POSSIBLE PRODUCTION OF SODIUM ALGINATE FROM NATURALLY GROWN BROWN ALGAE IN PAKISTAN

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ABSTRACT: *Sodium alginate is one of the important chemical uses in the reactive printing of fabric. Pakistan is also a big consumer of sodium alginate and more than 2500 MT import in a year. Brown algae are the basic raw material for the production of sodium alginate. China is the largest seaweed producing country and exporting its derivative. From last decay the consumption of seaweed in food sector is rapidly increasing year by year and the shortage have to face to the alginate industry which lift up the price of sodium alginate. From the start of February to the end of the July the pieces of naturally grown seaweed comes on seashore. To estimate the quantity of naturally grown brown algae, a region is selected from the Manora beach to the Hawks bay (AbdurRehman Goath) on the coastal area of Karachi. A method developed to estimate the quantity and then scale up the data for whole season. Sargassum, Laminaria, Oyster thief and Lessonia are the types of brown algae abundantly available on seashore of Karachi. Area under observation starts from Manora Beach to Abdulrehman Goath (Hawks Bay). The amount of the naturally grown algae is seriously depends on the weather condition, tides and lowers, sea level and daytime. From survey the total amount of brown algae can be collected in a season is more than 3500 MT. More than 25 percent demand of sodium alginate can be fulfilled by utilizing natural source and also decrease the import volume. The price of the sodium alginate can be managed by minimizing the import.*

Key wards: Algae, Brown Algae, Sodium Alginate, Reactive Thickener, Textile Printing

1. INTRODUCTION

In this paper, identify the source of raw material for the valuable product. A systematic method used to estimate the quantity of different types of brown algae [1]. Pakistan is one of the big consumers of textile printing thickener and have to import a huge volume about 500 MT/month. There are two sources of brown algae are naturally grown and cultivated. Naturally grown seaweed is the cheaper source but unreliable for the continuous production of sodium alginate. On other hand, cultivation of seaweed is comparatively more reliable but some capital is required to establish the set up for the regular cultivation.

Every season a huge quantity of seaweed, come on the seashore and wasted. In this paper, design a procedure to collect the seaweed from the selected region of coastal area of Karachi to estimate the quantity and the abundance of different types of brown algae. The collection survey is consist of three sessions which is describe in Table-1 mentioned below.

In these three sessions collected data is scale up to estimate the overall and individual abundance of types of brown algae for the production of sodium alginate.

2. MATERIAL AND METHOD

Some terms are describe to understand the experimentation bases. To estimate the quantity of naturally grown seaweed on seashore of Karachi, there are following two bases:

a) Selected region for the survey.
b) Method for collection of the samples.

2.1 Selected region for the survey

The selected region is near to the Karachi, started from the manora beach to the end of the Abdurrehman Goath. The selected coastal belt is about 25.5 km and the whole region is divided in five different location and their sub collection points. The detail description is given in Table 2 mentioned below:

Table 1: Collection Survey of three sessions

Session – 1		Session – 2		Session – 3	
Time Period	Description	Time Period	Description	Time Period	Description
Start of the season to the peak time	In the first half of the spring a huge quantity of seaweed grown and comes from deep sea. In this season Sargassum is the most abundant seaweed.	From Peak time to the end of the season	In the second half of the spring and start of the summer. Fucus and Oyster Thief are the abundant seaweed	In the last month of the season	In last session only Lessonia is the only seaweed which is grown in the end of the season on the rocks of the bdurrehman Goath. In these days the sea level is extremely high.

Table 2: Selected region for the survey.

Location	Collection Points	Length of Seashore (m)
Location – 1	5	4000
Location – 2	6	5500
Location – 3	8	8000
Location – 4	4	3500
Location – 5	5	4500
Total	28	25500

After the abdurrehman goath the rocky area started and due to sudden depth it is difficult to collect the samples. After few miles again the flat area started but it is far away from the city and labor and transportation cost increases 3 times. So the selected region has to restricted up to Abdurrehman goath. The selected region highlighted in figure 2.1 and 2.2 [2].

2.2 Method for collection of the samples

The second major factor to estimate the abundance of naturally grown seaweed on seashore of Pakistan is the methodology which use to streamline the data and close scale up.

