

Seaweed Industry in India

P. Kaladharan and N. Kaliaperumal

Abstract

The seaweed industry in India is mainly a cottage industry and is based only on the natural stock of agar yielding red seaweeds, such as *Gelidium acerosa* and *Gracilaria edulis*, and algin yielding brown seaweed species such as *Sargassum* and *Turbinaria*. India produces 110-132 t of dry agar annually utilizing about 880-1 100 t of dry agarophytes, and 360-540 t of algin from 3 600-5 400 t of dry alginophytes.

Introduction

India has a 8 085 km long coastline, 51 200 km² of continental shelf area and 2.02 million km² of EEZ. About 8.5 million ha of coastal area is in the form of sheltered bays and lagoons which are ideal for mariculture activities. However, the seaweed industry in India depends entirely on the natural stock of seaweeds and no attempts have been made to increase production through mariculture.

Seaweeds are one of the commercially important living marine resources that belong to the primitive group of non-flowering plants (*Thalophyta*) which grow submerged in intertidal, shallow and sometimes subsurface water up to 100 m depth in the sea and also in brackish water estuaries. These marine algae grow abundantly along the Tamil Nadu and Gujarat coasts of the mainland and in the Lakshadweep and Andaman-Nicobar archipelagos. There are also rich seaweed beds around Mumbai, Ratnagiri, Goa, Karwar, Varkala, Vizhinjam and Visakhapatnam and in the coastal lakes such as Ashtamudi, Pulicat, Chennai, Karakal, Adirampatinam, Kattumavadi, Kottaipatinam, Mandapam, Tuticorin, Ashtamudi, Varkala, Cochin, and Tuticorin (Fig. 1). We gathered information from 36 seaweed units all over the country through pretested interview schedules to look at the present status of the seaweed industry in India.

Seaweed Resources

About 700 species of marine algae have been reported from different parts of the Indian coast. Of these, nearly 60 species are commercially important and can be utilized as raw material for agar, algin and carrageenan production and for food, manure and pharmaceuticals. It is estimated that the total standing crop of all seaweeds in Indian waters is more than 100 000 t wet weight consisting of 6 000 t of agar yielding seaweeds, 16 000 t of algin yielding seaweeds, 8 000 t of carrageenan yield-

ing seaweeds and the remaining 70 000 t of edible and green seaweeds (Devaraj et al., in press).

In India, seaweeds are exploited commercially only for the manufacture of phycocolloids such as agar and algin. Major species are *G. acerosa*, *Gracilaria edulis*, *G. verucosa* and *Gracilaria* sp. for agar production and species of *Sargassum* and *Turbinaria* for sodium alginate production. These weeds are mainly exploited on the southeastern coast, especially in the areas between Vedaranyam to Kanyakumari.

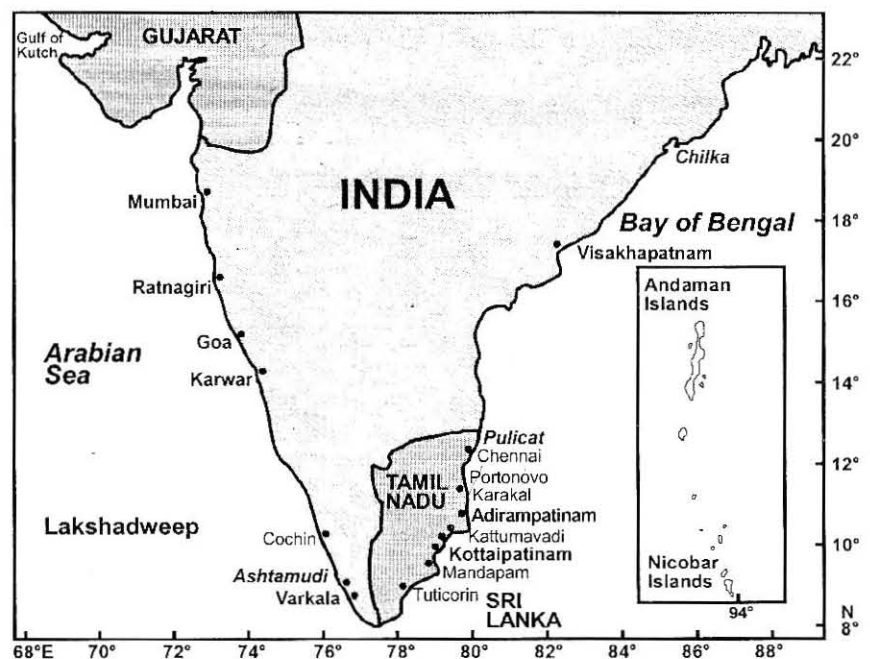


Fig. 1. Seaweed areas in India.



