

Heavy Metal Concentration in Body Walls of Malaysian Sea Cucumbers

HAWA ISMAIL, PUNTHAMALAR, A., NOOR IBRAHIM MOHD SAKIAN
& RIDWAN BIN HASHIM

ABSTRAK

Kepekatan logam berat pada dinding tubuh dua spesies timun laut, Stichopus hermanni Semper and Holothuria atra Jaeger, dari perairan Pulau Pangkor, Perak dan Pulau Kapas, Terengganu telah diukur. Kepekatan Cd, Pb, Zn, dan Cu ditentukan selepas pencernaan asid, menggunakan spektrometer serapan atom. Kepekatan Hg telah ditentukan menggunakan spektrometer serapan atom wap sejuk. Aras Cd, Pb, dan Hg adalah lebih tinggi secara signifikan dalam dinding tubuh holothuroid dari Pulau Kapas berbanding holothuroid dari Pulau Pangkor ($p < 0.05$). Kandungan Pb dalam dinding tubuh kedua-dua spesies dari Pulau Kapas dan Pulau Pangkor didapati lebih tinggi dari aras yang dibenarkan dalam tubuh manusia. Hasil kajian ini menunjukkan bahawa pembuangan sisa afluen industri tanpa kawalan dari Perak, Selangor dan Terengganu kemungkinan telah menyebabkan masalah pencemaran marin yang ketara termasuk juga pencemaran oleh logam berat, terutamanya Cd, Cu, Pb dan Zn.

Kata kunci: Stichopus hermanni Semper, Holothuria atra Jaeger, logam berat, Cd, Pb, Zn, Cu, Hg, timun laut, holothuroid.

ABSTRACT

Concentrations of heavy metals were determined in the body walls of two species of sea cucumbers, Stichopus hermanni Semper and Holothuria atra Jaeger, obtained from the tidal waters off Pulau Pangkor, Perak and Pulau Kapas, Terengganu. The concentrations of Cd, Pb, Zn, and Cu were determined after acid digestion by using atomic absorption spectrometer. Mercury concentration was determined by cold vapour atomic absorption spectrometer. The levels of Cd, Pb, and Hg were significantly higher in the body walls of holothuroids from Pulau Kapas than from the same species from Pulau Pangkor ($p < 0.05$). The Pb content in the body walls of both the species from Pulau Kapas and Pulau Pangkor was found to be higher than the permissible level in the human

body. The results obtained from our studies indicated that the uncontrolled dumping of industrial effluent from Perak, Selangor and Terengganu could possibly cause significant marine pollution problems which include heavy metal contamination, especially of Cd, Cu, Pb and Zn.

Key words: *Stichopus hermanni* Semper, *Holothuria atra* Jaeger, heavy metals, Cd, Pb, Zn, Cu, Hg, sea cucumber, holothuroids.

INTRODUCTION

Heavy metals are known to be potentially toxic because of their ability to be concentrated in the organs of marine organisms, thus posing a direct threat to consumers (Tariq et al. 1993). In view of this toxicity potential, serious concern has arisen in recent years and fish have been employed by several investigators as indicators for metal pollution in the marine environment (Chan 1995; Admundsen et al. 1997; Law & Singh 1997; Ismail & Ramli 1997). According to Farag et al. (1998) macroinvertebrates were often collected and sampled to determine the concentration of heavy metals from the polluted sea. Heavy metals are introduced into the marine environment through domestic, industrial and agriculture and mining activities. A large part of the heavy metal input ultimately accumulates in the estuarine zone, coastal areas and aquatic organisms such as macro invertebrates.

Sea cucumbers have long been used in traditional medicine in Malaysia. These marine macroinvertebrates' tissues are often used as the main ingredients in many traditional medicine preparations. Consumers' safety when consuming it is of utmost importance. To date, there are very few published data on heavy metals concentrations in these marine animals (Ridzwan 1993; Madhavan 1999; Mohansaraj 2000). This study presents work elucidating the concentrations of heavy metals in the body walls of two species of sea cucumber, *Stichopus hermanni* and *Holothuria atra* from Pulau Pangkor, Perak and Pulau Kapas, Terengganu.