Some mathematical equations are developed to understand the abundance and manage the data. In this section some description is given of the mathematical equations are used for evaluation. Some terms and parameters are described as under:

Wet Mass: The seaweed collected from the seashore called the wet mass.

Dry Mass: The moisture free seaweed is called as dry mass.

Wet Mass Flux (Kg/m.hr): The wet seaweed collected per unit length of the seashore to the per unit time in hour. This is one of the key factor for the evaluation.

Dry Mass Flux: The wet seaweed collected per unit length of the seashore to the per unit time in hour. This is one of the key factors for the evaluation.

Total Available Time: Collection of the seaweed seriously depends on the sea level and day time. So in night the sea level is normally high therefore is difficult to collect in night time.

The availability of seaweed is one of the key factors to estimate the overall abundance for whole season. Total available time is the possible collection time for individual types of seaweed in a season.

Overall Abundance (wet bases): Overall abundance of the wet biomass is the weight of the wet seaweed collected in selected region of seashore for one season.

Overall Abundance (dry bases): Overall abundance of the dry biomass is the weight of the dry seaweed collected in selected region of seashore for one season. Dry seaweed is the dry content of algae from wet matter.

Possible Production (Sodium Alginate): The possible production of sodium alginate is the amount of the sodium salt of alginic acid extracted from the naturally grown brown algae collected from the selected region of the seashore. Different types of brown algae have different amount of calcium alginate. So the yield of sodium alginate reported from the literatures [3].

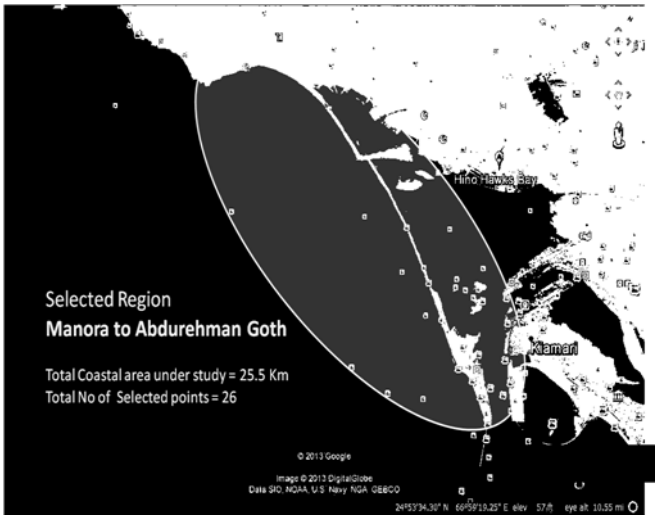

Fig 2.1: Selected region for the collection of naturally grown seaweed.

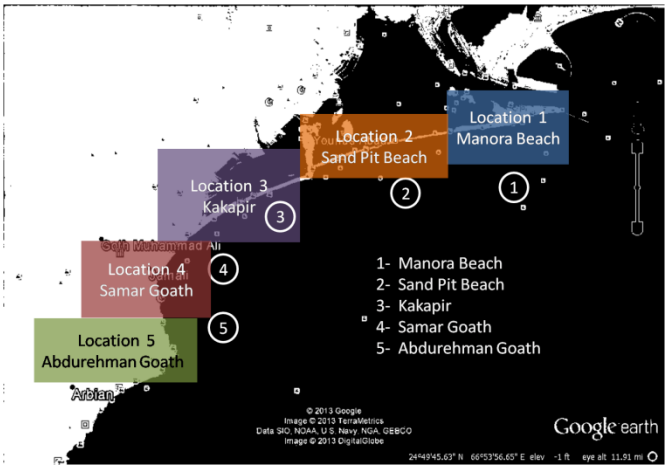

Fig 2.2: Selected region divided into five different Locations.

2.3 Mass Flux (MF)

Mass flux is show the mass of the collected sample per hour per meter length of selected site. Mathematically the mass flux is:

$M.F = W_{cd} / T_c \times L_c$ . . . . . (i)

Where:

W_{cd} = Collected weight of the dry brown algae (Kg)

T_c = Time for collection (hours)

L_c = Length of the beach in which collected (m)

2.4 Abundance

The Abundance shows the estimated weight of brown algae that comes on coast in a season. Here some bases are needed to be set because the time of the season start from mid of March to the end of August. The amount of algae comes on coast is also depend on the sea level which change due to rise and fall.

