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RESEARCH ARTICLE OPEN ACCESS

STUDY ON SEAWEED AS BIO-FILTERS

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ABSTRACT

The project's primary goal is to develop a good that benefits society and the economy. The research focuses on seaweed, a term that refers to a wide variety of marine plants and algae that are found in the ocean and other bodies of water.Seaweeds have a variety of health advantages, including the ability to treat conditions like arthritis, colds, flu, and rheumatoid arthritis. There are numerous industrial uses for seaweed, most of which are restricted to phycocolloid and other fine biochemical extraction. The utilisation of seaweed as a source of long- and short-chain compounds with industrial and medicinal applications is possible. The potential advantages of seaweed include its capacity to create biofuels, operate as a carbon sink, and enhance soil quality.Also, by defending shorelines and minimising the consequences of ocean acidification and deoxygenation, it aids in seaweed farming, which canaid in climate change adaptation. Moreover, seaweed cultivation may give fisherman a means of income and boost the Economy of the nation. Understanding how seaweed may function as a bio filter and advance efforts to create a cleaner ocean is the primary goal of this essay.

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INTRODUCTION

Many marine plant and algae species that thrive in the ocean as well as in rivers, lakes, and other bodies of water go by the generic name "seaweed." Microscopic seaweeds exist, such as the phytoplankton that supports the majority of marine food chains and lives floating in the water column. Some are incredibly large, such as the giant kelp that grows in voluminous "forests" and soars like underwater redwoods from 1 to 2 miles (1.6 to 3.7 kilometres) above the surface. the ocean's bottom is where their roots are. The majority wash up on beaches and shorelines all over the world at random, are medium in size, and are coloured red, green, brown, and black. A discoid holdfast is where Ulva lactuca, a thin, flat, green alga, grows. The margin is occasionally ripped and has some ruffling. Though typically much smaller, it can grow to be up to 30 centimetres broad and up to 18 centimetres long. The membrane, which is two cells thick, translucent, and develops withouta stipe on rocks or other algae, is held fast by a tiny disc-shaped holdfast. This Chlorophyta species, which ranges in colour from green to dark green, ismade up of two layers of erratically placed cells, as can be seen in the cross- section. Some authors describe the chloroplast as having a cup form, while others describe it as having a parietal plate and one to three pyrenoids. Several Ulva species exist, and they can be difficult to distinguish from one another.

Medical benefits of seaweed: Many claims have been made about the benefits of seaweeds for human health throughout Europe and North America. Seaweeds may be able to treat conditions including arthritis, colds, flu, and rheumatoid arthritis, among others. An efficient vermifugal agent is produced by the genus Digenea (Ceramiales; Rhodophya) (kainic acid). Aqueous extracts from two red algae in the Dumontiaceae family have recently been identified to suppress the herpes simplex virus, although no human testing have been done. Several ofthe claimed therapeutic benefits of marine algae have not been proven. Corallina is employed in the treatment of bone loss. An thorough assessment is provided by Stein & Borden (1984). Biologically active natural goods are currently gaining popularity among consumers as both medications and dietary supplements, cosmetics, and skincare items. Significant features of highly active sulphated polysaccharides extracted from seaweed include immunomodulatory, anticancer, neuroprotective, antilipidemic, antidiabetic, anti-inflammatory, antioxidant, renoprotective, and hepatoprotective effects. Sulphated polysaccharides are also utilised in regenerative medicine, controlled medication delivery, and wound healing.Sulphated polysaccharides can be used for cell treatment and tissue engineering due of their therapeutic potential. The usage of seaweed sulphated polysaccharides is appealing due to their distinctive features as wellas their low cost, near lack of toxicity and the emergence of disease resistance, high solubility, significant natural resource reserves, and potential for seaweed farming. With all of these benefits, these compounds are clearly excellent candidates for the development of biologically active additives and modern medications for the prevention and treatment of illnesses with varied causes (for further information see here). Brown seaweeds, which are historically used as a dietary component primarilyin Asia, have been linked to a number of health advantages.

