

Spirulina : The biotech super-food

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The Human population is increasing at an alarming rate day by day. There is a need for another Green revolution to fulfill the food needs of this population. In such a case Biotechnology can offer a solution by recommending alternative food sources such as spirulina. Water crisis is also one of the major problems the world is facing today. Large populations of people in many countries do not have an access to pure drinking water sources. The concept of using recycled water by treating the used water *i.e.* sewage can be developed only by means of its purification using biotechnological means.

“Let your food be your medicine and your medicine your food” (Hippocrates, 460-c. 370 BC)

This saying is really suitable for spirulina which being a complete food also has many medicinal and therapeutic uses. Apart from its uses in food and medicine, spirulina can also be incorporated in treatment of wastewater due to its property to accumulate ions of heavy metals such as Mercury, Lead, Arsenic, cadmium etc. and such reclaimed water can be used for various uses.

Introduction and history:

Spirulina is a blue green algae found in most lakes and ponds. Spirulina occurs naturally in tropical and subtropical lakes with high pH and high concentrations of carbonate and bicarbonate. It has been consumed for thousands of years by Mexican (Aztecs, Mayans), African

and Asian people. The name “spirulina” is derived from the Latin word for “helix” or “spiral”; denoting the physical configuration of the organism when it forms swirling, microscopic strands. Spirulina are free-floating filamentous cyanobacteria characterized by cylindrical, multicellular trichomes in an open left-hand helix.

Nutritional benefits:

– 100 times more Vitamin A than carrots! Spirulina is the world’s richest natural source of Beta-Carotene (Pro Vitamin A), which helps to improve eye sight.

– 6 times more protein than eggs! Spirulina has very high natural protein content (upto 70%). This protein is a called complete since it has 18 of the 22 amino acids that the body needs and being organic in form, has very high digestibility (upto 97%). This ensures proper utilization and assimilation of the food a person eats.

– 50 times more Iron than Spinach! Spirulina’s rich content of natural Iron and folic acid helps not only to greatly improve haemoglobin levels in the blood, but being organic, is 60 times more absorbable than synthetic iron present in most of the haematinics.

– 7 times more Calcium than milk! Spirulina is one of the World’s richest known sources of natural Calcium which helps build strong bones.

– 10 times more Potassium than vegetables! Its Potassium content (upto 10 times more than common



vegetables) helps prevent hypertension.

- Unique ‘Biliproteins’ and ‘Carotenoids’ in Spirulina strengthen the body’s immune system against possible infections.

- One stop shop for ‘Anti Oxidants’! Unstable molecules called “Free Radicals” are generated in every human body as a result of normal metabolic processes. These can lead to ailments like cancer, arthritis, cataracts, strokes, heart attacks, diabetes and premature ageing. To combat these free radicals you need ‘Anti-Oxidants’ like Vitamins A,C and E, Zinc, Selenium. Spirulina is the world’s richest and only natural source of all these ‘Anti-Oxidants’.

- Fat deposits in blood vessels called cholesterol are the reason behind a majority of heart problems. Spirulina has Gamma Linolenic Acid (GLA), which dissolves these fat deposits, thus preventing heart problems.

- Spirulina is the only known vegetarian source of Vitamin B12 which helps fight stress and calm your nerves.

Nutritional composition of spirulina (Content of its dry weight):

| | |
|-----------------|--------|
| - Proteins | 60-70% |
| - Carbohydrates | 15-25% |
| - Minerals | 7-13% |
| - Lipids | 6-8% |
| - Moisture | 3-7% |

Availability:

Naturally Spirulina is found in brackish ponds floating along with other cyanobacteria but commercially it is available in various forms such as:

- Powder
- Capsules
- Tablets

- Apart from human consumption spirulina can also be used to feed pets and other domesticated animals and hence also available as Fish Food, flakes etc.

Production:

Spirulina production involves three major steps, viz., cultivation, harvesting and processing. Selected strains are used for cultivation of alga in specially constructed ponds. Constant agitation of water is one of the important parameters in cultivation of spirulina. Agitation of algal culture is necessary to keep nutrients evenly dispersed and also to expose all the cells to sunlight. The algal biomass is carefully harvested using specially made filters to recover biomass. The washed biomass is dried and is

pulverized to get desired particle size and packed appropriately.

Uses and applications:

Spirulina as healthy food source:

The digestibility of spirulina is as high as 84%, so it can be digested easily by the human system. A 20 gm of spirulina can fulfill the daily requirement of amino acids, vitamins and minerals of an adult human for a day.

Spirulina for therapeutic use:

Spirulina is recommended for patients to reduce body weight, cholesterol deposition and to reduce blood sugar level in diabetes.

It promotes wound healing by stimulation of skin metabolism. The carotene in spirulina acts as anticancer agent to prevent the risk of cancer and it also increases the eye power by synthesis of vitamin – A.

Spirulina as food supplement for animals:

Feed supplement with spirulina increases lactation in cows and buffaloes. It increases the growth rate of pigs and goats and thus increases the meat yield. Silk worms fed with leaves of *Morus alba* (mulberry) and spirulina gives an increased yield of silk.

Spirulina as a raw material for cosmetics:

Spirulina is rich in amino acids, vitamin A and B which are essential for the growth of hair. It is used to formulate hair oils which promote hair growth. Phycocyanin, a bluish pigment extracted from spirulina and is used for making herbal face creams.

Beneficial aspects towards environment and future prospects:

It is a known fact that algae require a nutrient source as well as oxygen for their growth. Considering this fact, spirulina has been employed in degrading the organic content of sewage into simpler inorganic substances. The biodegradable soluble organic content of domestic sewage such as sugars, fats and organic short chain carbon compounds is used as a nutrient source by the growing cells in the tanks and oxygen is provided artificially or used up directly from the atmosphere. Further the biomass growing in industrial waste water can also accumulate heavy metal ions such as lead, mercury, arsenic, cadmium etc present in the effluent coming out of various industries. This process of using plants for the treatment of wastes is known as phytoremediation. This step is one of the most important steps in wastewater treatment because the effluent even if released in the

water bodies after this step does not cause any harm to the aquatic flora and fauna of the natural surroundings. If proper awareness is created amongst people it can

surely help the problems of malnutrition and food shortage in near future.

