Antioxidant Bio Marine Products: A Review

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Abstract— Bio-products isolated from marine origins have a library of therapeutic potential. Marine bio-organism rich in secondary metabolites from cyclic peptides to aromatic alkaloids and attract the researcher to search the new therapeutic value and discover the novel drugs for the treatment of skin, CNS, gastric, lymphatic, reproductive disorders, cancer and AIDS like chronic medical conditions. This review on marine bio-products consists of a compressive data related to antioxidant activity on products isolated from marine.

Indexed Terms-- Marine, bio-products, therapeutic value, antioxidant activity

I. INTRODUCTION

1.1 Marine Bioproducts

Marine Bioproducts: - products derived from marine organisms like microalgae, seaweeds, marine bacteria and animals are called marine bioproducts. Marine bioproducts are important sources of biologically active agents, and various bioactive compounds have been extracted from marine organisms like tunicates, sponges, soft corals, and molluscs. These biologically active compounds have been reported to modulate various biological activities.

1.2 Marine Organisms

1.2.1 Ascidians

Ascidians (tunicates) are invertebrate chordates, and prolific producers of a wide variety of biologically active secondary metabolites from cyclic peptides to aromatic alkaloids. Several of these compounds have properties which make them candidates for potential new drugs to treat diseases such as cancer [Watters D. J. 2018].

Figure 1 Ascidians

1.2.2 Sponge

Marine sponges have been considered as a gold mine during the past 50 years, with respect to the diversity of their secondary metabolites. Sponge derived or other marine microorganism's associated bioactive substances have possessed antibacterial, antiviral, antifungal, antimalarial, anthelminthic, immunosuppressive, muscle relaxants and anti-inflammatory activities [Anjum K. et al., 2016].

Figure 2 Sponge

1.2.3 Alcyonacea

Alcyonacea, or soft corals, are an order of corals. Soft corals, like sea fingers and sea whips, are soft and bendable and often resemble plants or trees. Coral reef plants and animals are important sources of new medicines being developed to treat cancer, arthritis, human bacterial infections, Alzheimer's disease, heart

disease, viruses, and other diseases [oceanservice.noaa.gov].

Figure 3 Alcyonacea

1.2.4 Mollusca

Mollusca are the second-largest phylum of invertebrate animals after the Arthropoda. The members are known as molluscs or mollusks. The operculum from Muricidae were used for curing a range of illnesses, such as swollen spleen, depression, rheumatism or arthritis, stomach ulcers, skin diseases including boils, warts and tumors, teeth problems, eye disease, hearing loss, epilepsy and paralysis [Benkendorff K.. et al. 2015].

Figure 4 Mollusca

1.2.5 Uniqueness of Marine Floral Drugs

Marine floras include microflora (bacteria, actinobacteria, cyanobacteria and fungi), microalgae, macroalgae (seaweeds), and flowering plants (mangroves and other halophytes). Occupying almost 71% of globe, the ocean is rich in biodiversity and the microflora and microalgae alone constitute more than 90% of oceanic biomass [Kathiresan and Duraisamy 2005].

This vast marine floral resource will offer a great scope for discovery of new drugs. It is increasingly recognized that ocean contains a huge number of natural products and novel chemical entities with unique biological activities that may be useful in finding the potential drugs with greater efficacy and specificity for the treatment of human diseases [Haefner et al., 2003].

It cannot be denied that with 3.5 billion years of existence on earth and experience in biosynthesis, the marine microfloras remain nature's best source of chemicals. The marine organisms produce novel chemicals to withstand extreme variations in pressure, salinity, temperature, and so forth, prevailing in their environment, and the chemicals produced are unique in diversity, structural, and functional features [Kathiresan et al., 2008].

