ANALYSIS OF PLASTIC DEBRIS ON MALAYSIAN BEACHES

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ABSTRACT

Plastic debris is the main cluster of solid waste component present in the marine environment. Anthropogenic activities namely recreational and fishing activities are believed to contribute to the abundance of plastic debris (1 – 30 mm in size) especially along the beach. This study was undertaken to quantify and assess the degree of plastic debris buried in sand according to size with a view to classify such debris deposition at some Malaysian beaches. Another objective, the abundance distribution of the buried plastics was also studied in relation to the tidal zones of the beaches. Six selected beaches (in three different states of Malaysia) served as the representative of the fishing and recreational beaches in this study namely; Teluk Kemang Beach, Pasir Panjang Beach, Batu Burok Beach, Seberang Takir Beach, Tanjung Aru Beach and Teluk Likas Beach. Plastic debris were sampled once a month for three consecutive months. At each beach, triplicates of 12.5 L of sand samples were collected from different tidal zones. The sand samples were sieved to collect and group small plastic debris according to types and sizes. A total of 2,542 pieces of plastics were collected from all selected beaches with a density of 265.30 g/m^2. Small-plastic debris occurred on all of the beaches, but the greatest abundance was in Seberang Takir Beach (879 items/m^2), followed by Batu Burok Beach (780 items/m^2), Teluk Likas Beach (249 items/m^2), Teluk Kemang Beach (231 items/m^2) and Pasir Panjang Beach (211 items/m^2). The least abundance of plastic pieces was collected in Tanjung Aru Beach (192 items/m^2). Different types of small plastic particles found in this study were classified into film (36.59%), foam (23.29%), fragment (13.34%), line (25.29%) and pellet (1.49%). The presence of small sized-plastics debris was due to the physical and chemical degradation. Plastic debris buried at different tidal zones have the potential to cause changes to the structure and profile of the sand. The presence of small plastic debris

could pose adverse impacts to marine ecosystem, especially to marine species. This study documents for the first time presence of small plastic debris on Malaysian beaches. Thus, more studies need to be conducted to enable more understanding on this scenario.

ABSTRAK

Sisa plastik adalah sebahagian besar daripada komponen sisa pepejal yang terdapat di persekitaran marin. Aktiviti antropogenik terutamanya aktiviti rekreasi dan perikanan dipercayai menyumbang kepada timbunan sisa plastik (bersaiz 1 – 30 mm) di sepanjang pantai. Kajian ini dijalankan untuk mengkuantitikan dan menaksir sisa plastik yang tertanam di dalam pasir pantai berdasarkan saiz selain mengklasifikasikan sisa plastik yang terdapat di sebahagian kawasan pantai di Malaysia. Objektif lainnya, taburan sisa plastik yang tertanam juga dikaji berdasarkan kawasan pasang-surut pantai. Bagi kajian ini, enam pantai (terletak di tiga negeri berbeza di Malaysia) dipilih untuk mewakili kawasan pantai beraktiviti perikanan dan rekreasi iaitu Pantai Teluk Kemang, Pantai Pasir Panjang, Pantai Batu Burok, Pantai Seberang Takir, Pantai Tanjung Aru dan Pantai Teluk Likas. Sisa plastik dikutip sekali sebulan di mana kajian dijalankan selama tiga bulan berturut-turut. Di setiap pantai, triplikasi sampel pasir sebanyak 12.5 L diambil di kawasan pasang-surut yang berbeza. Sampel-sampel ini diayak untuk mengasingkan sisa plastik kecil mengikut jenis dan saiz. Sebanyak 2,542 sisa plastik kecil diperoleh di kesemua pantai yang dipilih dengan ketumpatan 265.30 g/m^2. Sampel sisa plastik kecil dikesan di kesemua pantai tetapi jumlah tertinggi adalah di Pantai Seberang Takir (879 item/m^2), diikuti oleh Pantai Batu Burok (780 item/m^2), Pantai Teluk Likas (249 item/m^2), Pantai Teluk Kemang (231 item/m^2) dan Pantai Pasir Panjang (211 item/m^2). Jumlah yang paling sedikit pula diperoleh di Pantai Tanjung Aru (192 item/m^2). Perbezaan jenis-jenis partikel plastik kecil yang dijumpai dalam kajian ini diklasifikasikan kepada filem (36.59%), buih (23.29%), pecahan (13.34%), tali (25.29%) dan pellet (1.49%). Kehadiran sisa plastik bersaiz kecil adalah disebabkan oleh degradasi fizikal dan kimia. Sisa plastik yang tertanam di kawasan pasang-surut pantai yang berbeza mempunyai potensi untuk mengubah struktur dan profil pasir

pantai. Kehadiran sisa plastik kecil ini boleh mendatangkan impak buruk kepada ekosistem marin, terutamanya spesies marin. Kajian ini adalah dokumentasi pertama bagi kehadiran sisa plastik kecil di kawasan pantai di Malaysia. Oleh itu, lebih banyak kajian perlu dijalankan untuk memahami senario ini dengan lebih jelas.

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LIST OF SYMBOLS AND ABBREVIATIONS

%	percentage
^{o}C	degree Celsius
cm	centimetre
E	East
g	gram
ha^2	hectares square
kg	kilogram
km	kilometre
L	litre
m	metre
mL	millilitre
mm	millimetre
N	North
μm	micrometer
ANOVA	Analysis of Variance
BBB	Batu Burok Beach
CMC	Center for Marine Conservation
DBKK	Kota Kinabalu City Hall
DDT	dichlorodiphenyltrichloro-ethane
EPA	Environmental Protection Agency
FAO	Food and Agriculture Organization
GESAMP	United Nations Group of Experts on the Scientific Aspects of Marine Pollution
GI	Gastrointestinal
GPS	Global Positioning System
ICC	International Coastal Cleanup
KK	Kota Kinabalu
KL	Kuala Lumpur
KT	Kuala Terengganu

LIST OF SYMBOLS AND ABBREVIATIONS

LDC	London Dumping Convention
MARPOL	International Convention for the Prevention of Pollution from ships
MBKT	Kuala Terengganu City Council
MHLG	Ministry of Housing and Local Government
MPPD	Port Dickson Municipal Council
MSW	municipal solid waste
NGO	non-government organisation
NMDMP	National Marine Debris Monitoring Programme
NOAA	National Oceanic and Atmospheric Administration
PD	Port Dickson
PCBs	Polychlorinated biphenyls
PPB	Pasir Panjang Beach
RSP	Regional Seas Programme
SCUBA	Self Confidence Underwater Breathing Apparatus
STB	Seberang Takir Beach
TAB	Tanjung Aru Beach
TKB	Teluk Kemang Beach
TLB	Teluk Likas Beach
UNEP	United Nations Environment Programme
UNESCO	United Nations Educational, Scientific and Cultural Organization
UK	United Kingdom
USA	United State of America
USM	University of Science Malaysia
UVB	Ultraviolet B

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