



## SEQUENCE AND STRUCTURAL ANALYSIS OF ATP SYNTHASE IN *SARGASSUM MUTICUM*

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### ABSTRACT

Marine macro algae or seaweeds, are plant-like organisms that generally live attached to rock or other hard substrata in coastal areas. Red and brown algae are almost exclusively marine, whilst green algae are also common in freshwater (rivers and lakes), and even in terrestrial (rocks, walls, houses, and tree bark in damp places) situations. *Sargassum muticum* is brown seaweed; normally brown to yellowish with a length up to 10 m. It is an autotroph that uses energy from sunlight. *Sargassum muticum* growth is unlimited and the size is variable. In agriculture, algae are used as sources of nitrate and

potassium for fertilization. *Sargassum muticum* is able to carry out the bioabsorption of heavy metals like cadmium, chlorophenolic compounds, and nickel. **ATP synthase** is an enzyme that creates the energy storage molecule Adenosine TriPhosphate (**ATP**). **ATP** is the most commonly used "energy currency" of cells for all organisms. It is formed from adenosine diphosphate (ADP) and inorganic phosphate ( $P_i$ ). The sequence of ATP synthase retrieved from National Centre for Biotechnology Information The biophysical characterization and motif analysis were carried out using Bioinformatics tools like Jcat, scan prosite, Saps, and advanced Jcat server are used.

**KEYWORDS:** *Sargassum muticum*, NCBI, Bioinformatics, Adenosine TriPhosphate, Jcat server.

### INTRODUCTION

**Seaweeds** or macroalgae refers to several species of macroscopic, multicellular, marine algae. The term includes some types of red, brown, and green macroalgae. Certain species of seaweed are valuable for nutrition, biomedicine, bioremediation, and other uses. Carrageenan

is used in salad dressings and sauces, dietetic foods, and as a preservative in meat and fish products, dairy items and baked goods.

The development of seaweed as an alternative and sustainable source of food and animal feed ingredients depends on the sustainability of the natural resource of raw biomass and on moving the process of feed development from laboratory to industrial scale.

### Medicine and Herbalism

Seaweed on rocks a plant-based jelly similar to gelatin and made from seaweed — is extensively used as culture medium. Carrageenans, alginates and agaroses (the latter are prepared from agar by purification), with other lesser-known macroalgal polysaccharides, have several important biological activities or applications in biomedicine. Research suggests that the Australian seaweed *Delis pulchola* may interfere with bacterial colonization. Sulfated saccharides from both red and green algae have been known to inhibit some DNA and RNA enveloped viruses. Seaweed extract is used in some diet pills. Other seaweed pills exploit the same effect as gastric banding, expanding in the stomach to make the body feel more full.

### METHODOLOGY

- Target protein ATP Synthase sequence retrieved from NCBI database.
- The retrieved sequence is submitted to the following server and tool for annotation, functional and structural analysis.
- The retrieved sequence is submitted to sequence alignment tool, for the identification of similarity in the ATP Synthase.
- The retrieved sequence is submitted to the J-cat server, to know the CAI value of selected nucleotide sequence.
- The retrieved sequence is submitted to gym motif server, for motif analysis.
- The retrieved sequence is submitted to scan prosite, to know the motifs region and position on target sequence.
- The retrieved sequence submitted to saps tool, for the identification of repetitive structures, locally periodic motifs, and anomalous spacing in ATP Synthase.
- The retrieved sequence submitted to smart server, to know the functional characterization of ATP Synthase.
- The retrieved sequence submitted to coils tool, to identify probability that the sequence will adopt a coiled-coil conformation of ATP Synthase.

- The retrieved sequence is submitted to the DLP-SUM server, to know the domain regions of ATP Synthase.
- The retrieved sequence is submitted to swiss model server, to identify functional unit of ATP Synthase.
- The retrieved sequence is submitted to saves server, for the evaluation of ATP Synthase protein 3D structure.
- The retrieved sequence is submitted to protein- protein search tool, to know the interacting protein pair of ATP Synthase.
- The retrieved sequence is submitted to profunc tool, for the biochemical analysis of ATP Synthase.

