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FUCOIDAN: APPLICATION OF ITS BIOACTIVE POTENTIALITY IN AQUACULTURE

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ABSTRACT

Fucoidan as classic function, is frequently used in the medical and pharmaceutical world for human health care. Its potentiality might be applied in some animals including aquatic animals. This study investigated the effect of fucoidan as immune-stimulant, anticoagulants, and anti-inflammatory in aquaculture application. Moslty, fucoidan extracted from the brown algae and commonly used in shrimp culture as an antiviral that is resistant to Vibrio harveyi attack affected white disease spot syndrome virus (WSSV), one of the virulent pathogens and causes economic deficit in shrimp aquaculture. The function beside that is still unknown and the further research is necessary to examined other classic function and also additional function of fucoidan.

Introduction

Fucoidan is a compound complex polysaccharides with components main L-Fucose and its sulfate ester group can be isolated from brown seaweed and marine invertebrates (such as sea urchins and sea cucumbers) [1] [2]. Beside that, small amount of sugar such as xylose, galactose, glucose, mannose, uronic acids, and rhamnose also detected in fucoidan[3]. Fucoidan have the main bonds of α1,3-linked-L-fucose-4-sulfate and glycosidic bonds is also commonly found depending on the algal species [4].

It was shown that these acidic polysaccharides has various physiological and biological activities among others. It was recorded as an immune-stimulant [5] [6], anticancer [7] [8] [2], antiviral [9] [10], anticoagulants [11], triggers for apoptosis, anti-proliferation [12], and antioxidants [13].

These functions of fucoidan led many researchers to investigate these polysaccharides to human and veterinary health care, thus in recent year, the production and application of fucoidan as beneficial agents have been increasing gradually as important topics [5]. Research in the field of aquaculture has explained that fucoidan is capable increase productivity, such as antiviral for white disease spot syndrome virus in shrimp. The potentiality of biological activities from various fucoidanhas never been summarized. The aim of this review is to discuss the main bioactivities from fucoidan and its function in aquaculture for convenience application.

Immuno-modulating Activity of a Fucoidan

The use of immune-stimulants is considered as a more environmentally friendly and has been confirmed to enhance the specific immunity of animals and their resistance against pathogen. Fucoidan may be a promising candidate for the development of a potent immune-stimulant agent. Fucoidan has no direct effect to against virus, but it plays a role in the defense system through cellular and immun mechanisms to fight the virus.

Previous research has been done to establish the activity of immune-modulating agent from fucoidan. It was reported that Undariapinnatifidasporophyll is less cytotoxic to immune cells than Fucusvesiculosus and possesses immunomodulating activity to produce cytokines and chemokines from two major immune-related cells, from macrophages and splenocytes [5]. Beside difference type of species, the purity of fucoidan and molecular weight give an influence to the bioactivity as an immune-stimulant. The fucoidan with lower molecular weight showed higher resistance to cell transformation activity than high molecular weight [14].

Classic Function of Fucoidan as Antitumor, antiviral, and Anti-inflammatory

In general, the classic function of fucoidan have been investigated long time ago, especially for human. The antitumor activity of fucoidans are defined by their chemical structure, including the thesulphate, monosacaride, and sugar. Yang et al. compared the antitumor activity from the spore leaves of Undariapinnatifida and fucoidan that was depolymerized in a boiling water bath, the result showed no significant difference was investigated from two fucoidans in sulphate content, but the antitumor activity of LMWF was over 2-fold higher at the same concentrations [15]. In case of antiviral, fucoidan inhibits immune virus in human, such as herpes simplex virus (HSV), human cytomegalovirus, influenza virus and bovine viral diarrhea virus The mechanism of antiviral activity is to inhibit viral adsorption onto cells, thereby impeding virus entry [16]. Also, fucoidan can significantly reduce inflammation. Compared to other small molecule anti-inflammatory drugs, fucoidan as a macromolecular substance has broad prospects as a direct drug or food adjuvant. In addition, fucoidan derived from brown seaweed is proposed as an anticoagulant substitute for heparin.

Application and function of Fucoidan in Aquaculture

According to Hayashi et al. [17] Fucoidan, which has been isolated from several types of brown alga and proven to have active components antiviral, also has anti-oxidant activity [13]. Administration of fucoidan as a mixture of tiger shrimp feed too shows antiviral activity against white spot syndrome virus (WSSV) infection. Tiger prawns that were fed

with fucoidan mixtures show enhancement of nonspecific immunity. The fucoidan extracted from the brown algae Sargassum group polycystum also shows ability to inhibit the development of *Vibrio harveyi*, which infects tiger shrimp [18].

Research on fucoidan as immunostimulantshave been done on shrimp as antiviral in white disease spot syndrome virus. As an antiviral, fucoidan plays a role inhibits the formation of viral cell nuclei that is induced. Traifalgar et al. (2009), give PPF (partial purified fucoidan) through feed (orally) of 60 mg / kg shrimp body weight per day. The result, PPF able to prevent WSSV infection in shrimp. Some of the uses of fucoidan in shrimp as an antibacterial that is resistant to Vibrio harveyi attacks. Research result Chotigeat et al. [18] explained that fucoidancan increase activity phagocytosis in shrimp.Traifalgar et al. [19] successfully examined that use 500-2000 mg / kg capable shrimp feed increase biomass, efficiency ratio protein, feed conversion ratio (FCR) which low and has a high survival.

Fucoidan supplementation in shrimp feed for 30 days giving conversion results good feed with survival rates remains high (86-92%). Fucoidan supplementation nor does it cause any changes protein components, fats, and components other bodies [19]. In human health sciences, fucoidan used as an ingredient in several dietary supplement and replace products antacids (a mixture of aluminum salts, magnesium, and simethicone) which has negative for the kidney [5] [1]. The fucoidan given is also beneficial cytoprotection against gastric mucosal epithelium and increase growth factor production [1].

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