A strikingly homogenous picture emerges despite the wide variety of experimental methods used to evaluate various species and substances for their effects on immunity and inflammation. Three categories may be used to group the main impacts of consuming brown seaweeds or their compounds: (1) Reactive oxygen species, known to be significant contributors to inflammation, are inhibited; (2) proinflammatory NF-B signalling is generally regulated; (3) adaptive immune responses are modulated, particularly by preventing T-helper cell polarisation. Many disorders linked to inflammation have significantly grown during thepast few decades.They include autoimmune disorders and allergies in addition to lifestyle-related and aging-related morbidities. Hence, continued research on brown seaweeds and seaweed components as functional foods and nutraceuticals may help to address these issues.

Industrial use of seaweed

Applications and benefits of seaweed In many maritime nations, seaweeds are employed as a food source, in industrial processes, and as fertiliser. In Asia, notably in Japan, Korea, and China, where seaweed cultivation has developed into a significant business, these plants are mostly used as food. There hasn't been much motivation to improve seaweed growing methods in the majority of western nations since food and animal consumption are regulated. These are some current and future uses for seaweeds. The majority of industrial use now only involves the extraction of phycocolloids and, to a much lesser extent, a few fine biochemicals. While they are not currently used on an industrial basis, fermentation and pyrolysis are potential solutions for the twenty-first century. Seaweeds are being used as human meals, cosmetics, fertilisers, and to extract industrial chemicals and gums. They may be exploited as a source of long- and short-chain compounds for both industrial and medical applications. Moreover, marine algae may be employed as energy collectors, and fermentation and pyrolysis may be used to extract potentially beneficial chemicals. The image depicts a few of the numerous seaweed goods or products using seaweed that are now on the market; each of these items is produced by an Irish company or uses Irish seaweed.

Seaweed in food industry & their benefits

Nutritional content: Seaweeds are being used as human meals, cosmetics, fertilisers, and to extract industrial chemicals and gums. They may be exploited as a source of long- andshort-chain compounds for both industrial and medical applications. Moreover, marine algae may be employed as energy collectors, and fermentation and pyrolysis may be used to extract potentially beneficial chemicals. The image depicts a few of the numerous seaweed goods or products using seaweed that are now on the market; each of these items is produced by an Irish company oruses Irish seaweed.

U. lactuca has been shown in certain clinical tests to be a more effective source of dietary fibre than fruits and vegetables. Moreover, it has been demonstrated to possess antioxidant properties that aid in lowering blood levels of triglycerides, LDL cholesterol, and total cholesterol—all of which are importantrisk factors for cardiovascular disease.

Most seaweed-based food additives are polysaccharides, which are derived from brown and red algae and are long-chained molecules. Agars and carrageenans from red algae, as well as alginates from brown algae, are divided into three groups. Their primary emulsifying, stabilising, and thickening properties are what make them valuable, but nowadays, it's also important that they originate from a natural source. They can be a highly valuable ingredient in low-fat diets since it appears that humans are unable to break them down. Certain coralline algae are being utilised as organic calcium and magnesium sulphate sources. Alginate beads have been utilised as a substitute for fish eggs and were coloured with natural colours (see below) and additional fish oils.

Seaweed as bio filter: The ability of seaweed to operate as an efficient biofilter, collecting and degrading these hazardous contaminants, has shown great potential. Seaweed is perfect because it offers home for marine life and absorbs carbon, nitrogen, and phosphorus from the water to help it develop. Each of these processes might greatly enhance marine biodiversity and water quality, which would benefit the ecosystem as a whole.

