UNIVERSITI PUTRA MALAYSIA

SCREENING OF SEAWEED FOR ANTIOXIDANT ACTIVITY

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FP 2013 93

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This project report is submitted in partial fulfillment of the requirements for the degree of Bachelor of Agriculture (Aquaculture)

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SERDANG, SELANGOR

2013

ACKNOWLEDGEMENT

First and foremost, I am humbly thankful to God for giving me the opportunity to complete this research.

I'm grateful and would like to express my gratitude to my supervisor Dr. Natrah Fatin Mohd Ikhsan for countless hours of refining my writing, unwavering support, guidance and valuable advice throughout the course of my study. This research wouldn't be possible without the support of my supervisor. Besides, I would like to thank Assoc. Prof. Dr. Muta Harah Zakaria and Prof. Dr. Japar Sidik Bujang for their generous support and immerse knowledge.

I am eternally grateful to my senior Emmclan, Nur 'Izzati Ahmad, Wan Hazma, Wen Chen and Madam Yu who helped me while executing my research. To lab assistant Nur Shafika Abdul Jalil thanks for your guidance throughout my research execution. Besides, thanks to coordinator Prof. Madya Dr. Yuzine Bin Esa for his supervision and coaching in writing up my thesis. Thanks also to my friends, Farha Fazidah, Zarith Sofia and Nur Farahin for their support and advices.

Last but certainly not the least, I'm indebted to my dear family especially my parents En. Mamood Bin Yusof and Pn. Saton Binti Ngadiran for their love, constant encouragement and support. I'm blessed by having them beside me. My family's encouragement and conviction will always inspire me. I dedicated my work to them.

ABSTRACT

The distribution and life form of seaweed in Merambong shoal was recorded. Based on the growth forms, epipelic seaweed particularly from Rhodophyta division was the most abundant life form with values of 89.66% and the lowest was epilithic with values of 13.79%. On the other hand, the antioxidant activity of 13 Malaysian seaweeds around different location in Peninsular Malaysia was also evaluated. The antioxidant activities were determined by two assays, TEAC (trolox equivalent antioxidant capacity) and DPPH (2, 2-diphenyl-1-pricrylhydrazyl) assays. In this study, the highest antioxidant activity was from the methanolic extracts of brown seaweed in DPPH assay e.g., *Sargassum cristaefolium* with values of more than 45% while the green seaweed showed low antioxidant activity with values less than 15%. Meanwhile, for TEAC assay no significant differences were observed between all the seaweed samples from different location. The highest antioxidant activity was from *Halimeda macroloba* with values of 0.53±0.18 $mM.mg^{-1}$ dry extract. In conclusion, the studies showed that seaweeds have the potential as source of natural antioxidant.

ABSTRAK

Taburan dan bentuk kehidupan rumpai laut di beting Merambong telah direkodkan. Berdasarkan bentuk pertumbuhan, rumpai laut epipelik khususnya dari divisi Rhodophyta adalah yang paling banyak bentuk kehidupan dengan nilai 65.29% dan yang paling rendah adalah epilitik dengan nilai 3.91%. Sebaliknya, aktiviti antioksidan 13 rumpai laut Malaysia di sekitar lokasi yang berlainan di Semenanjung Malaysia juga dinilai. Aktiviti antioksidan ditentukan oleh dua ujian, TEAC (kapasiti antioksidan trolox setara) dan DPPH (2, 2- diphenyl -1-pricrylhydrazyl) ujian. Dalam kajian ini, aktiviti antioksidan yang tertinggi adalah dari ekstrak metanol daripada rumpai laut coklat dalam ujian DPPH contohnya, *Sargassum cristaefolium* dengan nilai lebih daripada 45% manakala rumpai laut hijau menunjukkan aktiviti antioksidan yang rendah dengan nilai kurang daripada 15%. Sementara itu, bagi ujian TEAC ada perbezaan ketara didapati antara semua sampel rumpai laut dari lokasi yang berbeza. Aktiviti antioksidan tertinggi adalah dari *Halimeda macroloba* dengan nilai-nilai sebanyak 0.53±0.18 $mM.mg^{-1}$ ekstrak kering. Kesimpulannya, kajian menunjukkan bahawa rumpai laut mempunyai potensi sebagai sumber antioksidan semula jadi.