## RESULT AND DISCUSSION

### I.Sequence Analysis

#### NCBI – sequence retrieval

#### Protein Sequence

>YP\_009049453.1 ATP synthase F0 subunit 8 (mitochondrion) [Sargassummuticum]  
MPQFDTITFFNQVFWLVLIVFNFYFIILRFMLPSLASSLKARNKNLRFTEESR

#### Nucleotide Sequence

>NC\_024614.1:31248-31460 Sargassummuticum mitochondrion, complete genome  
ATGAGAATAAAAGTTAAACAAAATTATTAGGTAATATATTATCGGATGGCAGT  
TTTAACTTTGTTTATG  
TTGATGACATTCACCAAATTATTTAAAATAATAACTGGTTTAGATATTGCAA  
TCATTTTGTGGAC  
CGGTAAAGGTCCTAAAGAACAACAGAAATTACAAGTTTTATCGCGCGGTTTAA  
CAAACGTAGACCAGTA  
TAA

The above result shows the Fasta format of protein and nucleotide sequence of protein ATP Synthase

#### SIMILMITY - BLAST P

job title: BAT47131.1 ATP synthase beta-subunit, partial...

RID:39M52T7F014 (Expires on 01-09 23:32 pm)

Query ID:lcl|Query\_349058

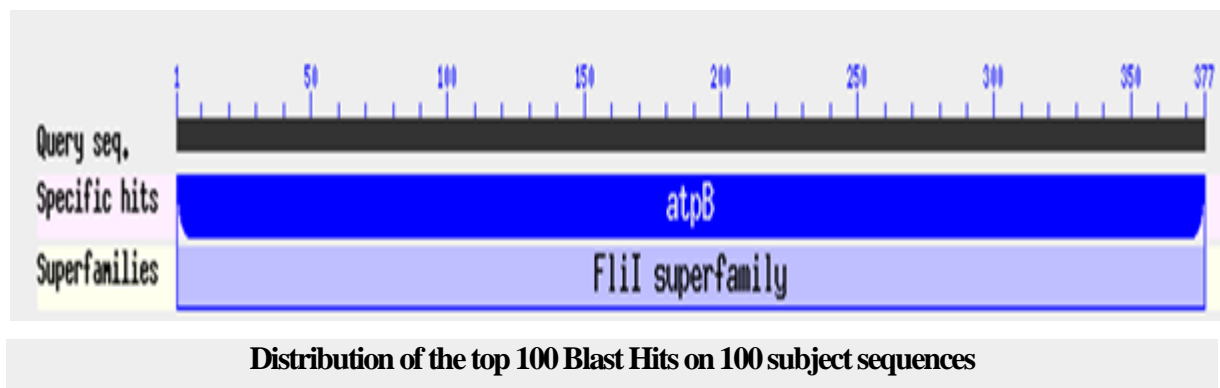
Description:BAT47131.1 ATP synthase beta-subunit, partial (chloroplast) [Sargassum muticum]

