POTENTIAL AND APPLICATION OF SARGASSUM EXTRACT IN AQUACULTURE

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ABSTRACT

Sargassum sp. is a tropical and sub-tropical brown algal species that lives in the subtidal and intertidal regions. Sargassum sp. is a brown algae that produces more alginate than other brown algae. Alginate is used as a raw material for the food, beverage, pharmaceutical, cosmetic and laboratory processing industries. *Fish cultivation problems that often occur are fish diseases related to weak conditions of the fish caused by several factors. Some of these factors are the feed-given factor and decreased water quality in cultivation media which could cause various impacts on fish growth. Sargassum sp. contains various nutrients. Among them are 7.94% crude oil, 0.72% fat, 35.84% ash, 4.93% crude fiber, and 50.57% carbohydrates. Sargassum sp. extract potential as antioxidants, antimicrobial and raw material for making surfactant, and so on. The application of Sargassum extract in the fisheries sector can be used to inhibit the growth of Vibrio harveyi, which is the most dangerous cause of firefly disease for Tiger prawn, as a feed additive to increase immunity and provide optimal growth in fish.*

Keyword : *Fish, Growth, Immunity, Nutrition, Sargassum sp.*

1. Introduction

Brown algae belong to the class Phaeophyceae [1]. Brown algae are the main source of alginate which also contains protein, vitamin C, tannins, iodine, and phenol. Brown algae (*Sargassum* sp.) has been used for a long time as an antibacterial, antioxidant, and immunostimulant. *Sargassum sp.* contains various nutrients. Among them are 7.94% crude oil, 0.72% fat, 35.84% ash, 4.93% crude fiber, and 50.57% carbohydrates [2].

Sargassum sp. is one of of the 150 species of tropical and subtropical brown algae that lives in the subtidal and intertidal regions. S*argassum sp.* is a brown algae that produces more alginate than other brown algae. Alginates are used as raw ingredients in the food, beverage, medicine, cosmetics, and materials industries [3].

Sargassum sp. is one of the various valuable marine organism that are economically important and have a high level of use [4]. This is because *Sargassum* sp. can be beneficial to both humans and the aquatic environment. The benefits for humans, among others, can be made as a food ingredient, cosmetic base material, or drug-making material.

Fish cultivation problems that often occur are fish diseases related to weak conditions of the fish caused by several factors. Some of these factors are the feed-given factor and decreased water quality in cultivation media which could cause various impacts on fish growth. The increase in the growth and survival of nilem fish has never been reported, this makes this topic very interesting to study.

1.1 Biology of *Sargassum* sp.

Sargassum crassifolium is one types of Phaeophyta or brown algae that grow in Indonesia. In Indonesia there are 15 species of Sargassum [5]. According to Fateha [6], seaweed is a form of algae (algae) that is polycellular and lives in the sea. *Sargassum fillipendula* is one types of algae included in the class Phaeophyceae or brown algae. Brown algae are in the form of threads or sheets, some are even similar to higher plants with parts similar to roots, stems, and leaves. According to Atmadja [7], brown algae habitat grows in waters at current and wave depths of 0.5-10 m. Brown algae live in clear waters that have a rock-bottom substrate and can thrive in the tropics. According to Majid [8], brown algae are branched plants in the form of small fine threads (Ectocarpus), short stems, and broad hairs (Copsaria, Alaria, and Laminaria, some of which are 2 m wide). In addition, *Sargassum fillipendula* also has chlorophyll a and b pigments, beta carotene, violaxanthin, and fucoxanthin.

General characteristic features of this sargassum are the general shape of the thallus cylindrical or sprawl, the lush branches that resemble a tree on land, the form of leaves widened, oval, or a sword, having bubble air (bladder) in general solitary, size long generally reaches 3- 7 meters, the color of the thallus is generally brown [9]. Sargassum is usually characterized by 3 traits that are the presence of a brown pigment covering the color green, the result of photosynthesis is saved in the shape of laminar, and algin as well exists flagella [10, 11].