The efforts to extract drugs from the sea started in the late 1960s. However, the systematic investigation began in the mid-1970s. During the decade from 1977 to 1987, about 2500 new metabolites were reported from a variety of marine organisms. These studies have clearly demonstrated that the marine environment is an excellent source of novel chemicals, not found in terrestrial sources. So far, more than 10,000 compounds have been isolated from marine organisms with hundreds of new compounds are still being discovered every year. About 300 patents on bioactive marine natural products were issued between 1969 and 1999 [Kathiresan et al., 2008]. Some marine organisms are proved to be the potent sources of drugs. These are mostly invertebrates that include sponges, soft corals, sea fans, sea hares, nudibranchs, bryozoans, and tunicates. It is now believed that microbial floras present in the invertebrates are responsible for the production of medicinal compounds. The search is mostly confined to marine faunal species, and floral species are largely ignored. Some of the compounds derived from marine organisms have antioxidant property and anticancer activities, but they are largely unexplored.

Marine floras have been used for medicinal purposes in India, China, the Near East and Europe, since ancient times. The people of China and Japan have been using seaweeds for consumption. The seaweeds especially brown seaweeds are rich in iodine and

hence there is a least incidence of goiter and glandular diseases. History reveals that maritime countries have been using seaweeds as vermifuge, anesthetics and ointment as well as for the treatment of cough, wounds, gout, goiter, venereal disease, and so forth. Sterols and related compounds present in seaweeds have ability to lower blood plasma cholesterol level. Seaweed dietary fibers perform varied range of functions such as antioxidant, antimutagenic, anticoagulant, and antitumor. The seaweeds also play an important role in modification of lipid metabolism in the human body. High intake of calcium, potassium, and sodium is associated with lower mean systolic pressure and lower risk of hypertension. All seaweeds offer an extraordinary level of potassium that is very similar to our natural plasma level. Seaweed extract is interestingly similar to human blood plasma. Two Japanese surgeons have used a novel technique of mixing seaweed compounds with water to substitute whole blood in transfusion and this has been successfully tried in over 100 operations [Langseth 1995].

Although, the use of seaweeds in medicine is not as wide spread as once it was, the use of seaweed polymer extract in pharmacy, medicine, and biochemistry is well established. Clinical trials are also in progress to make diabetic patients free from injection by introducing insulin secreting "jelly capsule" made of seaweed-derived alginic acid [Kjaervik et al., 1993]. The capsule renders protection to white blood cells and the patient's immune system. Seaweed gums like carrageenan (extracted from red seaweed) or algin (from brown seaweed) are rich sources of soluble fibers [Langseth 1995].

Marine-derived fungi are known to be a source of antioxidative natural products: (i) Acremonin A from Acremonium sp. [Abdel-Lateff et al., 2002] and (ii) Xanthone derivative from Wardomyces anomalus [Abdel-Lateff et al., 2003]. Reactions of free radicals, such as super-oxide radical, hydroxyl radical, peroxyl radical and other reactive oxygen and nitrogen are associated with diseases such as atherosclerosis, dementia, and cancer. Antioxidants delay or prevent oxidative damage and thus they may be useful as therapeutics or food additives. Phloroglucinol and its polymers, namely, eckol (a trimer), phlorofucofuroeckol A (a pentamer), dieckol, and 8,8′-bieckol (hexamers) isolated from the brown alga Eisenia bicyclis are shown to have antioxidant activity [Shibata et al., 2002]. The brown alga Eclonia cava has been hydrolyzed by using five different types of carbohydrases such as AMG, Celluclast, Termamyl, Ultraflo, and Viscozyme to produce enzymatic extracts and proved them to be potential natural water-soluble antioxidants with dose dependent radical scavenging activities [Heo et al., 2005].

