*International Journal of Food, Agriculture and Veterinary Sciences ISSN: 2277-209X (Online)*
*An Open Access, Online International Journal Available at http://www.cibtech.org/jfav.htm*
*2016 Vol. 6 (1) January-April, pp. 74-77/Pareek*

***Review Article***

# ALGAE: THE FUTURE FOOD SUPPLEMENT

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**ABSTRACT**
Algae are a diverse group of organism. It is subdivided into two group micro and macro algae. They are important sources of vitamin, minerals, proteins, poly unsaturated fatty acid and antioxidants. Marine algae are widely used for the production of agar, algin and carrageenan. These products are widely used in food industries. Microalgae also have high protein content. Commonly used algae are *Spirullina*, *chlorella*, *Dunaliella*, *Scenedesmus*, *Porphyra*, *Gracilaria*, *Palmaria* and *Laminaria*. Due to high protein content it could be used as alternative protein source in future.

***Keywords:*** *Microalge, Macroalgae, Agar, Algin*

## INTRODUCTION

The startling amplification of population has increased the demand for food production leading to gap in demand and supply. This situation has created a requirement for the formulation of alternative protein rich food sources. An alga is a diverse group of autotrophic organisms which ranges from unicellular (microalgae) to multicellular form (macroalgae) (Singh *et al.,* 2005). They are an important source of vitamins, minerals, proteins, polyunsaturated fatty acids and antioxidants (Pulz and Gross, 2004; Svircev, 2005; Blazencic, 2007; Gouveia *et al.,* 2008b). Algae also have high fibre content (Plaza *et al.,* 2008). These contents made them suitable nutritional supplement (Plaza *et al.,* 2008) Polysaccharides like agar, alginates and carrageenans are economically the most important products from algae, widely used in the food industry as gelling or thickening agents in marmalade, ice creams, jellies, etc. Certain algal polysaccharides are also of pharmacological importance acting on the stimulation of the human immune system (Pulz and Gross, 2004) or possessing a potential antiviral activity (Hemmingson *et al.,* 2006).

### *Macroalgae Consumed as Food*

From long back seaweeds has been used as food, fuel, fertilizer and as source of medicine (Raman *et al.,* 2013). Seaweeds are used as animal and human food in Japan and South Eastern Asia where macro algae represent an important economic resource. In coastal areas of all the continents it is cultivated and consumed as a part of diet. Most commonly consumed species are the red algae *Porphyra* (nori, kim, laver), *Asparagopsis taxiformis* (*limu*), *Gracilaria*, *Chondrus crispus* (Irish moss) and *Palmaria palmata* (dulse), the kelps *Laminaria* (kombu), *Undaria* (wakame) and *Macrocystis*, and the green algae *Caulerpa racemosa*, *Codium* and *Ulva* (Tseng, 1981; Drueh1,1988; Mumford and Miura, 1988). These algae usually are eaten fresh, dried or pickled (Abbott, 1988). According to studies these are consumed due to low calories and high minerals, vitamins, protein, fiber content (Plaza *et al.,* 2008; Kuda *et al.,* 2002; Ruperez, 2002). They are nutritionally valuable as fresh or dried vegetables or as ingredients in a wide variety of prepared foods (Fu *et al.,* 2000).

Marine algae are also rich source of antioxidants (Nagai *et al.,* 2003; Chandini *et al.,* 2008). Some active antioxidant compounds from brown algae are as phylopheophytin in *Eisenia bicyclis* (arame) (Cahyana *et al.,* 1992) and fucoxantinein Hijikia fusiformis (hijiki) (Yan *et al.,* 1999). Protein content in seaweed varies. It is low in brown algae at 5-11% of dry matter and in Green algae protein content is up to 20% of dry matter.

Red and brown algae are also rich in carotenes (provitamin A) and are used as a source of natural mixed carotenes for dietary supplements. Other vitamins are also present, including B12, which is not found in most land plants.

