COPPER (Cu) AND ZINC (Zn) IN THE FOOD WEB OF INTERTIDAL MANGROVE ECOSYSTEM OF SUNGAI PULOH, MALAYSIA

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COPPER (CU) AND ZINC (ZN) IN THE FOOD WEB OF INTERTIDAL MANGROVE ECOSYSTEM OF SUNGAI PULOH, MALAYSIA

By

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Thesis submitted to the School of Graduate Studies, Universiti Putra Malaysia, in Fulfillment of the Requirements for the Degree of Master of Science

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COPPER (CU) AND ZINC (ZN) IN THE FOOD WEB OF INTERTIDAL MANGROVE ECOSYSTEM OF SUNGAI PULOH, MALAYSIA

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The purpose of this study was to assess the copper (Cu) and zinc (Zn) levels in the intertidal mangrove sediment of Sungai Puloh (SGP) and Sungai Tengi (SGT). Another aim was to assess the bioaccumulation pattern of Cu and Zn in a food web of Sungai Puloh intertidal mangrove ecosystem. For the first goal, intertidal surface sediment samples were collected from four stations in each of the two intertidal mangrove ecosystems of Sungai Puloh (SGP N 03° 04.786´ E 101° 23.903´) and Sungai Tengi (SGT N 03° 24.682, E 101° 9.971´) in Selangor, between January and March, 2009. For the second objective, different components of intertidal mangrove ecosystem (mangrove leaves, roots, phytodetritus-algae and detritus, surface sediment, crabs, snails and fish) were collected from six stations in Sg. Puloh mangrove between August and December, 2009. The samples were determined for Cu and Zn by using an air-acetylene flame Atomic absorption Spectrophotometer (Analyst 800 model, by Perkin-Elmer) and presented in µg/g dry weight basis. The results revealed that
both SGP and SGT with mean Zn concentrations (302.64 ± 5.33 µg/g) and
(870.73± 61.04 µg/g) respectively were contaminated by Zn, while only SGP
showed elevated levels of Cu (67.17±4.95µg/g), and receives more
anthropogenic inputs of Cu (27.0%) and Zn (63.4%) compared to SGT with
anthropogenic inputs of Cu (13.2%) and Zn (31.4%) with a significant difference
\( (P < 0.05) \). It was also found in Sungai Puloh that there is a positive correlation
between the trophic chains with evidence of biomagnifications of Cu in \( Uca \)
annulipes – phytodetritus chain (biomagnifications factor BMF 2.83, \( r = 0.422 \ P
> 0.05 \)) and that of Zn was observed only in \( Periophthalmodon schlosseri \) gill –
\( U. \) annulipes chain (BMF 1.53, \( r = 0.130 \ P > 0.05 \)). In conclusion, Sungai Puloh
intertidal mangrove surface sediment is moderately contaminated and receives
more anthropogenic inputs of Cu and Zn compared to Sungai Tengi intertidal
mangrove surface sediments. Even though Cu and Zn accumulate in the
organisms and showed high concentration in SGP intertidal mangrove surface
sediment, it has not reached its toxic level in the food web of this intertidal
mangrove ecosystem. However, due to the economic importance of these
mangroves in supporting a variety of marine and terrestrial life including local
fishery activities, there is an urgent need to take actions by the appropriate
authorities to protect SGP intertidal mangrove ecosystem from anthropogenic
contaminants, while SGT intertidal mangrove ecosystem should be monitored
periodically.
Abstrak tesis ini telah di persembahkan kepada Senat Universiti Putra Malaysia bagi memenuhi keperluan ijazah Master Sains