$ABD = MF \times T_{TC} \times L_{TC}$ . . . . . (ii)

ABD = Abundance of Feed stock (Weight/season)

T_{TC} = Total time for the season (hours)
L_{TC} = Coastal length (meter)

3. RESULTS AND DISCUSSION

3.1 Wet Mass Flux

Wet mass flux is the collected weight per unit length of seashore per unit time (hr). Different types of algae have different flux in different location. on rocky area the focus and oyster thief have higher flux than other types. On plan seashore the surgassum has the higher wet mass flux. Lessonia is only found on the location – 5 in specific time period but in huge quantity.

Wet mass flux is the key factor to estimate the abundance of the naturally grown brown algae in a season from the collected samples. By using equation (i) the wet mass flux of different types of brown algae listed in table 3.1.

3.2 Abundance of brown algae

Abundance of the naturally grown brown algae calculated from equation (ii). The abundance of different types of brown algae in different location is given in fig 4.1. Sargassum is the most abundant brown algae available on the selected region of seashore of Karachi. Lessonia is the only type, which is abundantly available on location -5 in the end of the season.

Although Laminaria has higher yield for the production of sodium alginate but its abundance is on 3rd number. There is not suitable environment for the growth of the laminaria therefore small size of leaves is available as compare to its original size. Fucus is the second most abundant seaweed on seashore of Karachi.

The overall abundance of different types of brown algae is given in figure 3.1 and 3.2.

Sargassum has the highest value with 2150 MT in a season and after that focus with the abundance of 735 MT in a season Lessonia is the least abundant seaweed with the value of 72 MT in a season. The Laminaria and Oyster Thief are close in abundance with the value of 443 and 442.2 MT in a season. The overall naturally grown brown algae, which can be collected from the seashore of Karachi is about 3800 MT in a season [4]. This is a huge quantity which can be utilize to convert into valuable product like, sodium alginate or Alginic Acid.

A lot of variation in the composition of different types of brown algae is studied [5]. The active matter, calcium salt of alginic acid, in the cell walls of algae varies from 7 percent to the 25 percent of the dry mass. Different samples of sargassum have the average 20 percent of calcium alginate analyzed on dry bases. Whereas the focus and Oyster thief contain calcium salt of alginic acid average 15 percent on dry bases

.Table: 3.1 Wet mass flux of selected types of brown algae.

Types of Brown Algae	Abundance in Points	Best Time for Collection	Avg. Wet Mass Flux (Kg/hr.m)
Sargassum	The most abundant type of brown algae is Sargassum and available in selected full length of sea shore, from Location – 1 to Location – 5	With the start of March to mid of May.	0.84
Oyster Thief	Oyster thief is grows on the rocks and some other types of algae. This type mostly available where sea weaves are comparatively slow and low heighted. In which Location – 3, location – 4 and Location – 5.	In the end of February to the mid of March and again available in mid of April to end of May.	0.16
Laminaria	Laminaria and its different types are also available but not in a huge volume. Actually the laminaria find on sea shore is the part of the plants grown in bottom of sea.	Lamainari available from start of march to the mid of June and when sea level falls is the best time for collection.	0.14
Fucus	Due to its weight it can be collected through out the the selected region from location – 1 to location – 5.	season strat from march to the end of june.	0.4
Lessonia	Lessonia is the one of the type of brown algae that only grown on the rocky area of sea shore. It find only in Location – 5 where it is abundantly available.	The best time is start from the mid of july to the end of august.	0.2

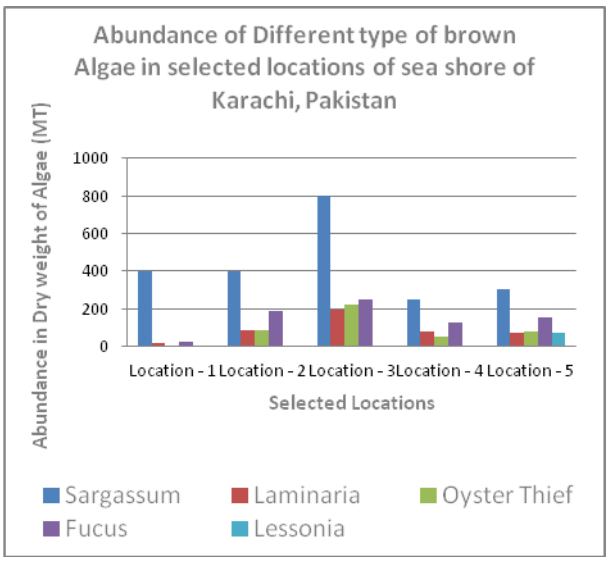

Fig 3.1: Overall abundance of different types of brown algae in different locations