Sargassum ready for transport to algin producers.

A market for selling the seaweed was first established at Mandapam in 1966 with the support of the Central Marine Fisheries Research Institute (CMFRI) and the Central Salt and Marine Chemicals Research Institute (CSMCRI). The local suppliers or dealers sell the seaweed with 30% moisture content. The purity is 75% for *Gelidiella acerosa* and 90% for other weeds. The impurities are sand, pebbles and other weeds.

Nearly 1 200 people are involved in seaweed collection and exploitation. Seventy percent of them are women and 30% are men and children. Fishing boats or dugout canoes are used to transport the seaweeds collected from deeper areas as well as from islands. There is a drying, sorting and packing yard for alginophytes, particularly *Sargassum* (in Sedukarai Road, Thirupullani Village of Ramanathapuram District at a sprawling area of 7 acres), adjoining the seashore where *Sargassum* exploited from the entire Tamil Nadu coast is

dried, sorted, cleaned thoroughly, packed in gunny bags and transported to algin producing industries.

The active seasons for exploitation of *G. edulis* are January to March and July to September, whereas for *Sargassum* it is August to October. Overexploitation of seaweeds has led to a scarcity of the raw material and poor quality of the products. The scarcity of raw material for the agar industry ended in 1991 with the introduction of the *Gracilaria* species to the market (Kalimuthu and Kaliaperumal 1991). This species is collected from the deeper bays along the Kottaipattinam-Adirampattinam areas (Fig. 1) with the help of bottom trawls (dragnets). Now most units in the area have adequate stocks of this raw material.

Seaweed Processing Industry

In India, the utilization of seaweeds for the extraction of soda ash, alginic acid and iodine started

during the second World War period. Production of agar started in 1966. Seaweed was exported until 1975 when the Government of India banned the export of seaweeds (Silas et al. 1987) in order to meet the requirement of the local agar industry. Agar and sodium alginate are the phycocolloids produced in India. There are 40 units processing seaweed of which 22 produce agar. There is no production of carrageenan. Almost all units are cottage industries with no sophisticated machinery.

Twenty-five percent of the units surveyed are hypothecated to banks. All the units have facilities for storing 5 to 10 t of dry seaweed to be used in the off season or during the monsoon months. The majority of the units (95%) work for 6 days/week. They stop production for 2 months in the rainy season as they are unable to dry the products and their workers go for harvesting paddy and subsequent agronomic practices at higher wages. Unlike in

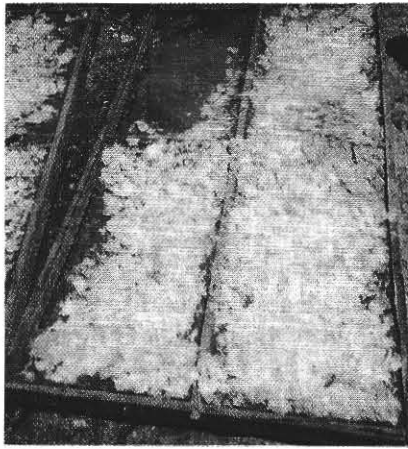
the gathering of seaweed from natural beds where female workers outnumber males (70/30), in the processing industry the number of male and female workers are almost equal. The usual structure in both the agar and algin industries is that each unit contains one skilled worker and 8 to 10 assistants. The skilled worker (always male) in 75% of the industry is either the owner or one of the immediate relatives of the owner. The skilled worker receives monthly wages of Rs. 1 200-1 500. Other male workers receive Rs. 900-1 200/month and the female workers Rs. 750-900/month, paid weekly (US\$1 = Rs. 40).

