



**SENGAMALA THAYAAR EDUCATIONAL TRUST WOMENS
COLLEGE**

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MEC III BASIC BIOTECHNOLOGY- 16SMBEBC3

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SINGLE CELL PROTEIN

Introduction


Dried biomass of a single species of microbe that can be used as a protein source in the diet, is known as **single cell protein (SCP)**.

The dried biomass of some microorganisms is rich nutritionally valuable proteins, vitamins and minerals and does not contain any toxic substance. It is used as a protein source in human diet and animal feed. Biomass of certain algae, some fungi and some bacteria are used as a single cell protein.

Advantages of Single Cell Protein

Single cell proteins have many advantages over the conditional protein source. They are mentioned here under:

- Microbial biomass gets doubled within a short time. The doubling time is 0.5-2 hrs for bacteria, 1-3 hrs for fungi, 2-6 hrs for microalgae. So much amount of biomass can be produced within a short period.
- Microbes require relatively small space for mass culture.

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- They can be grown in cheap raw material and wastes tanks or bioreactor.
 - Continuous culture of microbe is easy without the interference of climatic factors.
 - Microbial biomass is rich in easily digestible, nutritionally valuable proteins, vitamins and minerals.
 - Some microbial culture produce valuable secondary metabolites.

Spirulina As SCP

Spirulina is a spirally coiled, multicellular, filamentous blue green algae. The coils may be tight or relaxed.

Biomass of **Spirulina** is a rich source of protein (67%), vitamins, minerals and beta carotenes. The US Drug administration, recognise **Spirulina** as a supplement to human food and animal feed in 1980.

By 1821, **Spirulina Maxima** biomass was collected from Texcoco lake and made into biscuit.

Constituents of Spirulina SCP

The chemical constituents of dried biomass of **Spirulina fusiformis** (100g) is given below:

A . Major constituents

Crude Protein	65%
Carbohydrates	16%
Lipids	6.7%
Nucleic acid	4.2%



B . Vitamins

Biotin	0.2mg
Cyanocobalamin	66.0 mg
Folic acid	18.0mg
Riboflavin	1.8 mg
Thiamine	0.12mg
Tocopherol	0.8mg
Beta carotenes	320.08mg



C.Minerals

Calcium 6.6mg

Phosphorus 0.9mg

Sodium 4mg

Potassium 1.3mg

D.Essential Amino acid in protein

Lysine 2.99%

Cysteine 0.47%

Methionine 1.38%

Culture of Spirulina

Spirulina is cultured in large scales in artificial ponds tanks and oxidation ponds. Relatively simple economic media has been used for this purpose.

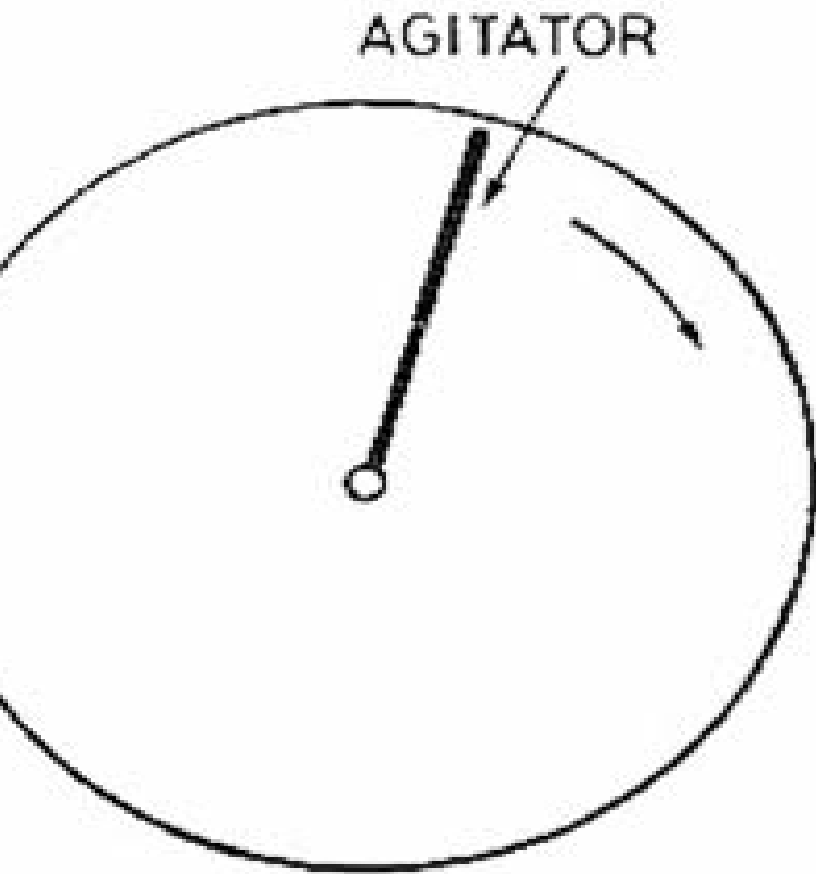
- 1. Open circulating system**
- 2. Oxidation pond system**