TEMBAGA (CU) DAN ZINK (ZN) DALAM WEB MAKANAN EKOSISTEM BAKAU, KAWASAN PASANG SURUT DI SUNGAI PULOH, MALAYSIA

Oleh

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ditentukan dengan menggunakan Spektrofotometer Penyerapan Atom (model 800 Analyst, oleh Perkin-Elmer) dengan nyala asetilena dalam unit mg/g berat kering. Keputusan kajian menunjukkan kedua-dua kawasan SGP dan SGT telah tercemar dengan logam Zink (dengan purata kepekatan Zn bagi SGP= 302.64 ± 5.33 μg/g dan SGT= 870.73 ± 61.04 μg/g). Bagi logam kuprum, hanya sampel dari SGP menunjukkan terdapatnya peningkatan logam berkenaan (dengan purata kepekatan Cu bagi SGP= 67.17 ± 4.95μg/g) berbanding kawasan SGT. Ini menunjukkan SGP lebih terdedah kepada input antropogenik yang mengandungi lebih Cu (27.0%) dan Zn (63.4%) jika dibandingkan dengan SGT yang lebih rendah input Cu nya (13.2%) dan Zn (31.4%) (P < 0.05). Selanjutnya, pengkaji menemui korelasi positif di antara rantai trofik yang berbeza di SGP dan ini dibuktikan melalui biomagnifikasi Cu dalam rantaian makanan di antara Uca annulipes dengan fitodetritus (dengan faktor biomagnifikasi, BMF 2.83, r = 0.422 P > 0.05). Manakala biomagnifikasi Zn hanya jelas dilihat dalam rantaian makanan di antara Periophthalmodon schlosseri dan U. annulipes (dengan faktor biomagnifikasi, BMF 1.53, r = 0.130 P > 0.05). Kesimpulannya, ekosistem bakau di SGP terutamanya sedimen permukaan yang mengalami pasang surut ini telah tercemar dan menerima lebih input antropogenik Cu dan Zn berbanding ekosistem bakau di SGT. Walaupun logam-logam seperti Cu dan Zn telah terkumpul di dalam organism-organisma di kawasan bakau SGP dalam jumlah kepekatan yang tinggi, namun tahap pencemaran logam-logam terbabit belum mencapai tahap toksik dan masih selamat untuk digunakan. Walaupun begitu, kepentingan ekosistem bakau di kedua-dua kawasan terhadap hidupan liar dan
ekonomi tempatan tidak dapat dinafikan. Justeru, terdapat keperluan mendesak bagi pihak berkuasa untuk melindungi ekosistem bakau SGP daripada pencemaran berterusan oleh bahan-bahan pencemar antropogenik serta pemantauan berterusan di kawasan SGT.
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Firstly, I offer my unalloyed gratitude to my supervisor, Professor Ahmad Ismail, PhD, who provided me with immense support, brilliant and invaluable ideas throughout this research work. He was always patient with me and ready to proffer solutions to my problems in the course of writing this thesis. My master’s degree is attributed to my supervisor’s encouragement and resilient effort to make sure I did not lose focus, and without him this thesis would not have been completed. He even gave me a print out “NEVER SLEEP STUDY HARD” which I strategically pasted in my study room. I would wish to have him as my supervisor for any further research if am given the opportunity to do my PhD by UPM.

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Approval sheet 1

I certify that an Examination Committee has been set on the 18th of March, 2011 to conduct the final examination of Udechukwu Bede Emeka on his Masters thesis entitled “Copper (Cu) and Zinc (Zn) in the food web of intertidal mangrove ecosystem of Sungai Puloh, Malaysia” in accordance with Universiti Pertanian Malaysia (Higher Degree) Act 1980 and Universiti Pertanian Malaysia (Higher Degree) Regulations 1981. The committee recommends that the student be awarded the Master of Science Degree.

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This thesis was submitted to the senate of Universiti Putra Malaysia and has been accepted as a fulfillment of the requirement for the degree of Master of Science. The members of the Supervisory Committee were as follows:

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Date:
DECLARATION

I declare that the thesis is my original work except for the quotations which have been duly acknowledged. I also declare that it had not been previously, and is not concurrently, submitted for any other degree at Universiti Putra Malaysia or any other institution.

UDECHUKWU BEDE EMEKA

Date: 18 March 2011
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