper.

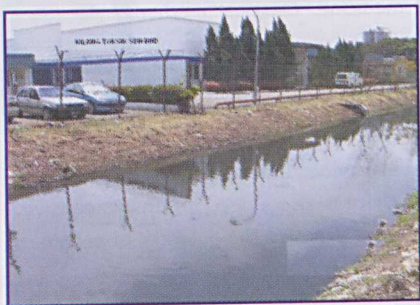
Field trials conducted at UPM with water samples collected from several rivers and drains in Penang especially in the Juru area revealed that the Juru Derhaka River contains heavy metals.



Field trial

Interference tests were also conducted. We added pesticides (Carbofuran, imidacloprid, diazinon, metalochlor, flucythrinate, coumaphos, car-

baryl, atrazine simazine, paraquat, diuron, endosulfan) 1 mg/L final) detergents (SDS and Dettol at 1% final), hydrocarbons (diesel at 1%). These xenobiotics, at the tested levels are commonly present in polluted water. We found that the Xenoassay kit is not interfered by the presence of these metals.



Interference tests conducted at toxic site

From the studies conducted, it can be concluded that the Xenoassay™ is suitable for monitoring industrial effluents, sewage outlets and rivers in Malaysia at large-scale levels. Thus, this system has a tremendous commercial potential.

The kit has won several medals and is patent-pending under Malaysian Patent registration number PI 20033505.

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