1.3 ANTIOXIDANTS

These are those Substances whose presence in relatively low concentrations significantly inhibits the role of oxidation of the targets. Due to continuous generation of partially reduced forms of oxygen by constitutive metabolic pathways, a number of protective antioxidant enzymes, such as superoxide dismutase (SOD), catalase (CAT), glutathione peroxidase (GSHPx), glutathione reductase (GSHRx), glutathione-S-transferase (GST), and nonenzymatic antioxidants, have involved to deal with toxic species. Oxidation is a chemical reaction that transfers electrons from a substance to an oxidizing agent. Oxidation reactions can produce free radicals, which start chain reactions that damage cells. Antioxidants terminate these chain reactions by removing free radical intermediates and inhibit other oxidation reactions by being oxidized themselves. Antioxidants are often reducing agents such as thiols, ascorbic acid, or polyphenols (Xianquan S. et al. 2005).

1.3.1 There are two types of antioxidants

1.3.1.1 Natural antioxidants:

They are the chain breaking antioxidants which react with lipid radicals and convert them into more stable products. They are mainly phenolic in structures and include the following: Antioxidant minerals: These are cofactor of antioxidants enzymes. Their absence will definitely affect metabolism of many macromolecules such as carbohydrates. Examples include selenium, copper, iron, etc. Antioxidant vitamins: They are needed for most body metabolic functions. They include vitamin C, vitamin E, and vitamin B. Phytochemicals: These are phenolic compounds that are neither vitamins nor minerals. These include: Flavonoids: These are phenolic compounds that give vegetables fruits, grains; seeds leaves, flowers, and bark their colors. Catechins are the most active antioxidants in green and black tea and sesamol.

Carotenoids are fat soluble color in fruits and vegetables. Zeaxanthin is high in spinach and other dark greens.

1.3.1.2 Synthetic antioxidants:

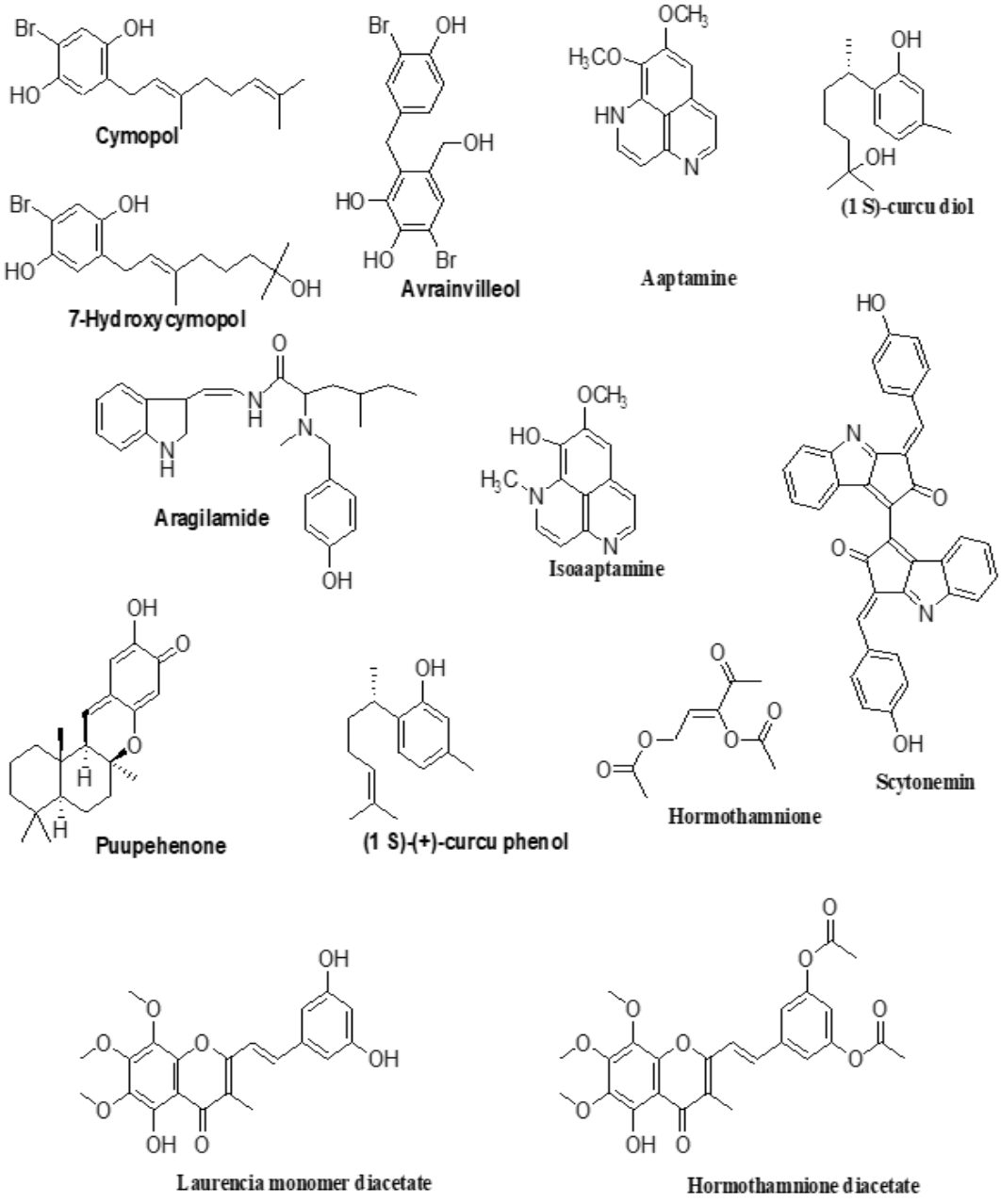
These are phenolic compounds that perform the function of capturing free radicals and stopping the chain reactions such as butylated hydroxyanisole (BHA), butylated hydroxytoluene (BHT), propyl gallate (PG) and metal chelating agent (EDTA), Tertiary butylhydroquinone (TBHQ), Nordihydroguaiaretic acid (NDGA) etc. (Hurrell R. 2003).

