International Journal of Pure and Applied Zoology
Volume 3, Issue 4, pp: 293-296, 2015
http://www.ijpaz.com

ISSN (Print) : 2320-9577
ISSN (Online): 2320-9585
Rishan Publications

Research Article

ENZYMES CONCENTRATIONS OF SELECTED SEAWEEDS FROM MANDABAM COAST, RAMESWARAM, TAMIL NADU, INDIA

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Article History: Received 7th September 2015; Accepted 1st October 2015; Published 15th October 2015

ABSTRACT

Seaweeds are considered an important source of bioactive molecules. The aim of this study was to characterize the enzymes concentration present in sea weeds of seaweeds. The algal species *Gracilaria folifera*, *Hypenea masiforms* (Red*) and Sargassum longifolia, Turbinaria gonaidae* (Brown) *and Bryopsis, Caulerpa peldata* (Green) was collected from the intertidal region at a depth of 1 m during March 2005 in of Mandabam Coast, Rameswaram, Tamil Nadu, India. Enzymes nitrate reductase, nitrite reductase, glutamine synthetase and glutamate dehydrogenase concentrations of sea weeds were estimated. Green algae *Bryopsis* has higher concentration of Nitrate reductase (12.5 ± 1.6 ng/gm). Brown algae of *Sargassum longifolia* showed maximum concentration of Nitrite reductase (7.21 ± 1.6 ng/gm). The red algae of *Gracilaria folifera* showed higher concentration of Glutamate dehydrogenase (5.01 ± 0.8 ng/gm). Brown algae of *Turpanaria gonaidae* has higher concentration Aspartate transminase of (2.1 ± 1.3 ng/gm) From the results, enzymatic extracts of the seaweeds might be valuable sources enzymes, which may be utilized for mankind and environment welfare.

Keywords: Enzymes, Characterization, Seaweeds, Mandabam Coast.

INTRODUCTION

Sea weeds play very important ecological roles in many marine communities. They are a food source for marine animals such as sea urchins and fishes, and are the nutritional base of some food webs. They provide shelter and a home for numerous fishes, invertebrates, birds and mammals. Large seaweeds form dense underwater forests. These forests provide a physical structure, food and shelter for marine communities. They are affected by the physical characteristics of their environment. Because they absorb gases and nutrients from the surrounding water, they rely on the continual movement of water to avoid nutrient depletion. Cholorophyta are clear green, the cholorophyll is not marked by other pigments. This group comprises practically are the more families freshwater algae and several marine types as well. Food reserves of green algae are starch, rarely insulin, oil and fats. Brown algae are all multicellular and are found in a variety of different physical forms including crusts, filaments and large elaborate keeps. Two unique type of compounds are found in brown algae are algin and fucans, which are used in the manufacturing of consumer goods. Red algae food reserves are Floriden starch, component of sugars and glycerol, cell wall components are cellulose, hemicelluloses, sulphated polysaccharides. Sea weeds are classified into three major groups such as green algae (Cholorophyta), brown algae (phaeophyta) and red algae (Rhodophyta). Nitrogen is the most important abiotic factor that limits the algal growth in the marine environment (Lobban and Harrison, 1994; Oliveira and Plastino, 1994) and its main available source is in the form of nitrate (Chapman and Harrison, 1988). The assimilation of nitrate involves its cytoplasmatic reduction to nitrite, catalyzed by the enzyme nitrate reductase. In the chloroplasts, nitrite is quickly reduced to ammonium by the enzyme nitrite reductase that uses ferredoxine as electron donor, and ammonium is then incorporated to nitrogen molecules as amino acids, purines, pirimidines and amines (Chapman, 1980; Lea and Leegood, 1995, Chow *et al.*, 2007).

Nitrogen is incorporated into glutamate and glutamine which form the major biosynthetic donors for all other nitrogen containing components in a cell. Glutamine is a source of nitrogen for the synthesis of purines, pyrimidines, a number of amino acids, glucosamine and ρ-benzoate, whereas glutamate provides nitrogen for most transaminases and is responsible for 85% of nitrogenous compounds in a cell (Nisizawa *et al.*, 1978; Rigano *et al.*, 1979; Duncan *et al.*, 1992; Reitzer, 2003; Chow *et al.*, 2004).

Seaweeds are considered an important source of bioactive molecules. By estimation enzymes presence in seaweeds we could able to use the seaweeds for different uses towards mankind and also for environment. The main

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objective of the present study was aimed to investigate the enzymes (nitrate reductase, nitrite reductase, glutamine synthetase, glutamate dehydrogenase and aspartate transaminase) concentrations of seaweeds of Mandabam Coast, Tamil Nadu, India.

MATERIALS AND METHODS

Collection of Seaweed

The algal species *Gracilaria folifera* (Red), *Hypenea masiforms* (Red), *Sargassum longifolia* (Brown), *Turbinaria gonaidae* (Brown), *Bryopsis* (Green) and *Caulerpa peldata* (Green) (Figure 1-6) were collected at Mandabam Coast, Rameswaram, Tamil Nadu, India from the intertidal region at a depth of 1 m during March 2005. Immediately after collection, the algal species were washed in sea water. They were subsequently washed in freshwater to remove associated organisms and other extraneous matters. Then the algal species were sun dried. The dried material was powdered to fineness used for the enzymes analysis.

Estimation of enzymes of seaweeds

Nitrate reductase enzyme was estimated by Hageman and Huckles by (1971) method. The activity of the extracted glutamate dehydrogenase was determined spectrophotometrically by measuring at 340 nm (using HITACHI model U-2000 double beam spectrophotometer). Nitrite reductase, Glutamine reductase and Glutamate dehydrogenase enzymes were estimated by Burdon (1957). Aspartate Transminase enzyme was estimated by Varley, (1980).

