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SEAWEED RESEARCH AND UTILIZATION IN INDIA

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ONE

INTRODUCTION

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Seaweeds are macroscopic algae, which form an important component of the marine living resource. They are available largely in shallow coastal waters wherever there is a substratum on which they can grow and flourish. Based on their pigmentation, the seaweeds are broadly grouped into green, brown, red and blue-green algae. They are harvested by man for centuries, particularly in Japan and China, where they form a part of the staple diet. The uses of seaweeds as food, fodder and manure are well known in many countries. Marine algae contain more than 60 trace elements in a concentration much higher than in terrestrial plants. They also contain protein, iodine, bromine, vitamins and substances of stimulatory and antibiotic nature. Seaweeds are the only source for the production of agar, alginate and carrageenan. These phytochemicals are extensively used in various industries such as of food, confectionary, textile, pharmaceutical, dairy and paper mostly as gelling, stabilising and thickening agents. Apart from these biochemicals, other products such as mannitol, laminarin and fucoidin are also obtained from marine algae. Now attempts are being made for screening pharmaceuticaly active compounds from seaweeds.

In earlier years marine algae were considered to be the major source for extraction of iodine and potash. Protein-rich seaweeds such as species of *Caulerpa*, *Porphyra*, *Gracilaria*, *Acanthophora* and *Laurencia* are used for human consumption in some of the South East Asian countries. However, in India, except for the use of *Gracilaria edulis* for making gruel in the coastal areas of Tamil Nadu, seaweeds are never used directly as a food item. There is a practice along some coastal areas in India of utilizing seaweeds washed ashore to manure coconut plantations, as seaweed manure has been found superior to the conventional organic (farm yard) manure. At the Central Marine Fisheries Research Institute a simple method has been formulated for preparing seaweed compost, which can be used as a cheap source of fertilizer. Seaweed extract can be used as a foliar spray for inducing faster growth in crops and fruiting plants. This has been practised recently on a large scale in countries such as U. S. A., U. K. and Norway.

It has been estimated that the seaweed resources of the world comprise about 1460 million tonnes wet weight brown algae and 261 million tonnes wet weight red algae. The total seaweed production may be about 1721 x 10^4 tonnes wet weight annually (Michanek 1975). The major sources of seaweeds are in the northeast, western central and southwest Atlantic and the eastern-central and northwest Pacific areas. There is not much information regarding the Antarctic and Arctic regions. India, with a long coastline (6100 km), has a vast resource of seaweeds along her many open coasts and estuarine areas. The Lakshadweep and Andaman-Nicobar Islands have rich seaweed vegetation. Resources surveys have been conducted by various organisations in India to assess the occurrence and distribution of seaweeds along our coasts, and it has been estimated that about 73,000 t of this resource is available along the areas explored so far.

The seaweeds mainly used by the seaweed industry in other countries for algin production are *Macrocystis*, *Nereocystis*, *Laminaria* and

Ascophyllum; for agar production *Gelidium, Gracilaria* and *Gelidiella;* and for carrageenan extraction *Eucheuma, Chondrus* and *Gigartina.* The seaweed utilization in India started during the Second World War, when soda ash, alginate and iodine were extracted from the seaweeds. Later, since the importance of seaweeds as a source of agar and alginates was realised, they began to be used for indigenous production of these materials. The seaweeds used for agar extraction in India are *Gelidiella acerosa, Gracilaria edulis* and *G. crassa* and for the production of alginates *Sargassum* and *Turbinaria* species are used.

Seaweeds such as *Gelidiella, Gracilaria* and *Sargassum* were being exported from India until 1975. But, the Government of India, considering the need of local agar and algin industries, later banned the export. However, the seaweed industries in India do not produce as yet the required quantities of sodium alginate and agar. As a result, India imports agar and algin every year, spending a considerable amount of foreign exchange. Commercial exploitation of seaweeds is neverthless going on in India since 1966. At present, seaweeds from Gujarat coast and many localities in Tamil Nadu are harvested by small- and large-scale industries. There are also many seaweed suppliers who harvest seaweeds *(Gelidiella acerosa, Gracilaria edulis, G. crassa* and species of *Sargassum* and *Turbinaria)* and sell them to industries. Sundried *Gelidiella acerosa, Gracilaria edulis* and *G. crassa* and formalin-treated and sundried *Sargassum* and *Turbinaria* are packed in gunnies, stored in sheds, and periodically transported to the processing plants.

Today there is a greater awareness in many countries of the need to cultivate seaweeds to meet the demand for food and of industry. In recent years many industries producing agar and algin have come up in our country too. Owing to the limited natural resources of desired seaweeds and to the industries' increasing demand for them, it has now become necessary for us to cultivate them on large scale. Some of the suitable sites for cultivation of seaweeds are found in Gulf of Mannar, Palk Bay, Gulf of Kutch, Malvan and the bays and lagoons of Lakshadweep and Andaman-Nicobar islands.

Species of *Monostroma, Caulerpa, Undaria, Laminaria, Macrocystis, Porphyra, Gracilaria, Eucheuma, Hypnea, Gloiopeltis* and *Chondrus,* belonging to Chlorophyta, Phaeophyta and Rhodophyta, are cultivated in different countries according to their needs, and different techniques are adopted for their cultivation. In Japan and China large industries are engaged in cultivation and processing of many of these seaweeds. In India, seaweeds are used mainly for the manufacture of agar and algin and hence attempts are being made to cultivate only the agar- and algin-yielding seaweeds. Rope net as base is being used for the species such as *Gracilaria edulis, Hypnea musciformis, Acanthophora spicifera,* species of *Sargassum* and *Turbinaria* and coralstone as base for *Gelidiella acerosa.* Since 1972, the Central Marine Fisheries Research Institute has been engaged in developing low-cost culture techniques for different species of seaweeds. These techniques now need to be taken up in large-scale application as full-time or part-time avocation in coastal villages where suitable sea conditions prevail. For this there should be planned programme which should not only augment production but also create large-scale job opportunities in the coastal rural sector.

At present, some of the national organisations such as Central Marine Fisheries Research Institute, Central Salt and Marine Chemical Research Institue and the National Institute of Oceanography and the Andhra University Botany Department are involved in major programmes of seaweed cultivation and utilization. The efforts of these institutions should be co-ordinated to identify need-based priority areas. Appropriate technologies for culture, harvesting and processing of seaweeds have to be developed. Extension programmes and transfer of proven technologies in seaweed culture should also receive immediate attention. Some centralised training for States' fisheries officials engaged in extension programmes may also be organized if necessary to accelerate developmental efforts.

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