Table 1 Marine bio-products found to have antioxidant activity

Compound	sources (reference)	DPPH activity	DCFH-DA IC_{50} (μM)	Reference
cymopol	Cymopolia barbata	+ + +	4.0	Ho gberg et al., 1976
7-hydroxycymopol	Cymopolia barbata	+ + +	>14.6	Estrada D. M. et al., 1987
Avrainvilleol	Avrainvillia spp.	+ + +	6.1	Sun et al., 1983
Aragilamide	Martensia fragilis	+ +	11	Kirkup et al., 1983
Puupehenone	Hyrtios spp., and other species	+ + +	27	Ravi et al., 1979
(1 S)-(+)-curcu phenol	Didiscus spp., and other species	+ +	209	McEnroe et al., 1978 , Wright. et al., 1987 and El Sayed et al., 2002
Aaptamine	Aaptos aaptos, and other species	+ + +	>55	Nakamura et al., 1982
Isoaaptamine	Aaptos aaptos , and other species	+ + +	>55	Shen et al., 1999
(1 S)-curcu diol	Didiscus spp., and other species	+ +	-	McEnroe F. J. et al., 1978 , Wright A. E. et al., 1987 and El Sayed K. A. et al., 2002
Scytonemin	Scytonema spp., and other species	+ +	>23	Proteau, P. et al., 1993
Hormothamnione diacetate	Chrysophaeum taylori	-	18.3	Gerwick W. H. et al., 1986 and Ayyangar N. R. et al., 1988
Laurencia monomer diacetate	Laurencia spectabolis	-	49	Bernart, M. W. et al., 1992
hormothamnione	Chrysophaeum taylori	+ +	>31	Gerwick, W. H. et al., 1986

Figure 5 Structure of marine bioproducts found to have antioxidant activity

+ + + Strong, + + Moderate, - Not active



CONCLUSION

The sea has become a valuable source of medicinal compounds with novel mechanisms of action. Thousands of novel compounds are discovered every year, yet only a small percentage of them are tested in clinical. This review focused on the antioxidant bio-chemicals isolated from marine life having excellent anti-oxidant power. In future the new bio-products will be created from marine plants, animals, and microorganisms due to their excellent power to defeat the medical conditions.

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