Chapter 8
Algae as Superfood

Shital Uddhav Giri
Ajeenkya D.Y. Patil University, India

Namdev Gopal Krishna Hadapad
Ajeenkya D.Y. Patil University, India

Aditya Akhade
Ajeenkya D.Y. Patil University, India

Parth Bhilare
Ajeenkya D.Y. Patil University, India

ABSTRACT

With the increasing population, there are problems like the shrinking of arable land, pollution, and feeding the entire growing population high-quality food and reaching consumer demand, and the list goes on. Novel superfoods are rich in nutrition and produced with the most sustainable methods, including algae, specifically microalgae. Microalgae have been studied for decades. Microalgae are one of the largest and most poorly understood organisms on planet earth, but in recent years, the research has been increased for the search of renewable and sustainable energy sources. Microalgae don't require much land for cultivation and thus do not compete with conventional agricultural land. Microalgae can double their size in 24 hours. CO2, solar rays, inorganic nutrients, and water are the basic requirements for them to grow. There are microalgae and macroalgae (e.g., seaweed) that grow in saline and hypersaline water. This chapter presents the promising potential of algae (microalgae and macroalgae) as a superfood.

BACKGROUND

In the year 1753 Carolus Linnaeus a Swedish botanist coined the term algae. Algae come under a division of the plant kingdom called Thallophyte which means, simple plants without roots stems, or leaves known as thallus. Algae are eukaryotic in nature but blue-green algae (cyanobacteria) are prokaryotic in nature. The composition of the eukaryotic algal cell consists of the cell wall, nucleus, endoplasmic reticulum, mitochondria, Golgi bodies, stigma or eyespot, vacuoles, flagella, and plastids.

DOI: 10.4018/978-1-6684-5269-1.ch008

COMPOSITION OF ALGAE

The cell surface plays a very vital role in both the external and internal sides of the cell. Various functions of cell surface include cell interaction, cell signaling, excretion and secretion of various compounds, protection, and servers as an osmatic barrier. The cyanobacteria are enveloped by two parts of the gelatinous sheath and cell wall. The sheath is very slimy in nature which acts as a protective layer. Due to their slimness blue-green algae are also called my xophyceae. Algae also consist of a cell wall outside the plasma membrane, it presents a granular structure and lacks microfibrils. The cell wall is composed of Glycosamine, muramic acid and diaminopimelic acid. It has a structure of gram-negative type.

Protoplast

Cyanobacteria lack chloroplast but have Chromoplasm. Protoplasm is totally differentiated into two regions.

1. Centro Plasm (Central Area)

It is a clear and transparent region of the protoplast that contains chromatin or genetic material.

2. Chromoplasm (Peripheral Denser Region)

In this region, thylakoids are present which consists of chlorophyll A responsible for providing green color in blue-green algae, and several types of carotenoids are embedded into it. thylakoids are not restricted to peripheral reagion they are found scattered all over the cell (*Gloeotrichia* sp). phycobilins are on the surface of thylakoids. The best-known phycobilins are phycoerythrin and phycocyanin. Phycobilins are water-soluble whereas chloroplast and carotenoids are fat-soluble. phycocyanin C is the characteristic of blue-green algae and is responsible for the blue color in blue-green algae.

Gas Vacuoles

Tiny, transparent structures which are commonly found in bacteria and arches. Gas vacuoles are responsible for the floating of algae. Nitrogen and oxygen are majorly found gases but also have a minute amount of CO and CO2 which is liberated from metabolic activity. Gases are produced when there is not enough sunlight reaching the algae, especially in deep-underwater algae (*Trichodesmium sp*), they have low photosynthesis, low osmotic pressure, low production of carbohydrates and therefore increasing the density of the cell. Under these circumstances, gases are produced at a high rate and gain buoyancy.

Eukaryotic Cell Composition

The eukaryotic algal cell is simple, unicellular, motile, freshwater algae. It consists of membrane-bound organelles.