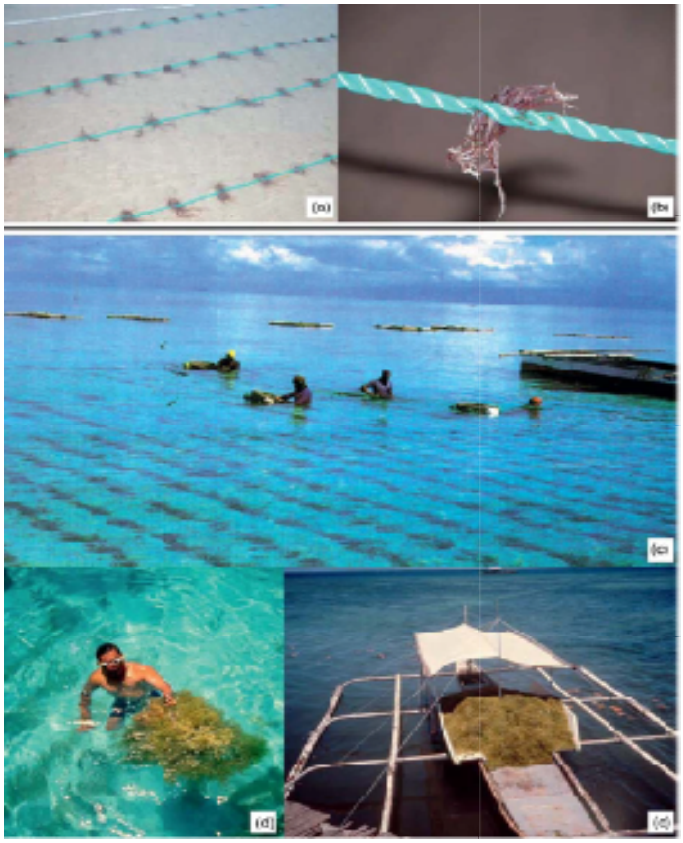
Seaweed Biofilters Aims to: Reduce nutrient runoff and acidification of the oceans Boost reef resistance to consequences from local climate change Improve biodiversity by providing habitat and better water quality To cut emissions, provide farmers useful products. Hire individuals for reef stewardship positions. Make money to pay for the remedy in the future. Contribute to the rural Queensland economy's sustained growth

Background: In the seas around the Great Barrier Reef, a new study is being carried out. On-water testing will soon start as the project, which is primarily focused on utilising seaweed to assist enhance water quality on the Great Barrier Reef, advances to several exciting stages. The effectiveness of native seaweed species planted in key spots to absorb harmful contaminants from the water will be put to the test by researchers. The nature-based approach was created by the Australian Seaweed Institute and has already been acknowledged by the World Economic Forum as one ofthe top worldwide solutions for ocean protection.

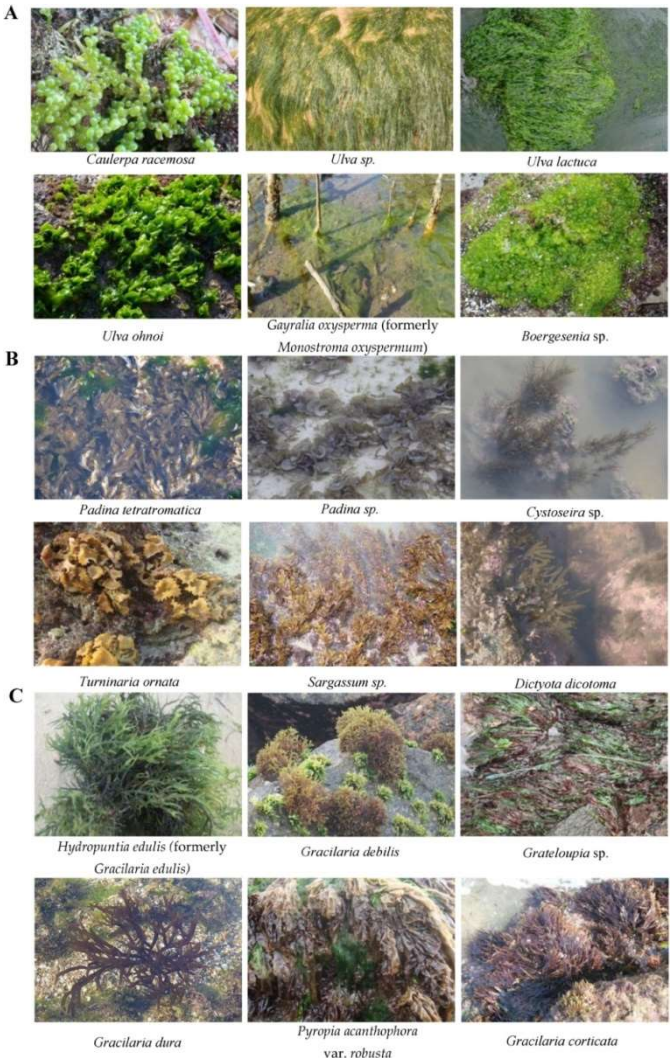
What's been achieved so far with the help of research

Asparagopsis taxiformis, Sargassum spp., and Gracilaria edulis were found to be three natural seaweed species that absorb significant quantities of nutrients in the concept design phase, the initial step of development on seaweed biofilters, in 2020. Moreover, experiments were conducted in tanks to determine the best techniques for raising these species.