Figure 1. Red algae, *Gracilaria folifera.*

Figure 2. Red algae *Hypenea masiforms*.

Figure 3. Brown algae *Sargassum longifolia.*

Figure 4. Brown algae *Turpanaria gonaidae.*

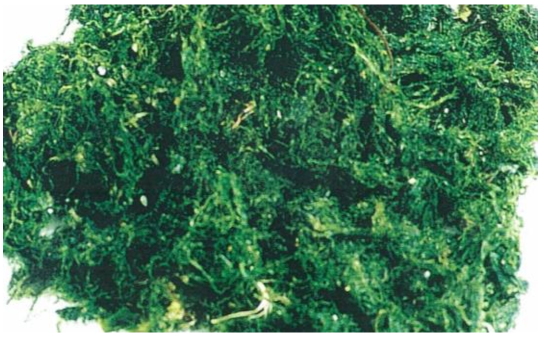

Figure 5. Green algae, *Bryopsis.*

Figure 6. Green algae, *Caulerpa peldata*.

RESULTS

The concentration of Nitrate reductase, Nitrite reductase, Glutamine synthetase and Glutamate dehydrogenase in algal species are presented in the (Table 1).

Nitrate reductase in seaweeds

The nitrate reductase status has been presented in Table 1. As per table green algae *Bryopsis* showing the higher concentration of nitrate reductase as 12.5 ± 1.6 and it will be followed by 8.91 ± 1.4 in brown algae *Turpanaria gonaidae* 7.31 ± 0.8 in ***Sargassum longifolia*** .

Nitrite reductase in seaweeds

As for as the nitrite reductase is concerned the green algae ***Sargassum longifolia*** showing a maximum concentration 7.21 ± 1.6 and *Bryopsis* as 6.10 ± 0.3 and ***Turpanaria gonaidae*** as 5.30 ± 1.8 (Table 1).

Glutamine synthetase in seaweeds

The red algae, *Gracilaria folifera*, an higher concentration of Glutamate dehydrogenase as 5.01 ± 0.8 and in *Bryopsis* it will be of 4.61 ± 2.1 and *Sargassum longifolia* 3.81 ± 0.8 (Table 1).

Glutamate dehydrogenase in seaweeds

The red algae, *Gracilaria folifera has* higher concentration of Glutamate dehydrogenase as 4.01± 1.9 and in *Hypnea masiforms* 3.2 ± 1.3 and ***Bryopsis*** 3.1 ± 0.2 (Table 1).

Aspartate Transaminase in seaweeds

Turpanaria gonaidae has an higher concentration Aspartate transminase of 2.1 ± 1.3 and 1.8 ± 0.5 in ***Gracilaria folifera*** and1.3 ± 0.6 ***Sargassum longifolia*** in (Table 1).

Table 1. Enzyme concentrations in seaweed species of Mandapam coast.

S. No.	Algal species	Enzyme content ng/gm				
		Nitrate reductase	Nitrite reductase	Glutamine synthetase	Glutamate dehydrogenase	Aspartate transaminase
1.	*Bryopsis*	12.5 ± 1.6	6.10 ± 0.3	4.61 ± 2.1	3.1 ± 0.2	0.98 ± 0.2
2.	*Turpanaria gonaidae*	8.91 ± 1.4	5.30 ± 1.8	2.62 ± 1.4	1.01 ± 0.3	2.1 ± 1.3
3.	*Sargassum longifolia*	7.31 ± 0.8	7.21 ± 1.6	3.81 ± 0.8	2.9 ± 1.2	1.3 ± 0.6
4.	*Gracilaria folifera*	7.01 ± 0.2	0.46 ± 0.01	5.01 ± 0.8	4.01 ± 1.9	1.8 ± 0.5
5.	*Caulerpa peldata*	6.41 ± 0.8	3.1 ± 0.2	2.81 ± 0.7	1.92 ± 3.1	0.92 ± 0.5
6.	*Hypenea masiforms*	5.31 ± 1.6	1.81 ± 0.03	3.4 ± 1.6	3.2 ± 1.3	0.81 ± 0.4

DISCUSSION

Over the years, the biological activities of seaweeds could have gained a considerable research interest because of their specific functional compounds (Norrie, 2008), which may not be available in land plants. The enzyme status of marine seaweeds has been reported in the present findings. Among the seaweeds, *Bryopsis* has more concentration of Nitrate reductase and Glutamate dehydrogenase. Similarly *Gracilaria folifera* are rich in Glutamine synthetase and Glutamine dehydrogenase. The *Sargassum longifolia* showed a maximum concentration of Nitrate reductase and Glutamine synthetase. *Turpanaria gonaidae* are rich in Aspartate transaminase Similar enzyme status has been reported by Inokuchi *et al.* (1999). These researchers have quantified the enzymes of the marine seaweed and are good agreement with our present findings.

CONCLUSION

Marine seaweeds are always having rich source of biochemical constituents and enzymes and initially involved in the *Caulerpa peldata* supplementary food for fishes, pond species and human. As far as the enzyme status is concerned the green algae, *Bryopsis* reflecting more picture of nitrate reductase and glutamate dehydrogenase. *Gracilaria folifera* are rich in glutamine synthetase and glutamine dehydrogenase. Similarly *Sargassum longifolia* showing a maximum concentration of nitrate reductase and glutamine synthetase. *Turpanaria gonaidae* contains maximum concentration of Aspartate transaminase The extracted enzymes may be tested and utilized for their biological activity.

ACKNOWLEDGEMENTS

The author is thankful to Dr. M. Ayyavoo for his help in collection of seaweeds. He helped a lot for my reference work. He has been source of inspiration throughout the research work.

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