

**DISTRIBUTION OF ELEMENT IN SEAWEED ALONG THE  
EAST COAST OF PENINSULAR MALAYSIA**

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**MASTER OF SCIENCE  
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**DISTRIBUTION OF ELEMENT IN SEAWEED ALONG THE EAST COAST  
OF PENINSULAR MALAYSIA**

**SITI MASHITAH BINTI MOHAMMAD**

**Thesis Submitted in Fulfillment of the Requirement for the  
Degree of Master of Science in the Institute of Oceanography  
Universiti Malaysia Terengganu**

**JULY 2011**

*Dedicated to,*  
*Zulkipeli Bin Taib*  
*&*  
*Azizah Bt Hat*

Abstract of thesis presented to the Senate of Universiti Malaysia Terengganu in fulfillment of the requirement for the Degree of Master of Science.

## **DISTRIBUTION OF ELEMENT IN SEAWEED ALONG THE EAST COAST OF PENINSULAR MALAYSIA**

**SITI MASHITAH MOHAMMAD**

**JULY 2011**

**Chairperson : Assoc. Prof. Dr. Aidy @ M. Shawal M. Muslim**

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The distribution of elements (trace metals, REEs and Polonium-210) in 4 types of seaweeds was studied along 12 stations on the east coast and 4 stations at Port Dickson on the west coast of Peninsular Malaysia in May and June 2009. The relative average abundance of trace metals showed consistent enrichment of essential metals in *Padina*, *Sargassum*, *Colpomenia*, and *Gracilaria*. REEs showed enrichment of Light REEs to the Heavy REEs in all genera. With regard to food safety, the concentrations of Hg, Cd, Pb and Zn on a wet weight basis are well within permissible limits. The results indicate a general lack of contamination by metals in seaweeds at studied stations. However Cd and Pb concentrations in *Padina* were indicative of pollution at Batu Layar and at Blue lagoon in Port Dickson. Metals and REEs concentration showed spatially significant variations in their distribution ( $p < 0.05$ ,  $p < 0.01$ ). The very high correlation of the contaminant metals Pb and Hg to REEs however indicate their contribution being derived from granitic rocks. REEs concentration showed a saw-tooth pattern while chondrite-normalized REEs pattern

showed negative Eu anomaly, a slight upward convexity centered on the intermediate REE (Gd) and lower HREE concentrations in all genera. NASC-normalized REEs pattern resulted in M-type trend for all genera. The normalized patterns did not vary and seemed to be independent of genus and location, which suggests that they are of similar origin. The activities of  $^{210}\text{Po}$  were found higher in *Padina* compared to *Sargassum*, where the highest activity was recorded at Cherating (S7). Low ( $r=0.2-0.4$ ) and moderate correlation ( $r=0.4-0.7$ ) were found between  $^{210}\text{Po}$  with metals and REEs. *Padina* was found as suitable genus for biomonitor compared to the other seaweeds studied, based on their widespread distribution and ability to accumulate trace metals, REEs and  $^{210}\text{Po}$  several times higher than others.

Abstrak tesis yang dikemukakan kepada Senat Universiti Malaysia Terengganu sebagai memenuhi keperluan untuk ijazah Master Sains.

**TABURAN KEPEKATAN ELEMEN DALAM RUMPAI LAUT SEPANJANG PANTAI TIMUR SEMENANJUNG MALAYSIA**

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Kajian taburan elemen (logam surih, unsur nadir bumi dan Polonium-210) dalam 4 jenis rumpai laut telah dijalankan di 12 lokasi sepanjang pantai timur dan 4 lokasi di Port Dickson di pantai barat Semenanjung Malaysia, pada bulan Mei dan Jun 2009. Kadar purata relatif taburan logam surih menunjukkan pengkayaan logam perlu yang konsisten di dalam *Padina*, *Sargassum*, *Colpomenia*, dan *Gracilaria*. Unsur nadir bumi juga menunjukkan pengkayaan unsur nadir bumi ringan berbanding unsur nadir bumi berat di dalam semua genus. Perbandingan kepekatan logam Hg, Cd, Pb dan Zn dengan paras logam toksik maksimum di dalam makanan yang dibenarkan menunjukkan bahawa nilai di dalam kajian masih di bawah paras selamat. Secara keseluruhan, pencemaran adalah ditahap yang rendah di dalam rumpai laut di sepanjang kawasan kajian. Namun, Cd dan Pb sedikit membimbangkan di dalam genus *Padina* di Batu Layar dan Blue Lagoon di Port Dickson. Taburan kepekatan logam surih dan unsur nadir bumi telah menunjukkan nilai yang signifikan antara lokasi ( $p < 0.05$ ,  $p < 0.01$ ). Perkaitan yang tinggi di antara

logam pencemar Pb dan Hg dengan unsur nadir bumi menunjukkan bahawa secara umumnya Pb dan Hg adalah bersumberkan dari batuan granit. Taburan kepekatan unsur nadir bumi menunjukkan pola gigi-gergaji, dan corak unsur nadir bumi yang dinormalisasikan dengan nilai 'chondrite' telah menunjukkan anomali Eu negatif, sedikit penaikan di bahagian tengah (Gd) dan kepekatan unsur nadir bumi berat yang rendah di dalam semua genus. Corak unsur nadir bumi yang dinormalisasikan dengan nilai 'Shale' (NASC) pula menghasilkan pola M untuk semua genus. Persamaan corak unsur nadir bumi yang dinormalisasikan menunjukkan bahawa genus dan lokasi kajian tidak mempengaruhi corak taburan tersebut, dan ini menunjukkan bahawa unsur nadir bumi di kawasan kajian mungkin berasaskan dari sumber yang sama. Kadar aktiviti  $^{210}\text{Po}$  dilaporkan tinggi di dalam *Padina* berbanding *Sargassum* dengan kadar aktiviti tertinggi dicatatkan di Cherating (S7). Nilai hubungkait bagi  $^{210}\text{Po}$  yang rendah ( $r=0.2-0.4$ ) dan sederhana ( $r=0.4-0.7$ ) telah dijumpai di antara logam surih dan unsur nadir bumi. Berdasarkan hasil kajian, *Padina* dilaporkan sebagai penunjuk biologi yang sesuai berbanding genus yang lain berdasarkan taburannya yang meluas dan keupayaan mengumpul logam surih, unsur nadir bumi dan  $^{210}\text{Po}$  yang tinggi berbanding yang lain.