Agar Production

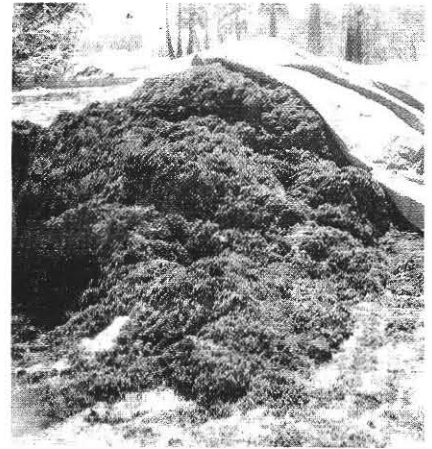
Agar producers in India follow a simple method of agar extraction, i.e., by boiling the dry weed. The hot extract is filtered, cooled, freeze-thawed, bleached and dried in the sun. The agar is marketed either in strips or as powder. The raw materials used for agar extraction are *G. edulis*, *G. acerosa* and *Gracilaria* sp. *G. acerosa* yields industrial grade agar with a gel strength up to 600 g/cm², whereas *Gracilaria* yields food grade agar with gel strength varying between 150 and 200 g/cm². The capacity of the agar producing units varies between 500 and 800 kg dry agar/month, using 4-5 t dry weed/month. The raw material is purchased from the dealers at the price of Rs. 3 000-4 200/t for *Gracilaria* and Rs. 12 000 to 16 000/t for dry *Gelidiella*. The product is sold weekly to the Bombay market for Rs. 200-250/kg of food grade dry agar and Rs. 400-500/kg of industrial grade dry agar. The total annual production of agar in India ranges between 110 and 132 t, utilizing about 880-1 100 t of dry weed per year.

Algin Production

Algin is manufactured as sodium alginate at the cottage industry level through alkali digestion, precipitation



Dry agar to be powdered.



Sargassum, stored in the drying yard.



Agar being dried in the sun after bleaching.



Dry Sargassum filled in gunny bags.

by acidification, centrifuging, drying, etc. Sodium alginate is marketed as a fine powder. *Sargassum* and *Turbinaria* are the two major raw materials used in the algin industry. *Sargassum* is preferred over *Turbinaria* as the quality and quantity of algin yield are better from the former. Most of the units are capable of producing 20-30 t/yr. The total production is 360-540 t of algin annually utilizing 3 600-5 400 t of dry *Sargassum* and *Turbinaria*. The raw material is purchased from the dealers for Rs. 2 200-2 500/t and the product is sold in the Mumbai and Ahmedabad markets for Rs. 10 to 150/kg, depending upon the quality, color and texture.

Problems and Prospects

The major problem faced by the agar and algin producers in India are the poor quality of the raw materials available to them. The commonly available species of raw materials are inherently poor yielders (10-13%) of phycocolloids and are of low quality. *Eucheuma*, *Chondrus*, *Gelidium* and the kelps available in subtropical and temperate climates yield a better quality and quantity of product.

The raw material available has 75% purity due to adulteration by unwanted weeds, seagrass leaves and other debris. The moisture content in the 'dry weed' is about 30-35%. Scarcity of raw material is keenly felt during the rainy season (October-December). Though most producers keep sufficient stocks, during the rainy season production is affected due to insufficient drying of colloids and fungal infestation in both the raw material and the finished products.

Labor shortage is experienced during the paddy harvesting and transplanting season. The lack of technology to improve the quality, viscosity and yield of agar and algin, and adequate information on new and alternative sources of raw

materials are a hindrance. The value is low because of a lack of prescribed standards and quality control measures. Therefore, the majority of the units sell their product either to the local trader or in the domestic market, where it is further processed to improve the color and texture and other characteristics as required by the international market and then exported.

The following technology and training needs were identified from the responses to the interview schedules:

1. Improving the quality of the product in terms of color, gel strength, viscosity, etc.;
2. Quality control and testing of the product to match ISI standards for agar and alginic acid;
3. Identifying new sources of raw material domestically or through import of dry raw materials like *Eucheuma*;
4. Hygienic and scientific methods of producing phycocolloids;
5. Further processing and marketing as higher value products like beverages and food;
6. Waste disposal and utilization of sludge as manure or feed for livestock;
7. Indoor drying instead of freezing and thawing;
8. Mariculture for the production of *Gelidiella acerosa*;
9. Marketing channels to increase share of the final market price; and
10. Production technology for agarose and carrageenan.

Conclusion

As the demand for phycocolloids is increasing and new units are being set up, raw material exploitation will increase, especially of agarophytes. Production of raw materials through mariculture would be a good source of supply. Existing algin yielding seaweed resources can

sustain some expansion in the industry. The existing agar producers can also take up carrageenan production using *Hypnea* spp. as raw material or with imported *Eucheuma*. Technology and training is needed to improve the quality of their products and for marketing.

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P. KALADHARAN and N. KALIAPERUMAL are from the Central Marine Fisheries Research Institute, Kochi-682 014, India.