1. Open circulating system

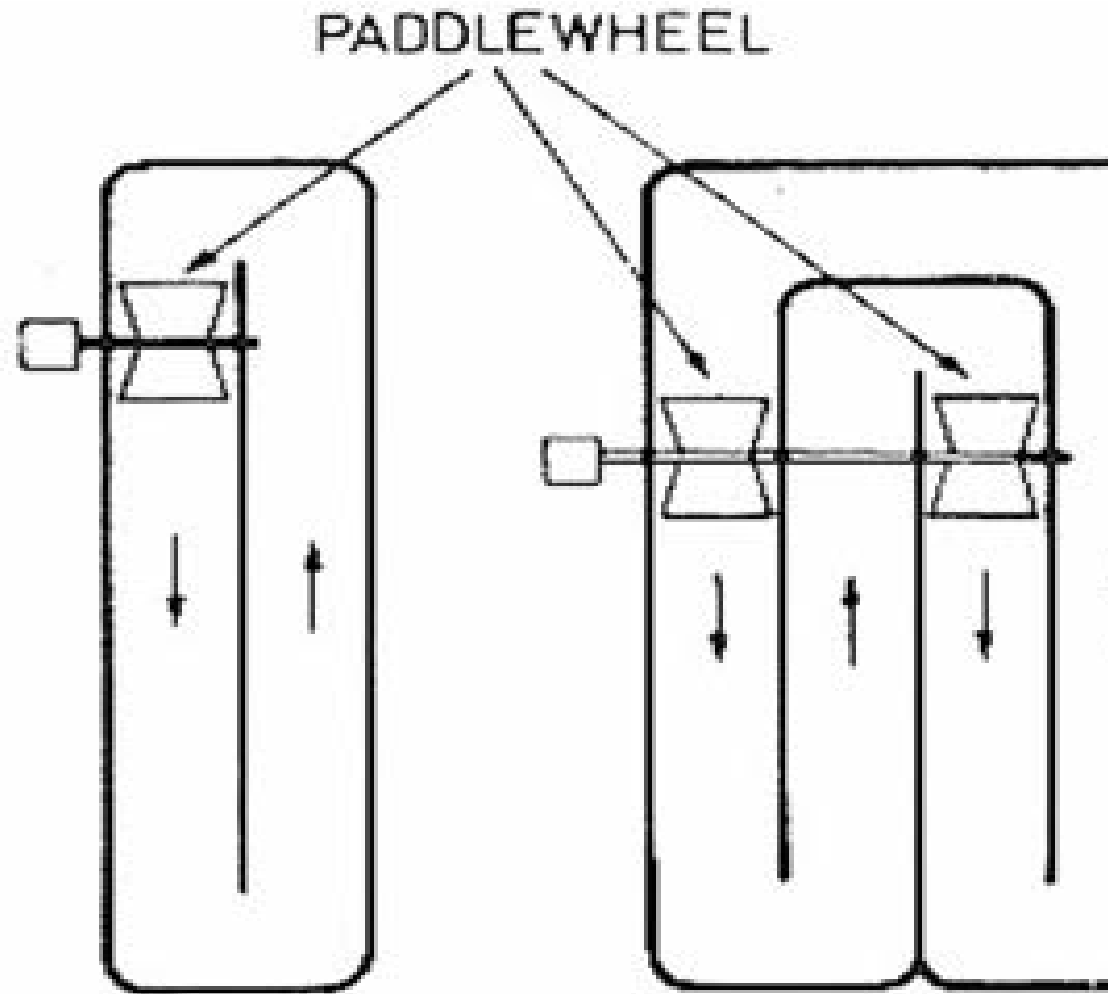
An open circulating system is a man made open tank or shallow pond. It may be circular or rectangular in shape. The depth of the tank should be in between 25 and 30cms. Size of the tank may be 500-5000m². It is built with brick or concrete and the interior sheet of **Polyvinyl chloride (PVC)**.