MATERIALS AND METHODS

Two species of sea cucumbers, *Stichopus hermanni* and *Holothuria atra* were collected at random from the tidal waters off Pulau Pangkor. The samples were identified according to Ridzwan (1993). The organisms were eviscerated and the body walls were washed with distilled water and homogenized. They were then placed in an oven at 105°C for 3 hrs and later burnt in a furnace at 650°C. The ash was then digested in 5 ml concentrated hydrochloric acid. The digested sample was then diluted with double distilled

water and then analyzed by atomic absorption spectrometer model 4100 Perkin Elmer. The analysis was based on Perkin Elmer's method (2000) modified by Fairulnizal et al. (1998). The data is presented in mg/g dry weight. To avoid contamination, all glassware and equipment were soaked in 5% nitric acid and rinsed in distilled water. The body wall constituents were analyzed using acid digestion and the concentrations of Cu, Pb, and Zn were determined by Atomic Absorption Spectrometer (AAS) model GBC 906. Mercury (Hg) concentrations were determined by cold vapour atomic absorption spectrometer (CVAAS) model AS 90 and for cadmium, atomic absorption spectrometer (AAS) model 330 was used. Data were analysed using the Mann-Whitney-U. For all comparison, differences were considered to be significant when $p = < 0.05$.

RESULTS AND DISCUSSION

Metal concentrations in the two species of sea cucumbers are presented in Table I. As bottom feeders, holothuroid accumulate the sediment contents of the seabed in its body wall. Our results suggest that sea cucumber can also be used as an indicator for marine pollution.

Marine animals usually have high cadmium content. However, except for a report by Mohansaraj (2000) which indicated the presence of the metal at 3.25 – 6.9 µg/L in coelomic fluid, there does not appear to be any other report on Cd content in sea cucumber walls. The level of Cd was found to be three times more in *Holothuria atra* from Pulau Kapas as compared to those from Pulau Pangkor, which was present at 33.027 µg/g ($p < 0.05$). Cadmium can enter the aquatic system through soil erosions, rock sediment and the use of fertilizers in agriculture, and industrial waste disposed directly into the sea. Phosphate fertilizers used by farmers contain 10 –100 µg/ml cadmium (Cook and Morrow 1995). Coastal areas of sampling are located close to the agricultural land of Kuala Terengganu and industrial areas of

TABLE I. Mean metal concentrations in body wall of sea cucumbers from Pulau Pangkor and Pulau Kapas (mg/g) dry weight.

Origin	Species	Cd	Pb	Zn	Cu	Hg
P. Pangkor	<i>S. hermanni</i>	10.48 ± 0.15	9.87 ± 0.10	43.54 ± 0.47	38.87 ± 0.14	0.09 ± 0.01*
	<i>H. atra</i>	8.00 ± 0.16	10.32 ± 0.12	30.38 ± 0.53 ±	41.13 ± 0.15	0.08 ± 0.14*
P. Kapas	<i>S. hermanni</i>	12.09 ± 0.18*	15.77 ± 0.10*	59.13 ± 0.43	29.45 ± 0.10	0.10 ± 0.01*
	<i>H. atra</i>	33.03 ± 0.18*	15.67 ± 0.13*	51.67 ± 0.33	31.32 ± 0.11	0.17 ± 0.01*

* $p < 0.05$

Kerteh. These factors could contribute to the pollution of the sea with cadmium. The body wall of *H. atra* from Pulau Pangkor showed a high copper content compared to the same species from Pulau Kapas but the difference was not significant.

The dumping of toxic wastes containing mercury from the drainage system into the sea could have caused high mercury accumulation in both the species, but it was significantly higher in holothuroids from Pulau Kapas (0.10 – 0.17 $\mu\text{g/g}$) compared to the two from Pulau Pangkor (0.08 – 0.09 $\mu\text{g/g}$) ($p < 0.05$). Kuala Terengganu used to have gold mining activities a few years ago where mercury could have been used to separate gold from other impurities. These wastes might have been improperly disposed off into the aquatic system. Our results also showed that there was no significant difference in the level of zinc in both the species from the two areas.

The lead content of *H. atra* and *S. hermanni* from Pulau Kapas (15.67 and 15.77 $\mu\text{g/g}$, respectively) was significantly higher than those from Pulau Pangkor (9.87 and 10.32 $\mu\text{g/g}$, respectively) ($p < 0.05$). The levels of Pb in both species were above the permissible level (2 $\mu\text{g/g}$). The established petroleum industry in Terengganu could have contributed as a source of lead pollution in the sea. Lead toxicity could lead to neurological or hematological diseases, but to date there have been no adverse reports from consuming sea cucumber or its finished preparation in traditional medicine.

CONCLUSION

These results could further serve as a baseline for future studies on the management of heavy metal pollution of the waters off the coastal areas of Perak and Terengganu.

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Hawa Ismail,
 Punithamalar, A.
 Noor Ibrahim Mohd Sakian
 Biomedical Science Department
 Faculty of Allied Health Sciences
 Universiti Kebangsaan Malaysia
 Jalan Raja Muda Abdul Aziz
 50300 Kuala Lumpur

Ridzwan Hashim
 Kulliyah of Science
 International Islamic University Malaysia
 Jalan Gombak, 53100 Kuala Lumpur