The Australian Seaweed Institute and Central Queensland University worked together on this project. They discovered seaweed biofilters had the capacity to annually remove from the water thousands of tonnes of dissolved inorganic nitrogen, a significant contaminant of the Great Barrier Reef.



The issue we are facing: A severe problem that has an impact on the environment, animals, and public health is water pollution. It happens when dangerous compounds are added to water bodies, including oceans, rivers, lakes, and groundwater. Chemicals, oil, sewage, and used plastic are just a few examples of these contaminants. Water pollution may have a severe influence on local economies that depend on clean water, as well as harm to aquatic life and poor water quality for human needs including drinking, irrigation, and pleasure. Combining efforts to reduce the use of dangerous compounds, enhance wastewater treatment, and raise public understanding of the value of clean water are necessary to combat water pollution. The problems we have with water contamination can be resolved by employing these bio filters. Surface waterways are frequently polluted by some kind of outflow from cities, towns, and settlements along the water. Human waste that has been treated before being released to surface waterways after being collected in sewers and routed to municipal sewage treatment facilities. Particularly susceptible to contamination is water. More compounds can be dissolved by water than by any other liquid on earth, earning it the moniker "universal solvent". Kool-Aid and bright blue waterfalls exist because of it. It is easily dissolved and mixed with toxic compounds from companies, municipalities, and farms, which results in water contamination.

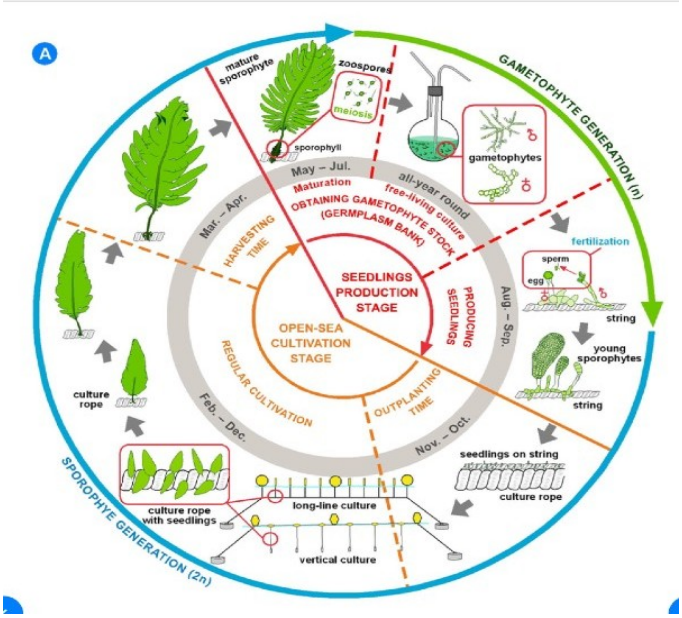


Eliminating contaminants at the source is the answer to water contamination. By employing biofilters, treating point sources to eliminate pollutants, and having each person be more aware of how human activity affects the landscape and aquatic environment, this may be achieved. One of the best solutions to the problem of water contamination comes from this source. Treating point sources using bio filters, which employ biological systems and organisms to remove pollutants, can be successful. In addition, by employing best management practises, lowering the use of hazardous chemicals, and appropriately disposing of trash, people and businesses may lessen their negative effects on the environment.

Production of seaweed:

- Seaweed cultivation and harvesting is known as "seaweed farming" or "kelp farming." It consists, in its most basic form, of the management of naturally occurring batches. In its most sophisticated version, it entails total control overthe algae's life cycle.
- Many processes are involved in the manufacturing of seaweed;

- Seaweed extraction.
- Laboratory cultivation.
- Regular cultivation.
- Seasonal harvest.



