

# SEAWEED

## A versatile resource and its applications

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### Abstract

Seaweeds are the most researched marine algae for various agrochemicals, pharmaceuticals, cosmetics and biotechnological applications due to the bio-activities which safe for their usage. Seaweeds, in particular, are a rich source of substances with potential therapeutic benefits, including antibacterial, anticancer, and anti-inflammatory properties. Seaweeds on

economy-provide sustainable livelihood near sea-shore areas. Research suggests green seaweeds to be beneficial for soil/plant amendments and red seaweeds to have some potential for animal feeds.

**Keywords:** Seaweeds, antibacterial, anticancer, anti-inflammatory and animal feed

### Introduction

Seaweed, a valuable marine resource, is rich in fiber, proteins, carbohydrates, vitamins, and minerals. Brown seaweed is particularly known for its iodine content. While protein and calcium levels vary by species, seaweed is generally low in fat. Green and red varieties tend to have higher protein content (up to 30%) compared to brown seaweed (up to 15%). Recognizing its nutritional value, many Southeast Asian nations including Japan, China, Korea, Malaysia, Thailand, Indonesia, the Philippines, and others incorporate seaweed into their diets. Popular seaweed species used in soups, salads, and curries include *Ulva*, *Enteromorpha*, *Caulerpa*, *Codium*, *Monostroma*, *Sargassum*, *Hydroclathrus*, *Laminaria*, *Undaria*, *Macrocystis*, *Porphyra*, *Gracilaria*, *Euclima*, *Laurencia*, and *Acanthophora*. Some seaweeds are also consumed dried.

*Gracilaria corticata* possesses notable antibacterial and antifungal properties. Its extracts exhibited potent antibacterial activity against a range of pathogenic bacteria, including *Klebsiella pneumoniae*, *Enterobacter aerogenes*, *Bacillus subtilis*, *Bacillus cereus*, and *Streptococcus pyogenes*. Antimicrobial compounds are also present in *Turbinaria ornata* and *Sargassum wightii*.

### As anti-inflammatory property

Methanol extracts from *Undaria pinnatifida* and *Ulva linza* demonstrated superior anti-inflammatory effects when tested on mouse ear edema and erythema. These seaweeds effectively inhibited edema formation and exhibited the strongest reduction in erythema.

### As anticancer agents

Seaweeds are a prime source of novel medicinal compounds for human use. Research has shown that certain seaweed extracts can completely eradicate or significantly reduce cancer cells.

### As antimicrobial and antifungal activity

Dietary seaweed consumption has been linked to a decreased risk of breast cancer. Species like *Fucus*, a brown alga, have demonstrated effectiveness against breast and colon cancer. Historically, *Laminaria*, a seaweed used in Chinese medicine, was employed for cancer treatment, a practice also mentioned in ancient Ayurvedic texts. Regular seaweed intake can help prevent breast and other cancers by inhibiting cancer cell growth and proliferation through various mechanisms.

#### **As antiviral activity**

Researchers from multiple countries showed the antiviral properties of *Aghardhiella tenera* and *Nothogenia fastigiata* sp. against human infectious diseases, including HIV, Herpes simplex virus (HSV) types 1 and 2, and respiratory syncytial virus (RSV). There appear to be antiviral sulfated polysaccharides in all marine algae. Significant antiviral activity is exhibited by carrageenans, fucoidans, and sulfated rhamnogalactans against enveloped viruses, including HIV and herpes. While other algal fractions have virucidal and enzyme inhibitory capabilities, or can slow down syncytium development, these chemicals block viruses from entering cells.

#### **As antibiotic activity**

Algae function as natural antibiotics due to the presence of inhibitory compounds. These substances exhibit antimicrobial properties against bacteria, fungi, and viruses. Extensive research and patent filings have identified these compounds primarily within the Phaeophyceae, Chlorophyceae, and Rhodophyceae families. Key antimicrobial constituents include fatty acids, tannins, terpenoids, phenolglucinol, bromophenols, and halogenated compounds.