Molecule type:amino acid

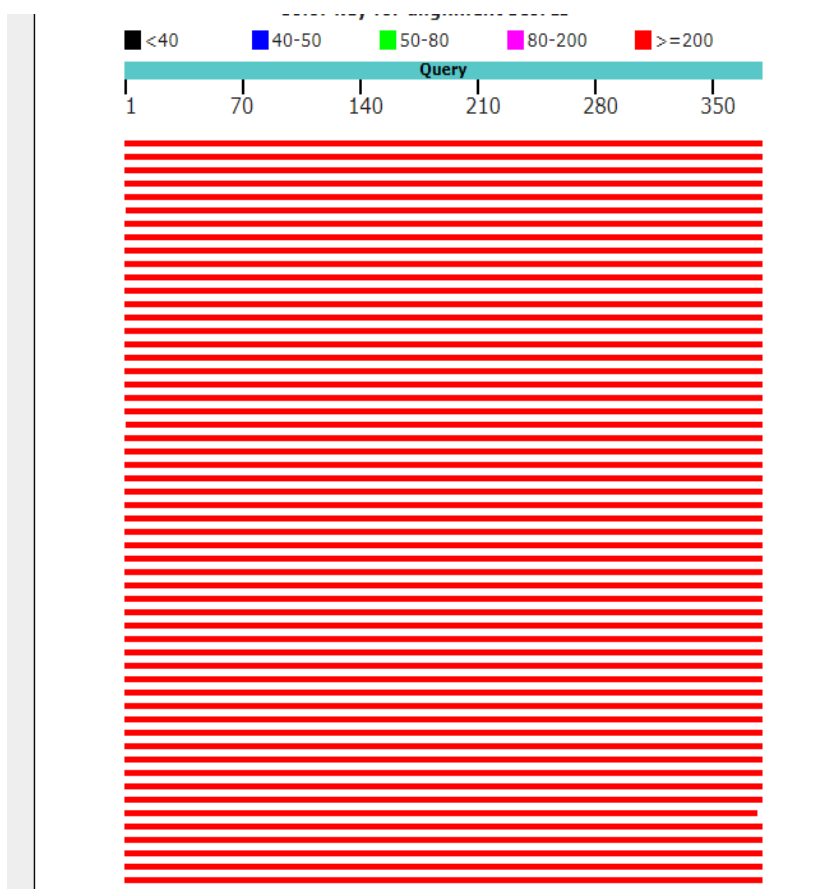
Query Length:377

Putative conserved domains have been detected, click on the image below for detailed results.

**Mouse over to see the title, click to show alignments**



**Color key for alignment scores**



The above results shows the similarity sequence of ATP Synthase.

**FUNCTIONAL ANALYSIS****Annotation****Jcat**

S.no	Name of protein	Cai value
1.	Ribosomal protein L31 (Mitochondrion) [Sargassummuticum].	0.95
2.	Ribosomal protein S14 (Mitochondrion) [Sargassummuticum].	0.95
3.	Hypothetical protein sarmuMpo8 (Mitochondrion) [Sargassummuticum].	0.96
4.	NADH dehydrogenase subunit 4L (Mitochondrion) [Sargassummuticum].	0.95
5.	Ribosomal protein S10 (Mitochondrion) [Sargassummuticum].	0.95
6.	ATP synthase Fosub unit 8 (Mitochondrion) [Sargassummuticum].	0.95
7.	Ribosomal protein S19 (Mitochondrion) [Sargassummuticum].	0.95
8.	Ribosomal protein L16 (Mitochondrion) [Sargassummuticum].	0.95
9.	NADH dehydrogenase subunit 6 (Mitochondrion) [Sargassummuticum].	0.95
10.	NADH dehydrogenase subunit 9 (Mitochondrion) [Sargassummuticum].	0.95

The above table shows the J-cat server, to know the CAI value of selected nucleotide sequence.

**MOTIF ANALYSIS****Scan Prosite****Hits for all PROSITE (release 2018\_11) motifs on sequence NP\_001284719-1:**

Found in 1 hit 1 sequence:

NP\_001284719-1 (505 aa)