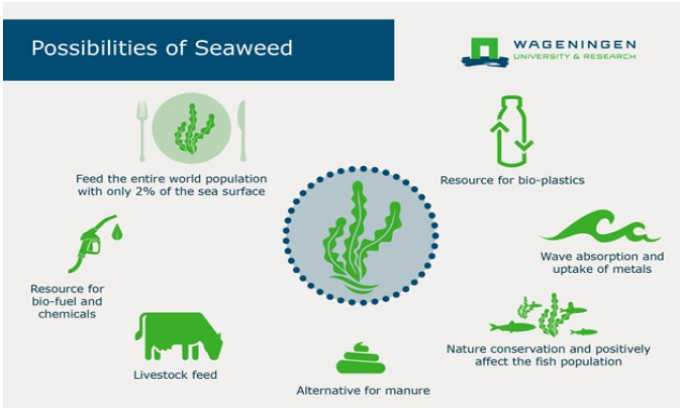
Seaweed extraction: The technique of gathering wild seaweed from the ocean or other bodies of water is known as seaweed extraction. This may entail hand-harvesting or the use of boats outfitted with specialised tools and equipment to gather vast amounts of seaweed. The initial phase in seaweed farming is frequently seaweed extraction, which serves as a source of seed material for further steps such as laboratory cultivation. It serves as a source of food, medicine, and revenue in many coastal communities, making it significant. If not done appropriately, it can also have detrimental effects on the ecosystem, such as the loss of habitat for marine life and the removal of crucial food supplies for marine species. Seaweed extraction is frequently controlled and monitored by regional authorities to reduce these effects by local governments and organizations to ensure that it is done in a sustainable manner.

Laboratory cultivation: The process of cultivating seaweed under controlled conditions, usually in a lab or greenhouse, is referred to as laboratory culture. By this method, seaweed seedlings are created that may either be utilised for routine cultivation or to examine the growth and development of various seaweed species. To maximise development and guarantee the success of the seaweed culture, several factors such as temperature, light, and nutrient levels may be carefully managed in laboratory cultivation. In order to continue growing and harvesting, the laboratory-grown seaweed seedlings can be moved to larger-scale, outdoor culture locations. The improvement of seaweed farming's production and efficiency as well as the conservation and preservation of seaweed species depend on this phase in the process.

Regular cultivation: Routine culture is the continual activity of cultivating and caring for seaweed plants in outdoor or partially outdoor settings. This might involve securing seaweed plants in the water with nets, ropes, or other materials, supplying the food and light they need to develop, and controlling the crop to lessen the effects of environmental elements like waves, currents, and predators. Seaweed may be produced commercially since regular culture is normally carried out on a bigger scale than laboratory cultivation. The type of seaweed being grown and the unique characteristics of the growing location, such as water temperature, light exposure, and nutrient levels, will determine the conditions and proceduresutilised in routine cultivation. A crucial component in the seaweed farming process is routine cultivation, which enables farmers to produce a steady supply of seaweed for harvest and sale.

Seasonal harvest: The act of gathering mature seaweed crops for use in commerce is referred to as seasonal harvest. After the seaweed has grown to the proper size and quality,this normally takes place at specified periods of the year. The seaweed is cut or plucked from the ropes, nets, or other cultivation-related materials during the harvest and brought to land for additional processing. The harvesting techniques will vary depending on the type of seaweed being cultivated and the unique features of the production area. Seaweed can be dried, packed, and marketed for use in food, medicine, cosmetics, and fertiliser once it has been harvested. Seasonal harvest is a crucial phase in the production of seaweed since it enables farmers to reap the financial rewards of their investment and contributes to the industry to the sustainable development of coastal communities. Buisness concept- problems solving. After the seaweed has grown to the proper size and quality, this normally takes place at specified periods of the year. The seaweed is cut or plucked from the ropes, nets, or other cultivation-related materials during the harvest and brought to land for additional processing. The harvesting techniques will vary depending on the type of seaweed being cultivated and the unique features of the production area. Seaweed can be dried, packed, and marketed for use in food, medicine, cosmetics, and fertiliser once it has been harvested.

Seasonal harvest is a crucial phase in the production of seaweed since it enablesfarmers to reap the financial rewards of their investment and contributes to the industry Adding oxygen to the water will mitigate the local consequences of ocean acidification and deoxygenation. Nevertheless, the potential for expanding seaweed aquaculture is constrained by issues such as the scarcity of appropriate places and rivalry for acceptable sites with other purposes, engineering systems capable of withstanding harsh offshore conditions, and rising market demand for seaweed products. Notwithstanding these drawbacks, seaweed farming techniques may be improved to maximise climatic advantages, which, if financially rewarded, may increase seaweed producers' revenue.



CONCLUSION

Seaweed may be utilised for a variety of purposes, including the reduction of pollution and the production of biofuels and animal feed. But, when seen broadly, it serves as a means of economic gain for fishermen whose lives are in danger because of the rising loss of marine ecosystems caused by pollution. TheGDP of the nation might increase by a billion rupees as a result in the coming years.

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