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Potential Antioxidant Activity of Tropical Brown Macroalgae *Turbinaria* Ethanol Extract from Kabung Island West Kalimantan

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Abstract: Naturally, the human body has tolerance to free radical attacks. However, the natural antioxidant ability will decrease when exposure to free radicals from within and outside the body occurs intensively. Antioxidants play potential preventive role to protect the body from damage associated with oxidative stress by free radicals. One of the potential marine resources used as an antioxidant is macroalgae. *Turbinaria* is widely distributed in tropical waters of Indonesia, including West Kalimantan. This genus produces secondary metabolites with several biological activities. This genus abundantly grows in Kabung Island. However, it has not been used by the local community, even tends to be considered as a weed that disturbs others marine biota. This study aimed to evaluate the potential antioxidant activity of tropical brown macroalgae *Turbinaria* ethanol extract from Kabung Island, West Kalimantan. antioxidant activity was evaluated using the DPPH (1,1-diphenyl-2-picrylhydrazyl) free radical scavenger method with UV-vis spectrophotometer. The result showed that the ethanolic extract had a high of potential antioxidant activity which IC_{50} was 87.31 mg/L and it was classified into strong antioxidant potential.

Keywords: antioxidant; *Turbinaria*; ethanol; Kabung Island; West Kalimantan

Introduction

Macroalgae is widely distributed in tropical waters of Indonesia, including West Kalimantan (Safitri et al., 2021; Sofiana et al., 2021; Sofiana et al., 2022; Warsidah et al., 2022; Qurniasih et al., 2022; Sumarni et al., 2022). Macroalgae plays an important role in marine environment, such as support the primary productivity (Sudhakar et al., 2018), provides oxygen, foods, and habitat for various aquatic organisms (Niamaimandi, 2006; John and Al-Thani, 2014). Economically, macroalgae is also a potential source to be developed, because it contains bioactive compounds used in various industrial fields (Pereira, 2018; Leandro et al., 2020; Kumar et al., 2021).

Macroalgae produce secondary metabolites (Biris-Dorhoi et al., 2020), with several biological activities, such as anti-bacterial (Safitri et al., 2021), antiviral (Lomartire and Gonçalves, 2022; Pliego-Cortés et al., 2022), antiproliferative (Prasedya et al., 2018; Donapaneedi et al., 2018), anti-cancer (Miranda-Delgado et al., 2018; Lee et al., 2021; Reyes et al., 2020), antidiabetic (Kim et al., 2021), antiangiogenesis (Namvar et al., 2013), and antioxidant (Safitri et al., 2021). Seaweeds *Caulerpa racemosa*, *Eucheuma spinosum*, *Padina pavonica Hauck* and *Sargassum polycystum* from Kabung Island waters have

been reported to have antioxidant activity (Safitri *et al*., 2021; Sofiana *et al*., 2021).

Naturally, the human body has tolerance to free radical attacks. However, the natural antioxidant ability will decrease when exposure to free radicals from within and outside the body occurs intensively. This condition eventually causes some damage to the body, disrupt cellular metabolism, and alter the major target as lipids, proteins, and DNA (Young and Woodside, 2001). Free radical attacks are closely related to the body's physiological processes, especially degenerative diseases (diabetes mellitus, cancer and atherosclerosis), and aging (Bhaigyabati et al., 2011). Antioxidants play potential preventive role to protect the body from damage associated with oxidative stress by free radicals (Ozsoy et al., 2008). These substances can also inhibit the oxidation of lipids and other biomolecules by blocking the initiation step and scavenging various free radicals in order to detoxify the organism (Kumaran and Karunakaran, 2006).

One of the potential marine resources used as an antioxidant is macroalgae. According to the pigment content, macroalgae is classified into green algae (*Chlorophyceae*), red algae (*Rhodophyceae*), and brown algae (*Phaeophyceae*) (Anggadiredja et al., 2006). Brown seaweed have bioactive compounds, such as polyphenols, tannins and phlorotannin which can inhibit free radical exposure (Hermund et al., 2016). Several species of brown algae have been reported with antioxidant activity, such as *Turbinaria tricostata* with an IC_{50} of 43.2-54.6 µg/mL (Chale-Dzul *et al*., 2014), *Padina australis* (IC_{50} value of 87,082 µg/mL) (Maharani et al., 2017), *Sargassum* (IC_{50} of 119,66 µg/mL) (Luthfiyana et al., 2016), and *T. conoides* from Serang waters with strong antioxidant activity (IC_{50} of 15,148 g/mL) (Yanuarti et al., 2017).

Turbinaria belongs to the group of Phaeophyceae due to the pigment of fucoxanthin (Husni and Budhiyanti, 2021). Today, the study on the genus *Turbinaria* is currently increasing. This genus abundantly grows in Kabung Island. However, it has not been used by the local community, even tends to be considered as a weed that disturbs others marine biota. For this reason, this study aimed to evaluate the potential antioxidant activity of tropical brown macroalgae *Turbinaria* ethanol extract from Kabung Island, West Kalimantan.

Materials and Methods

Samples collection and identification

Sample of *Turbinaria* was taken from Kabung Island, West Kalimantan, Indonesia. Sample identification and extraction were carried out in the Laboratory of Marine Science, Faculty of Mathematics and Natural Sciences, Universitas Tanjungpura. The test of antioxidant activity was conducted in the Laboratory of PT. Sucofindo, Pontianak.