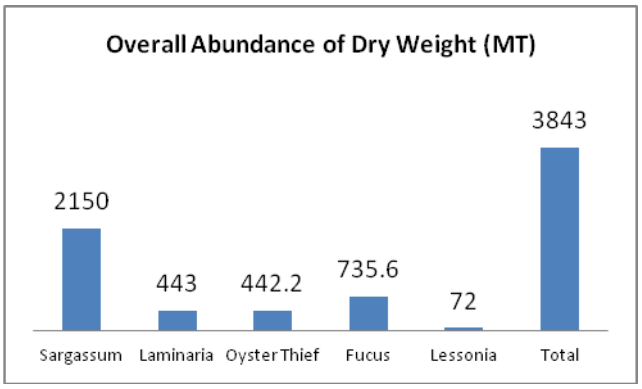

Fig 3.2: Overall Abundance of different types of brown algae in a season.

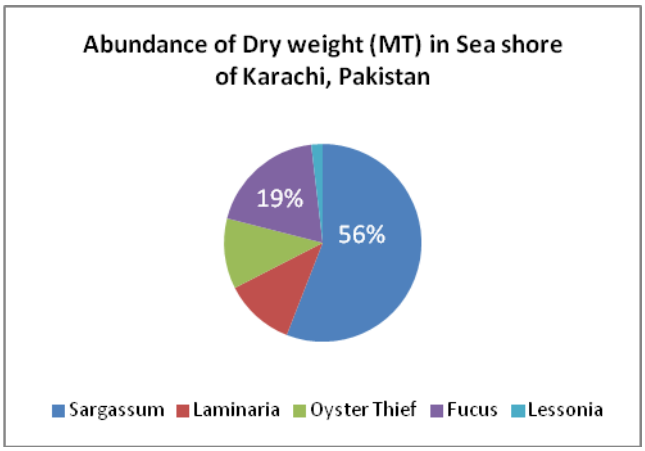

Fig 3.3: Relative Abundance of different types of brown algae on seashore of Karachi.

In Season Sargassum more than 50 percent of the total brown algae collected from the seashore of Karachi as given in figure 3.3.

4. CONCLUSIONS

Sodium alginate is the major product of seaweed derivative. The brown algae is the only raw material for the production of sodium alginate. Sodium alginate is extracted from the cell wall of brown algae and extraction yield depends on the calcium alginate content in algae. The content of active matter also depends on the climate condition, region and way of cultivation. For the collection and the abundance of naturally grown seaweed do not significantly influenced by climate conditions and region.

Among the available types of brown algae the sargassum has the highest content of active matter for the extraction of sodium alginate. 370 MT of sodium alginate can be produced by sargassum, which is more than 50 percent of the total possible production sodium alginate. Average possible production of sodium alginate is about 624 MT in a season. Only from the naturally grown seaweed, the 25 percent of total consumption of reactive thickener can fulfill. By utilizing the wet biomass, we can decrease the 25 percent of import volume.

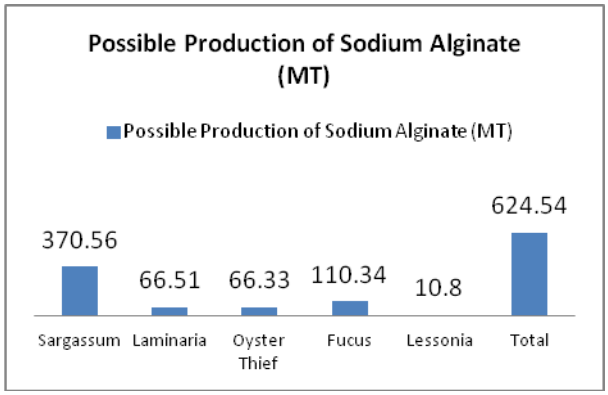

Fig 4.1: Possible Production of Sodium Alginate from the Naturally Grown Brown Algae on the sea shore of Karachi.

5. REFERENCES

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