# SINGLE CELL PROTEIN

- Purified, dried microorganisms used as source of protein are called as **single celled proteins**.
- In olden days, the filamentous alga *Spirulina* was harvested in the **lake Chad** of **Africa** was consumed as food.
- During 1st world war **Germans** used *Candida utilis* in soups and sausages. It was extensively used during second world war. It was produced in industrial scale in 1967.

**Advantages of SCP**

- It has **high protein** and **low fat** content.
- It is good source of **vitamins** particularly B-complex. e.g. Mushrooms and Yeasts
- It can be produced through-out the year.
- Waste materials are used as substrate for the production of these proteins. It reduces the environmental pollution and helps in recycling of materials.
- SCP organisms grow faster and produce large quantities of SCP from relatively small area of land and time.
- These have proteins with required aminoacids that can be easily selected by genetic engineering.
- During the production of SCP biomass, some organisms produce useful bye products such as organic acids and fats.

**Sources of SCP**

**1. Algae:**

- *Chlorella*, *Scenedesmus acutus* and *Sprulina maxima* are grown for SCP.
- These have about **60%** protein with good amino acid composition but **less in sulphur** containing amino acids.
- *Chlorella* and *Spirulina* are used for commercial scale production in **Thaiwan, Thailand, Japan, Israel, Mexico** and **USA**.
- It is **spray dried** and sold as **pills** and **powders**.
- *Spirulina* grown on sewage water is free of pathogenic microorganisms.

**Disadvantages:**

- These are not suitable for human consumption because they are rich in **Chlorophyll**. (Except Spirulina)
- It has low density i.e. **1-2 gm** dry weight/litre of substrate.
- There is lot of risk of contamination during growth.

**2. Yeasts and Fungi**

- The filamentous fungi such as *Chaetomium celluloliticum* – grows on cellulose waste, *Fusarium graminearum* – grows on starch and *Paecilomyces varioti* – grows on sulphur liquar are used for the production of SCP. These have about **50 – 55 %** protein.
- Yeasts such as *Candida utilis* (Torula yeast), Candida lipolytica – grow on Eathanol and Saccharomyces cervicea – grows on Molasses are used for SCP production.
- Torula yeast as a food is obtained through fermentation using molasses as substrate. It has high protein – carbohydrate ratio than forages. It is rich in lysine but poor in methionine and cysteine.
- Saccharomyces consists of high protein with good balance of amino acids and rich in B – complex vitamins. It is more suitable as poultry feed.
- Several species of Mushrooms are used as protein rich food

**Disadvantages:**

- These have high nucleic acid content.
- Filamentous fungi show slow growth rate than yeasts and bacteria.
- There is contamination risk.
- Some strains produce mycotoxins and hence they should be screened.

**3. Bacteria**

- These have more than 80% protein. They are poor in sulphur containing amino acids.
- *Brevibacterium* uses hydrocarbons as substratum and *Methylophilus methylitropous* uses methanol.
- It has high nucleic acid content

**Disadvantages:**

- It has high RNA content.
- Risk of contamination is very high during the production process.
- Recovering the cells is a bit problematic.
- Endotoxin production should be carefully tested.