Industrial production of agar, algin carrageenan is also from seaweeds. These products are widely used in the food industry as stabilizers, thickeners and gelling agents.

***Microalgae Used as Food***

Microalgae utilizes solar energy and produces wide range of metabolites such as proteins, lipids, carbohydrates, carotenoids and vitamins for food and feed additives. The first use of microalgae by humans dates back 2000 years to the Chinese who used *Nostoc* to survive during famine. Due to rich in nutrients, they are a major source of food especially in Asian countries like China, Japan and Korea. The high protein content of various microalgae species is one of the main reasons to consider them as an alternative source of proteins in human diet. Moreover, the average quality of protein present in algal species is mostly superior to plant proteins (Becker, 2007). Microalgal biomass contains three main components: proteins, carbohydrates and lipids (Um and Kim, 2009). Microalgae are also added to pasta, snack foods or drinks either as nutritional supplements or natural food colorants (Becker, 2004).

Most popularly used microalgae are Species of Chlorella and Spirulina. As per several studies their Worldwide popularity, as a food is mainly because of their high protein content (Colla *et al.,* 2007), polyunsaturated fatty acids (Sajilata, 2008), pigments (Rangel-Yagui *et al.,* 2004; Madhyastha and Vatsala, 2007), vitamins and phenolics (Colla *et al.,* 2007; Ogbonda *et al.,* 2007) and they are easy to grow also. Dried *Spirulina* bio-mass contains all the essential amino acids and about 68% of proteins, which is threefold higher than in beef. Another microalga, *Chlorella*, contains about 50-60% of proteins, which is comparable to the proteins of yeast, soyflour and milk powder (Blazencic, 2007). Phycocyanin present in *Spirulina* is a blue photosynthetic pigment used commercially as natural food colourant in Japan. It is marketed under the name lina blue and used in Japan and China in food products like chewing gums, candies, dairy products, jellies, soft drinks, etc (Gouveia *et al.,* 2008b). By study it is suggested that phycocyanin posseses an antioxidant, anti inflammatory, neuroprotective and hepatoprotective activity but also appears to be a potential chemotherapeutic, as well as a hypocholesterolemic agent (Gantar and Svircev, 2008). *Spirulina* genus contains tenfold more β-carotene than any other food, including carrots (Mohammed *et al.,* 2011) and more vitamin B12 compared to any fresh plant or animal food source. This genus represents the richest source of vitamin E, thiamine, cobalamine, biotin and inositol Gantar and (Svircev, 2008)

The important products of Chlorella are byproducts that are used in fruit and vegetable preservatives (Hills and Nakamura, 1978). As per study the important substance in *Chlorella* seems to be beta-1, 3-glucan, which is an active immune-stimulator, a free-radical scavenger and a reducer of blood lipids Spolaore *et al.,* (2006). *Spirulina* and *Chlorella* are marketed as tablets, capsules and liquids which are used as nutritional supplement (Becker, 2004; Pulz and Gross, 2004).

There is another important microalgae Dunaliella *salina*. This species is grown for a source of photosynthetic pigment and betacarotene. Betacarotene is used as an orange dye and as a vitamin C supplement. Studies show that salt tolerant algae of genus *Dunaliella* can be grown in saline water to yield single cell protein, glycerol and betacarotene as coproducts. An indogerman project is instituted at CFTI, Mysore (India) for culturing *Scenedesmus* species in artificial ponds Marx (1989).

Single cell protein (SCP) production is a major step to meet out the demand for algal protein production. This would make food production less dependent on land and relieve the pressure on agriculture (Anupama and Ravindra, 2000).

***Conclusion***

By various studies it is suggested that algae could be a substitute protein source in future. For this purpose algae should be cultured on large scale. SCP is one of the way to meet out the demand. Further initiatives should be taken to explore new techniques for SCP production to improve the yield.

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