Sargassum is widespread in Indonesia, growing in protected waters as well as big waves in rocky habitats, in intertidal and subtidal areas [9], [5]. The substance that can be extracted from Sargassum is alginate which is an alginic acid salt containing sodium, calcium and barium ions. Sargassum generally grows in coral reef areas such as the Seribu Islands, especially in sand flat areas [9]. *Sargassum* sp. has many uses as a raw material in the food, pharmaceutical, cosmetic, feed, fertilizer, textile, paper, and so on industries. Alginate is widely used in the food industry to strengthen the texture or stability of processed products, such as ice cream, fruit juices, filled cakes and cakes. Sargassum sp. has also been used in the pharmaceutical and animal husbandry [11,12].

1.2 The active compounds of *Sargassum* sp.

Secondary metabolites are compounds produced by living things under certain circumstances. One of the ways to qualitatively test secondary metabolites in natural products is to carry out phytochemical tests. Seaweeds from the Phaeophyta division produce algin or alginate, laminarin, cellulose, and mannitol. Usually, the Phaeophyta species used as alginate producers are Macrocystis, Turbinaria, Padina, and *Sargassum* sp. [13]. The utilization of the potential of seaweed continues to grow and expand the pharmaceutical, cosmetic, and drug fields.

Phaeophyceae show the activity of antioxidants highest between *Rhodophyceae* and *Chlorophyceae* [14, 15]. As a defense against UV (ultraviolet) radiation, Phaeophyceae in tropical areas make more secondary metabolites. Phenolic compounds and their derivatives are thought to be the primary antioxidant compounds produced by Phaeophyceae [16]. According to Demirel et al. (2009) [17], phenolic compounds are more effective than -tocopherol and nearly as effective as synthetic antioxidants such as butylated hydroxyanisole (BHA) and butylated hydroxytoluene (BHT).

Khotimah et al. (2013) [18] found the results of analysis of the active compound of brown algae *Sargassum fillipendula* is a type of carotenoid which is a group of phenol and benzene dicarboxylic acids. The active compound extract of *Sargassum fillipendula* obtained DPPH-free antiradical activity of 81.281ppm. The addition of active compounds from *Sargassum fillipendula* can prevent damage to the neutralization process of lemur fish oil with the best treatment or optimum concentration is the addition of 0.2% concentration of *Sargassum fillipendula* extract with details of an iodine value of 3.42%, a peroxide of 6.19 meq/ kg and the TBA value of 5.14 mg malonaldehyde/kg oil.

Santoso et al. (2004) [19], mentioned that antioxidants in *Sargassum* sp. were able to reduce the oxidation that occurred in fish oil emulsion for storage at 50 °C for 24 hours which was determined by a lower peroxide score (59.1 meq/kg) compared to control (308.5 meq/kg). Prabowo et al., (2013) [20] who used the ethanol extract of Sargassum sp. able to give better results in inhibiting the oxidation process of fish oil emulsions compared to the control. The use of 1% ethanol extract of Sargassum sp. can inhibit the rate of oxidative damage better than fish oil without using antioxidants for the numerical parameters of peroxide, anisidin number, and totoks value.

Sargassum sp. has been utilized as anticholesterol [21], biofuel [22], biofertilizer [23, 24], antibacterial [25], antitumor [26, 27], anticancer [28], antifouling [29, 30], antivirus [31], and cream cosmetics [32]. Extract *Sargassum* sp. also potential as antioxidants. Researches about this have been done in Indonesia [33, 34].

2. Application of Active Compound of *Sargassum* sp. on aquaculture

Macroalgae have potential active ingredients that can inhibit the growth of bacteria and viruses. Production of active ingredients from secondary metabolites of seaweed such as *Sargassum* sp. is expected to be an alternative for disease control in aquaculture in Indonesia. According to Patra et al., (2008) [35] that the methanol extract of *Sargassum* sp. showed very strong antioxidant activity. Besides that, it can also function as an antimicrobial against gram-positive and gram-negative bacteria such as *Bacillus subtilis*, *Escherichia coli*, and *Staphylococcus aerus*.