In circular tanks a stirrer with rotating arm is kept at centre to provide enough stirring for the culture. In rectangular tanks a paddle wheel is kept in the tank to stir the culture.

A. Circular open tank



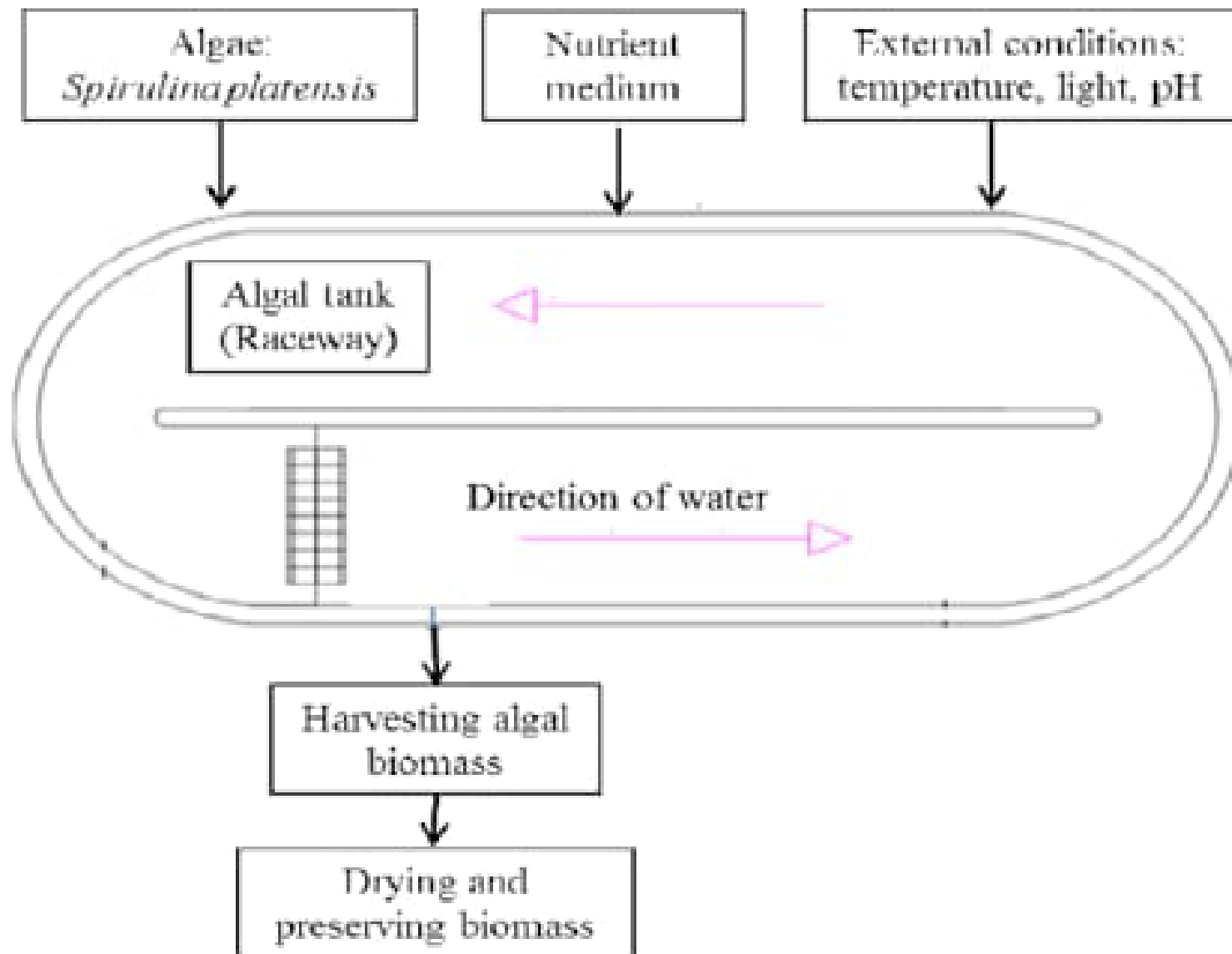
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B. Rectangular open tank






