CHAPTER I

INTRODUCTION

1.1 Background of the Study

Agriculture, industry and urbanization are main factors which contribute to environmental pollution; pollution of air, land and water. Day by day, the rate of emission of chemical contaminants such as several aliphatic and aromatic compounds, heavy metals, radionucleotides and phthalate esters into air, water and land is increasing (Kamala-kannan.S et al., 2008). The pollution by heavy metals in the coastal environment has become a worldwide ecological and health concern because of the environmental persistence, bioaccumulation, and biomagnification in food chains and toxicity of these elements (Ali.H *et* al., 2019). Coastal zones, lakes and rivers are polluted by toxic metals which are usually present at low concentration; deposits of anthropogenic origin which has harmed the existence ecosystem of living aquatic organisms. These problematic materials are also no exception to be found in seaweeds.

Heavy metals are defined as metallic elements that have a relatively high density compared to water. They also include metalloids, such as mercury (Hg), cadmium (Cd), arsenic (As), chromium (Cr), nickel (Ni), lead (Pb), cadmium (Cd) and mercury (Hg) (Tchounwou *et al.*, 2012). Heavy metals are toxic to aquatic organisms they are significantly accumulated by many different freshwater and marine species (Muse *et al.*,1999). Several seaweed species are effective to bind metal ions from water environment. These are caused because they contains several functional groups which are able to role as a ligand of metal ions.

Seaweeds can be negatively impacted by natural or anthropogenic phenomena, such as heavy metal deposition, which again can directly or indirectly affect organisms at higher trophic levels and the integrity of entire ecosystems. Exposure to environmental pollution in a long run may cause the formation of free radicals and other oxidizing agents in the algal specimen (Roleda *et al*., 2019).On the another hand, seaweeds have developed various strategies to minimize oxidative damage and maintain cellular integrity against these adverse conditions; this ability is often associated with the presence of an effective antioxidant systems. These systems reduce an accumulation of reactive oxygen species (ROS) and other free radicals and thus prevent an irreversible damage to proteins, amino acids, lipids and DNA.

Commercial utilization of seaweeds in industries can be found in many Asian countries, especially in the coastal areas. Countries with most coastal dwellers, like Indonesia, use different species of fresh seaweeds as food and supplements due to their nutritional benefits (Roleda *et al*., 2019). Worldwide there are about 1,500 species of brown seaweeds and they produce vast numbers of useful active component. They are a large and diverse group of simple, typically autotrophic organisms ranging from unicellular to multicellular forms. They are primitive non-flowering plants without root, stem and leave (Sathya *et al.* 2017). It falls into three groups and based on their pigmentation: red algae, brown algae, and green algae *(*Dawczynski *et al.* 2007).As seaweeds are cable of producing a wide range of secondary metabolites such as antidiabetes, antioxidant, anticancer, antibacterial and antiviral properties, they can be regarded as one of the crucial contributors to bioactive compounds in the coastal ecosystems (Vairappan *et al*. 2001). Seaweeds are highly demanded as raw materials for commercial products as they have highly

bioactive compound, they contain a lot of vitamins, minerals, proteins, polyphenols, polysaccharides, and dietary fibers (Holdt & Kraan, 2011).

Generally, an antioxidant can be defined as a substance which can prevents or delays the adverse effects caused by free radicals, even when the amount of the antioxidant substance is less than the substance to be oxidized. Antioxidant exists both in enzymatic and non-enzymatic forms in the intracellular and extracellular environment (Nimse & Pal., 2015). Antioxidant compounds play an important role to fight against diseases (eg. cancer, cardiovascular disorders, skin diseases, and chronic inflammation) and aging processes; one of such is phlorotannin which is a class of polyphenols that consist of polymers of phloroglucinol *(*Khairy & El-Sheikh. *2015).* These can be extracted from different species of seaweeds, such as the brown seaweed as part of their secondary metabolism (Jormalainen & Honkanen., 2004). Being rich in polyphenols, brown seaweeds not only can supply as a functional ingredient in the human diet but also perform the strongest antioxidant activity which may develop food shelf life by reducing a ROS-promoted degradation of oils and fats and increase both nutritional quality and food security, and improve health-related beneficial properties (Roohinejad *et al*., 2017).

In this research, the antioxidant activities of the methanol extracts of *Sargassum duplicatum* and *Padina tetrastromatica* from two different sites of Jumiang beach and Camplong beach (near the oil industry plant) will be studied by DPPH scavenging assay. In addition, the heavy metal content in *Sargassum duplicatum* and *Padina tetrastromatica* from two different sites of Jumiang beach (non-oil extraction site) and Camplong beach (oil extraction site) will be determined by using an atomic absorption spectrometer.

1.2 Problem of Research

1. How about antioxidant activity of methanol extracts of *Sargassum duplicatum* and *Padina tetrastromatica* collected from two different sites of Jumiang beach (non-oil extraction site) and Camplong beach (oil extraction site)?
2. How about total phenolic content and phytochemical profile of methanol extracts of *Sargassum duplicatum* and *Padina tetrastromatica* collected from two different sites of Jumiang beach (non-oil extraction site) and Camplong beach (oil extraction site)?
3. Is there any differences the heavy metal content of methanol extracts of *Sargassum duplicatum* and *Padina tetrastromatica* collected from two different sites of Jumiang beach (non-oil extraction site) and Camplong beach (oil extraction site)?
4. Is there any differences the toxicity content of methanol extracts of *Sargassum duplicatum* and *Padina tetrastromatica* collected from two different sites of Jumiang beach(non-oil extraction site) and Camplong beach (oil extraction site)?

1.3 Objective of Research

1 To evaluate the antioxidant activity of the methanol extracts of *Sargassum duplicatum* and *Padina tetrastromatica* collected from two different sites of Jumiang beach (non-oil extraction site) and Camplong beach (oil extraction site).

2 To determine total phenolic content and phytochemical of the methanol extracts of *Sargassum duplicatum* and *Padina tetrastromatica* collected from two different sites of Jumiang beach (non-oil extraction site) and Camplong beach (oil extraction site).

3 To determine the heavy metal content of the methanol extracts of *Sargassum duplicatum* and *Padina tetrastromatica* collected from two different sites of Jumiang beach (non-oil extraction site) and Camplong beach (oil extraction site).

4 To evaluate the toxicity content of the methanol extracts of *Sargassum duplicatum* and *Padina tetrastromatica* collected from two different sites of Jumiang beach (non-oil extraction site) and Camplong beach (oil extraction site).

1.3 Benefit of Research

The obtainable results will be shown that the methanol extracts of *Sargassun duplicatum* and *Padina tetrastramatica* can be used as a source of antioxidants for pharmacological preparations. Furthermore, the heavy metal levels present in *Sargassum duplicatum* and *Padina tetrastromatica* from two different sites of Jumiang beach (non-oil extraction site) and Camplong beach (oil extraction site) will be assessed as well.