MFALRAASKADKNLLPFLGQLSRSHAAKAAKAAAANGKIVAVIGAVVDVQFDDN

LPPILNALEVD

NRSPRLVLEVAQHLGENTVRTIAMDGTEGLVRGQKVLDTGYPIRIPVGAETLGRIINV

IGEPIDER

GPIDTDKTAIIHAEAPEFVQMSVEQEILVTGIKVVDLLAPYAKGGKIGLFGGAGVGK

TVLIMELIN

NVAKAHGGYSVFAGVGERTREGNDLYNEMIEGGVISLKDKTSKVALVYGQMNEPP

GARARVALTGL

TVAEYFRDQEGQDVLLFIDNIFRFTQAGSEVSALLGRIPSAVGYQPTLATDMGSMQE

RITTTKKGS

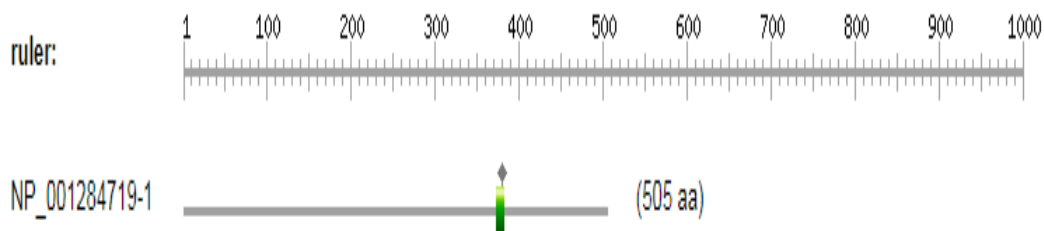
ITSVQAIYVPADDLTDPAATTFAHLDAITVLSRAIAELGIYPAVDPLDSTSRIMDPNII

GQEHYN

VARGVQKILQDYKSLQDIIAILGMDELSEEDKLTVARARKIQRFLSQPFQVAEVFTGH

AGKLVPLE

QTIKGFSAIAGDYDHLPEVAFYMGPIEEVVEKADRLAKEAA

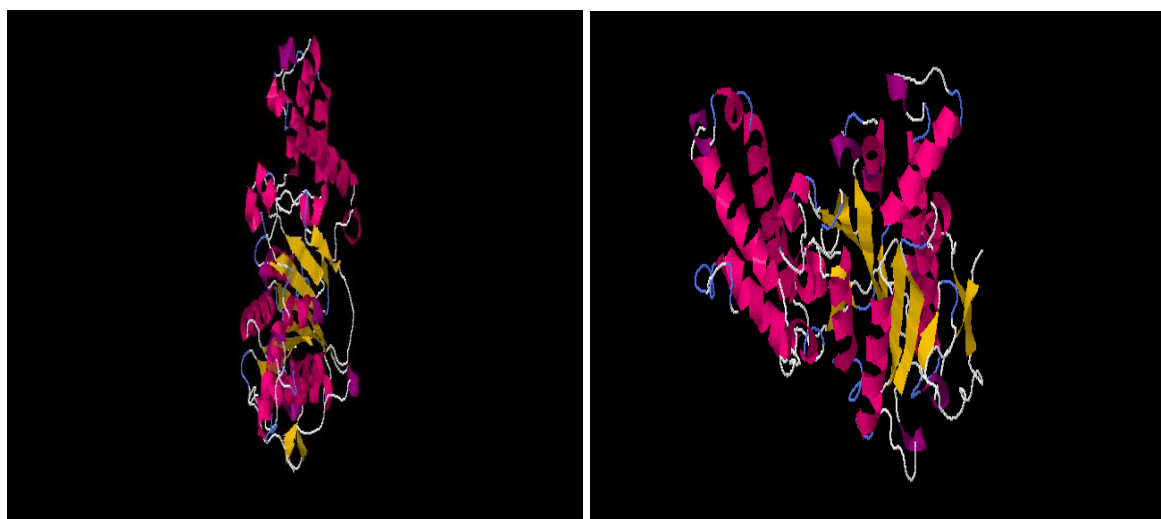


PS00152 **ATPASE\_ALPHA\_BETA** ATP synthase alpha and beta subunits signature:

**373 - 382:** [confidence level: (0)] PAVDPLDSTS

The above result shows the motif region and position on target sequence in yellow colour and conserved domain region in green colour.

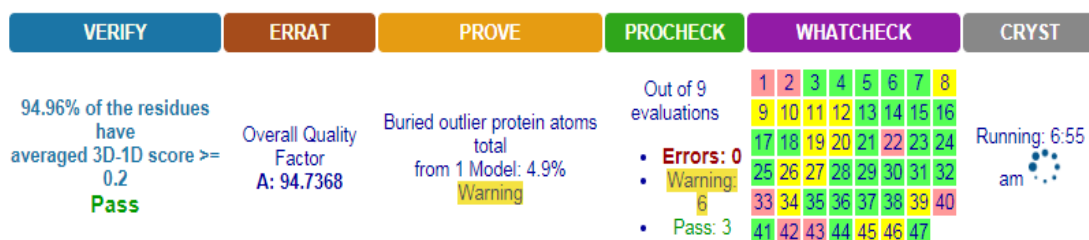
### STRUCTURAL ANALYSIS – SWISS MODEL SERVER



The above result shows the functional unit of ATP Synthase, here yellow colour shows the sheets, pink colour shows the helix, white colour shows the coiled region, blue colour shows the turns.

### VALIDATION

#### Saves server



The above result shows the evaluation of ATP Synthase protein structure.

## CONCLUSION

Seaweeds are rich source of phytochemicals having antioxidant and antimicrobial properties. Addition of seaweed to food enhances the antioxidant potential and also seaweeds are used as fertilizer, composting, and potential source of bioethanol. Seaweeds is an ingredient in toothpaste, cosmetics, and paints. The ATP synthase is an important protein present in seaweed *Sargassum muticum*. From the literature studies it shows that the ATP synthase proteins present in *Sargassum muticum* seaweeds. Hence, it has been taken for various studies like protein primary structure analysis, Secondary structure analysis, and protein three dimensional structure predictions. Hence, it is concluded that in future, this results would be using for protein modeling and drug docking studies.

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