The results of research by Izzati (2007) [36] who tested the antibacterial activity of seaweed extract against pathogenic bacteria in tiger shrimp, found that Sargassum sp. seaweed was suitable/can be developed for dual aquaculture with tiger shrimp because Sargassum extract was active for two species of Vibrio bacteria tested (*Vibrio harveyi* and *Vibrio parahaemolyticus*). In addition, the activity of Sargassum extract was higher with a wider area of inhibition zone compared to other seagrass extracts (*Halimeda* sp.; *Caulerpa racemosa*; *Padina* sp.; and *Gelidium* sp.).

According to Hayashi et al. (2008) [37], Fucoidan has been isolated from several types of brown algae and has been shown to have antiviral activity and anti-oxidant activity [38]. Giving fucoidan as mixed feed for tiger shrimp also showed antiviral activity against White Spot Syndrome Virus (WSSV) infection. Prawns fed tiger prawns with a mixture of fucoid showed increased non-specific immunity [39]. Fucoidan extracted from *Sargassum polycystum* also showed the ability to inhibit the development of *Vibrio harveyi* which infects tiger shrimp [40].

One of the fish feed ingredients that has the potential to increase immunity as well as growth is sargassum extract, which is a local biological resource and has the potential to be used as a source of vegetable protein in fish feed. According to Hafezieh et al. (2014) [41], the nutritional content of Sargassum sp. is 9.18% protein, 2.11% fat, 29.15% ash, 10.34% crude fiber, and 49.22% carbohydrates. Based on the nutrition values, the carbohydrate content itself is high enough that it can be used as a source of carbohydrates to replace rice bran or pollard, whose raw materials are imported.

Seaweeds are the most primitive group of vegetation and have become very urgent as a source of promising bioactive compounds that can be used for development of medicine. Seaweed can produce various bioactive compounds, with various types of biological activity, including antibacterial, antifungal, anti microalgal, antioxidant, and others. Several living marine macroalgae (*Corallina pilulifera, Enteromorpha clathrata, Undaria pinnatifida, Laminaria japonica, Porphyra tenera, Ulva pertusa , Sargassum thunbergii*) have been found to inhibit the growth of microalgae such as *Cochlodinium polykrikoides, Skeletonema costatum, Heterosigma akashiwo, and Prorocentrum micans* [42].

Suryatman (2022) [43] states that there has not been much utilization of sources of bioactive materials from algae. The bioactive compounds contained in brown algae (*Sargassum* sp.) can act as anti-bacterial compounds that can inhibit the growth of pathogenic bacteria in fish and shrimp such as *Vibrio* sp. (Suryatman & Achmad, 2022) [44]. Ramdhani (2017) [45] states that the addition of 3% of Sargassum seaweed to a feed formulation can provide optimal growth in the growth performance of nilem (*Osteochilus hasselti*).

3. Conclusion

Based on the description above, it can be concluded that the species *Sargassum* sp. there are about 12 species known in Indonesia, namely: *S. duplicatum, S. histrix, S. echinocarpum, S. gracilimun, S. obtusifolium, S. binderi, S. policystum, S. crassifolium, S. microphylum, S. aquofilum , S. vulgare*, and *S. Polyceratium.* Sargassum sp. can be used as anti-cholesterol, biofuel biofertilizer, antibacterial, antitumor, anticancer, antifouling, antiviral and cosmetic cream. *Sargassum* sp. extract. also has the potential as an antioxidant and raw material for making other surfactants. The application of Sargassum extract in the fisheries sector can be used to inhibit the growth of *Vibrio harveyi* which is the most dangerous cause of firefly disease for tiger prawns as well as being an additive to increase the immunity of fish feed and provide optimal growth in fish.

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