Samples preparation

Sample of *Turbinaria* was cleaned, then dried at room temperature approximately for five days to reduce water content. Extraction was carried out by maceration method using ethanol solvent. Samples were roughly chopped and grinded to be fine powder. A total of 250 g of sample powder was macerated using ethanol in a ratio of 1:5 (w/v), then shaken at 150 rpm for 1 x 24 hours. The ethanol extract was hereinafter concentrated using a rotary evaporator for further analysis.

Antioxidant Activity Test

The determination of antioxidant activity was realized according to the method of Banerjee *et al*. (2005). Sample solution was prepared in several concentrations of 50, 100, 150, 200, and 250 ppm. The next step was preparation of 0.1 mM DPPH (1,1-diphenyl-2-picrylhydrazyl) reagent by dissolving 0,002 g of DPPH in 50 mL of 95% ethanol. As much as 3 mL of sample solution of each concentration was added with 1 mL of DPPH solution. Furthermore, samples and DPPH were mixed using vortex for 1 minute and incubated at room temperature for 30 minutes. The measurement of absorbance was conducted using a Spectrophotometer U-1240 Shimadzu UV-vis at a wavelength of 517 nm, and ethanol was used as blank solution. Antioxidant standard solution using ascorbic acid. The percentage of inhibition was calculated by the following formula:

$$\%\ inhibition = \frac{Ao - A1}{Ao}\ x\ 100\%$$

where, A_0 is control absorbance (DPPH 0.1 mM) and A_1 is sample absorbance (sample + DPPH 0.1 mM).

Result and Discussion

Identification of Macroalgae

Thallus of *Turbinaria* is brown in colour, has many branches, and serrated at the edges. The stipe tapers downwards and widens upwards, forming a crown-like portion. According to Guiry and Guiry (2018), the classification of *Turbinaria* is as follows:

Kingdom : Plantae
Phylum : Ochrophyta
Class : Phaeophyceae
Order : Fucales
Family : Sargassaceae
Genus : *Sargassaceae*

Figure 1. Sample of *Turbinaria* from Kabung Island West Kalimantan

Macroalgae are widely distributed in Indonesian waters with suitable physio-chemical parameters condition (Kadi, 2006). Currently, the study on brown algae, especially the genus *Turbinaria* has been conducted from biodiversity, bioprospecting, and the use of bioactive compound in various industrial fields. In West Kalimantan, this genus found in Kabung Island and Lemukutan Island with the abundances of 1.92 ind/m^2 (Sofiana et al., 2022).

Antioxidant Activity

According to previous studies showed that *Turbinaria* contains bioactive compounds, such as triterpenoid/steroid, saponin, dan tanin, alkaloid, flavonoid, and steroid (Nurunnisa, 2021). *Turbinaria* was commonly utilized as natural source of alginate, fucoidan (Handayani *et al*., 2018), and several biological activities, such as antibacterial (Arguelles and Sapin, 2020), Antiproliferative (Stranska-Zachariasova et al., 2017; Rushdi et al., 2020), and antioxidant (Islami et al., 2014; Chakraborty et al., 2015; Sari et al., 2019; Arguelles and Sapin, 2020).

The test of antioxidant activity was based on the ability of antioxidant compounds in *Turbinaria* extract to capture free radicals released by DPPH compounds, with reactions as described below (Figure 2).

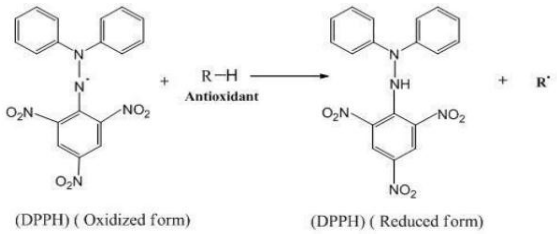

Figure 2. DPPH free radical scavenging reactions by antioxidants compounds (pubs.rsc.org)

The concentration of antioxidant compounds in the sample was measured through the absorbance of the sample solution added with DPPH free radicals. Decreasing color intensity of DPPH from dark purple to light yellow is proportional to the content of antioxidant compounds in the samples. The determination of antioxidant activity was done by IC_{50}, value describes the concentration of antioxidant needed to inhibit 50% of DPPH radicals (Chakraborty and Joseph, 2016). This value was obtained using linear regression as the relationship between the concentration of the test extract and the percentage of free radical inhibition (Zou et al., 2004).

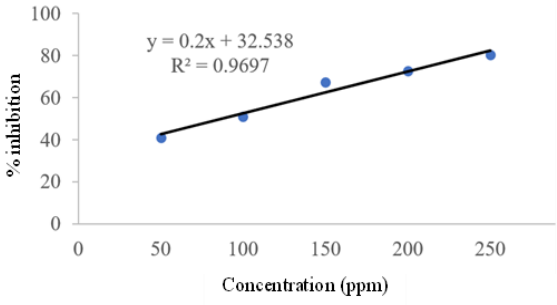

Figure 3. Antioxidant Activity of Ethanol Extract of *Turbinaria* from Kabung Island West Kalimantan

The result of ethanolic extract of *Turbinaria* showed a potential antioxidant activity which IC_{50} was 87.31 mg/L, and it was classified into strong antioxidant potential. According to Molyneux (2004), the value of IC_{50} <50 mg/L was classified as a very strong antioxidant, ranging from 50-100 mg/L was classified as a strong antioxidant, and IC_{50} >100 mg/L was classified as a weak antioxidant.

Conclusion

It could be concluded that ethanolic extract of *Turbinaria* showed a potential antioxidant activity which IC_{50} was 87.31 mg/L, and it was classified as strong antioxidant potential.

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