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LIST OF ABBREVIATIONS/ SYMBOLS

ABTS•	2, 2-azinobis (3-ethylbenzthiazoline-6-sulphonic acid) free radical
dH_2O	distilled water
$K_2S_2O_8$	potassium persulfate
g	gram
%	percent
°C	degree celsius
>	greater than
<	less than
mg	milligram
ml	millilitre
mM	millimolar
nm	nanometer
pH	power of hydrogen
µg	microgram
µl	microliter
µm	micrometer
w/v	weight per volume
mg mL^{-1}	milligram per millilitre
µg mL^{-1}	microgram per millilitre

CHAPTER 1

INTRODUCTION

In the past decade, the search for natural antioxidant compounds has gained considerable attention among researchers. Antioxidant compounds play an important role against various diseases (e.g., chronic inflammation, atherosclerosis, cancer, heart disease, diabetes mellitus, neurodegenerative, arthritis, atherosclerosis, cardiovascular disorders, brain dysfunction (Parkinson's, Alzheimer's, Huntington's diseases) (Butterfield *et al*., 2002; Qusti *et al*., 2010) and ageing processes (Kohen and Nyska, 2002), which explains their considerable commercial potential in medicine, food production and the cosmetic industry.

Antioxidants safety in biological systems has multiple functions, including against oxidative damage and in the major signalling pathways of cells (Giordano, 2005; Abd El-Hady *et al*., 2012). The natural antioxidants (phenolic compounds) play a key role in antioxidative defense mechanisms in biological systems and act as free radical scavengers (Sies, 1997; Gokce and Haznedaroglu, 2008). Free radicals are types of reactive oxygen species (ROS), which include all highly reactive, oxygen-containing molecules (Chai *et al.*, 2012). Under normal conditions, ROS and free radicals are effectively eliminated by antioxidant defense systems such as antioxidant enzymes and non-enzymatic factors (Je *et al.*, 2009). Antioxidants terminate ROS attacks and appear to be of primary importance in the prevention of diseases and health problems.

Recently, various phytochemicals like polyphenols, which are widely distributed in plants, have been reported to act as free radical scavengers (Sánchez-Moreno *et al.*, 1999). Marine seaweeds produce a diverse array of compounds that function as chemical defence systems facilitating their survival in extremely competitive environments (Babu *et al.*, 2006). Research on the natural products and chemical defences of seaweeds has been shown to exhibit bioactive properties (Wijesinghe and Jeon, 2012).

Seaweeds in general are photosynthetic plant-like organisms that have beneficial nutrients e.g., vitamins, trace minerals, lipids, plant sterols, amino acids and antioxidants, all of which form part of a healthy diet (Athukorala *et. al.*, 2006). Seaweeds are also rich in minerals and polysaccharides such as alginates, fucans, and laminarans. The high nutritive values of seaweed have encouraged their cultivation and use as a food source in many parts of the world (Cardozo *et al.*, 2007).

Numerous studies have reported on antioxidant capability of seaweeds or their extracts from research conducted in various countries, such as Malaysia (Matanjun *et al.*, 2008), Indonesia (Santoso *et al.*, 2004), India (Chandini *et al.*, 2008), Korea (Heo *et al.*, 2005) and Japan (Matsukawa *et al.*, 1997), Thailand (Yangthong *et al.*, 2009) and the Andaman Sea (Amornlerdpison *et al.*, 2007; Peerapornpisal *et al.*, 2010). Although most photosynthesizing plants including seaweeds are exposed to a combination of light and high oxygen concentrations, which lead to the formation of free radicals and other strong oxidizing agents, they seldom suffer from any serious photodynamic damage *in vivo* (Ahn *et al.*, 2004). The observations suggest that their cells have protective antioxidative mechanisms as well as antioxidative compounds (Dykens *et al.*, 1992; Sukenik *et al*., 1993; Matsukawa *et al.*, 1997).

Due to the multifunctional characteristics of phytochemicals, the antioxidant efficacy of a plant extract is best evaluated using commonly accepted assays, taking into account different oxidative conditions, system compositions, and antioxidant mechanisms (Frankel and Meyer, 2000; Prior *et al.*, 2005). Among the assays are the DPPH (2, 2-diphenyl-1-picrylhydrazyl) assay that measures the capacity of antioxidants to directly react with (scavenge) DPPH radicals and the TEAC (trolox equivalent antioxidant capacity) assay that measures the direct scavenging of the radical cation ABTS+ (2, 2-azino-bis (3-ethylbenzothiazoline-6-sulfonic acid)).

In conclusion, it is commonly recognized that antioxidants can neutralize potentially harmful reactive free radicals in body cells and, therefore may help to prevent cancer or heart disease.

Thus, the aims of this study are;

1. To study the distribution and life form of seaweed in Merambong shoal
2. To screen seaweed from different locations for antioxidant activity.

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