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 a good source of **vitamins** particularly **B-complex**. e.g. Mushrooms and Yeasts
- It can be produced throughout 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 amino acids that can be easily selected by genetic engineering.
- During the production of SCP biomass, some organisms produce useful by-products such as organic acids and fats.

**Sources of SCP**
1. **Algae:**
   - **Chlorella**, **Scenedesmus acutus** and **Spirulina 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 **Thailand, 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. **Yeast and Fungi**
   - The filamentous fungi such as **Chaetomium celluloliticum** – grows on cellulose waste, **Fusarium graminearum** – grows on starch and **Paecilomyces varioti** – grows on sulphur liquor 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 cervicatana** – 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.