#### **As beauty enhancer**

Algotherapy is the scientific application of seaweed extracts for cosmetic and therapeutic purposes. Seaweed baths were popularized in coastal resorts during the late 19th and early 20th centuries, often prescribed for conditions like rheumatism and arthritis. Today, seaweed powder, primarily derived from *Ascophyllum nodosum*, is a key ingredient in numerous body

care and cosmetic products. The industry is increasingly focused on isolating specific seaweed compounds for targeted cosmetic benefits, with several of these ingredients gaining market prominence.

#### **As antitumour activity**

Extracts from various marine blue-green algae species have demonstrated efficacy against lymphocytic leukemia and Ehrlich ascites tumor in mice. Additionally, these extracts have shown promise in promoting wound healing, treating ulcers, and protecting the liver.

#### **Medicinal and pharmacological properties**

Seaweed has been a dietary staple since prehistoric times due to its rich content of vitamins and minerals. Derived products and extracts serve as potent nutritional supplements. Beyond their nutritional value, seaweeds exhibit a range of pharmacological properties including antibacterial, antiviral, antifungal, antiallergic, anticoagulant, anticancer, antifouling, and antioxidant effects, which have been explored for treating various diseases. *Sargassum wightii*, a brown alga, is specifically recognized for its antibacterial, antioxidant, anti-inflammatory, and anti-tumor characteristics.

#### **As insecticidal activity**

Extracts from marine macroalgae have insecticidal and acaricidal properties, making them environmentally benign methods for controlling arthropod populations in integrated pest management applications. Because they have distinct mechanisms of action, these botanical biopesticides are safer than synthetic ones and just as effective. As a result, there is less chance that their targets will get resistant to them. Numerous studies have documented the pesticidal or repellent properties of algal extracts against a variety of arthropods that are either agricultural pests or have an impact on human and animal health. As anticipated, a wide variety of chemical structures, including polysaccharides, phenolics, proteins, terpenes, lipids, and halogenated chemicals, are among the bioactive substances found in the extracts. For instance, the red algae *Plocamium*

*cartilagineum* contained two halogenated monoterpenes, violacene and mertensene, as well as the mertensene derivatives dibromomertensene and dihydromertensene, which exhibited potent insecticidal activity against the cereal aphid *Schizaphis graminum* and the tomato moth *Tuta absoluta*. Alkaloids, tannins, and phenols were found in water and ethanol extracts of the brown algae *Sargassum vulgare* and the cyanobacterium *Arthrospira platensis*.

#### As herbicidal activity

Herbaceous weeds pose a significant challenge to agriculture, impeding crop growth and reducing yield. Natural bioherbicides offer a promising solution to this problem. Among these, algal metabolites, particularly cyanotoxins, have shown potential herbicidal properties. Research indicates that cyanotoxins function as allelochemicals in the environment, inhibiting the growth of bacteria, algae, and competing plants.

#### Conclusion

Seaweeds are a veritable treasure trove of nutrients, including proteins, lipids, carbohydrates, enzymes, and essential minerals. Their diverse composition has led to widespread applications in medicine, industry, and pharmaceuticals. Despite these challenges, the marine environment offers a promising

#### As food complement for farm animals

Seaweed serves as a valuable nutritional supplement for livestock, including cattle and poultry. Its balanced micronutrient profile enhances disease resistance, reduces ailments like mastitis in cows, and improves milk quality, including fat and iodine content. Additionally, seaweed boosts egg yolk color, fertility, and birth rates in animals.

#### As organic manure

Seaweed is commonly used as a fertilizer due to its rich composition of minerals, growth hormones, potassium, nitrogen, and humic acids. These components make it an effective soil enhancer. Species like *Laminaria*, *Ascophyllum*, and *Sargassum* are popular choices for organic manure as they are biodegradable, non-toxic, and environmentally safe. Additionally, seaweed's moisture-retention capacity contributes to improved soil fertility.

frontier for the discovery of novel bioactive compounds. To fully realize the potential of seaweeds, careful research, cultivation practices, and quality control measures are essential to ensure their safe and sustainable utilization.