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LIST OF SYMBOLS AND ABBREVIATIONS

$^1O_2$ Singlet oxygen

A549	Alveolar carcinoma
ABTS	2,2-azinobis-3-ethylbenzo thizoline-6-sulfonate
ADA	Americans with Disabilities Act
APC	Adenomatous polyposis coli
APOP	Apoptosis
BCL-2	B-cell lymphoma-2
BCL-xL	B-cell lymphoma-extra large
BER	Base excision repair
BHA	2-*t*-butyl-4-methoxyphenol
BHT	2,6-di-*t*-butyl-4-methyl phenol
$CHCL_3$	Chloroform
CIN	Chromosomal instability
DMSO	Dimethly sulfoxide
DNA	Deoxyribonucleic acid
DNase	Deoxyribonuclease
DPP-4	Dipeptidyl peptidase-4 enzymes
DPPH	2,2-diphenyl-1-picrylhydrazyl
DW	Dry weight
FADD	Fas-associated death domain
G1 phase	Gap 1 phase
GI	Glycaemia index
GLI	Zinc finger protein
H_2O_2	Hydrogen peroxide
H_2SO_4	Sulphuric acid
HbA 1c	Hemoglobin A1c
Hela	Cervical cancer
HepG2	Heptacellular carcinoma
HIF1	Hypoxia inducible factor 1
HO_2•	Hydroperoxyl radical
Huh7	Hepatocarcinoma cell line
IARC	International Agency for Research on Cancer
IC_{50}	The Half Maximal Inhibitory Concentration
IL-6	Interleukin-6

IR	Insulin resistance
LMWF	Lower molecular weight fucoidan
MCF-7	Breast cancer
MDA-MB-231	Human mammary adenocarcinoma
MGC-803	Human gastric adenocarcinoma cancer cells
MMR	DNA mismatch repair
Mn	Manganses
MTT	3-(4,5-dimethyliazol-2yl)-2,5-diphenyltetrazolium bromide
Na_2CO_3	Sodium carbonate
NER	Nucleotide excision repair
O_2^-	Superoxide radical
P53	Tumor suppression protein
PARP	Poly (ADP-ribose) polymerase
PI3K	Phosphoinositide 3-kinase
pNPG	p-nirophenyl α-glucopyranoside
PUFAs	Polyunsaturated fatty acids
RB	Retinoblastoma tumor suppressor gene
ROS	Reactive oxygen species
RPMI-7951	Human malignant melanoma obtained
RTK	Receptor tyrosine kinase
SK-ML-28	Human malignant melanoma
SK-ML-5	Human malignant melanoma
SMAD	Intracellular mediator
SOD	Superoxide dismutase
SP	Sulfated polysaccharide
T2D	Type 2 diabetes
T47D	Breast cancer cell line
TNF	Tumor necrosis factor
TNFR	Tumor necrosis factor receptor
UV	Ultraviolet

SUMMARY

Indonesia, an archipelagic country with 81,000 km long coastline, has a great potential for seaweed production: the most commonly found species there are red and brown seaweeds. The increased cases of oxidative stress have attracted the scholar's attention to explore the importance of antioxidant to resolve various public health concerns. The seaweeds contain antioxidants including carotenoids, vitamins E, chlorophylls, and polyphenol of ascorbic acid which prevent the oxidative stress stimulated by reactive oxygen species (ROS) such as hydroxyl radical, hydrogen peroxide, superoxide anions and nitric oxide that were reacted with biomolecules such as DNA, proteins, lipids and change the normal cellular functions which cause tissue damage and cell death.

Diabetes is considered a major global health threat, which can affect the people of all ages from different demographic regions. It is commonly known to result from the defects of beta cells that produced insulin or when the body is not able to use the secreted insulin. Cancer has become the second most life-threatening disease and one of the important health problems in worldwide that caused by an abnormal growth of cells and tissues. Internal causes of cancer may be attributed to lack of apoptotic function, genetic mutation, oxidative stress, and hypoxia, while the external cause of cancer may be linked to excessive exposure to ultraviolet rays, radiation, pollution, smoking, and stress

The current study involved the investigation of crude extracts and three fractions of *S. duplicatum* and *P. tetrastromatica* from two different sites in phytochemical content, total phenolic content, antioxidant, antidiabetic, anticancer activities and toxicity. by using Folin-Ciocalteus method, the 2,2-diphernyl-1 picrylhydrazyl (DPPH), α-glucosidase enzyme, 3-(4,5-dimethylthiazol-2-yl)-2,5-diphenyltetrazolium bromide (MTT) and brine shrimp assay, respectively. *S. duplicatum* and *P. tetrastromatica* were extracted with methanol solvent and the obtained crude extracts were partitioned with three solvents (normal hexane, ethyl acetate, and distilled water).

The result of total phenolic content in ethyl acetate fraction of *S. duplicatum* and *P. tetrastromatica* from non-oil extraction site had the highest contents (105.17 ± 5.12^{e} and 589.79 ± 7.14^{g} mg GAE/g) than those that are obtained from oil extraction site ($66.20\pm6.54^{a,b}$ and 112.35 ± 4.51^{e} mg GAE/g). Therefore, ethyl acetate fractions of *S. duplicatum* and *P. tetrastromatica* from non-oil extractions had the best potent of DPPH inhibitory activity (IC_{50} 214.06 ± 16.46^{e} and $25.25\pm5.15^{a,b}$ µg/mL) and the highest inhibitory effect against on α-glucosidase enzyme (IC_{50} 712.51 ± 9.44^{h} and 249.12 ± 1.77^{b} µg/mL) as compared to those that are collected from oil extraction site (IC_{50} 954.65 ± 17.02^{l} and 419.32 ± 9.91^{c} µg/mL). These fractions equally demonstrated the highest total phenol contents, which might be a major contributor to the antioxidant activities of the two seaweed species.

The inhibitory activity against on A549 (lung cancer cell line), crude extract and all fractions of *P. tetrastromatica* from non-oil extraction site demonstrated the strongest activities with IC_{50} values of 80.44 ± 12.88^{b}, 165.46 ± 0.66^{e}, 70.56 ± 2.56^{a}, $77.50\pm0.43^{a,b}$ µg/mL when compared with those that are from oil extraction site with IC_{50} values of 136.43 ± 7.12^{d}, 169.94 ± 1.19^{e}, 125.10 ± 0.51^{c}, 134.30 ± 1.14^{d} µg/mL. Meanwhile, the lowest activity was found in crude extract and all fractions of *S. duplicatum* from oil extraction site (IC_{50} 241.49 ± 3.83^{i}, 361.22 ± 3.20^{j} and 236.24 ± 7.24^{i} µg/mL) as a compared to those that are from non-oil extraction site (IC_{50} 182.41 ± 13.27^{f}, 214.98 ± 1.33^{g}, 178.98 ± 1.15^{f}, and 227.78 ± 2.36^{h} µg/mL). According to exposures for toxicity test between 24 h and 48 h incubation time,

there was no 100% mortality rate found at a different concentration in the crude extracts and all fractions of *S. duplicatum* and *P. tetrastromatica* from two different sites. However, *S. duplicatum* and *P. tetrasttromatica* from oil extraction site were considered to be mild toxic while those from non-oil extraction had nontoxic after 48 h of incubation.