Usually the culture tanks are kept open while functioning. Sometimes, they may be covered with a transparent glass or plastic sheet to prevent contamination.

Economic media are used to culture **Spirulina**. Liquid effluent taken from well digested human excreta, modified sea water and zarrouk medium are used for this purpose.

Another economic medium is the sea water. The water is treated with NaHCO_3 to precipitate



Out excess Ca and Mg ions. To this sea water K_2HPO_4 , $FeSO_4$ and Urea are added to make it a culture medium. The pH of the media is adjusted to 8.5.

Spirulina filament develop gas vacuole in the cells and hence they float on the surface of culture medium. As the density of filament increase, a dense bluish green may develop on the surface of the culture. The biomass is harvested by filtration using a fine mesh or cloth.

2. Oxidation pond system

In this method all sea wastes and suspended particles are removed from the sewage by primary and secondary treatment. The sewage wastes allowed to flow into an oxidation pond.

A few litres of **Spirulina** culture is inoculated into oxidation pond as a starter culture. **Spirulina** grows in the nature system and produces a dense mat on the surface of the sewage water.

The biomass is harvested by using special device that a larger amount of sample.

Uses of Spirulina SCP

Spirulina is used as a health food, therapeutic agents, source of cosmetic. The important uses of **Spirulina** are given below:

- 1.Spirulina As Health food**
- 2.Spirulina As Therapeutic agent**
- 3.Spirulina As a supplement Animal feed**
- 4.Spirulina As a raw material for cosmetic**

1. Spirulina as health food

- **Spirulina SCP** is a source of nutritionally valuable proteins, vitamins and minerals. Its digestibility is as high as 84% and it has a good by human system.
- Medical council all over the world, have recommended to use as spirulina as a supplement food in the source of undernourished children.
- Spirulina serves as food for instant energy for sports and need more calories .

2. Spirulina As Therapeutic Agent

- Spirulina is recommended for patients to reduce body weight, cholesterol deposition and reduce blood sugar levels in diet.
- It promotes wound healing by stimulating the skin metabolism .
- Taking 3g of spirulina in the previous night reduce menstrual stress in women.
- **Spirulina** biomass increase lactation in nourishing mothers.

3. Spirulina As a supplement Animal feed

- Feed supplement with **Spirulina** increase lactation in cow and buffalo.
- It increases the growth rate of pigs ,goat , and increase meat yield.
- Calves grow well when they are fed with supplement with Spirulina.
- Fish feed supplement with Spirulina increase growth rate and body weight of fishes. e.g **mossambica, catla catla**, etc.

4. Spirulina As a raw material for cosmetic

- **Spirulina is rich in essential amino acid and vitamin A and B , which are essential for the growth of hair. It is used formulated hair oils which promotes hair growth.**
- **Phycocyanine ,a bluish pigment, is extracted from **Spirulina** and used for making herbal lipsticks and face Cream.**

Thank you!