

## Use of Microorganisms in Single Cell Protein Production for Food and Feed

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Single cell protein (SCP) typically refers to sources of mixed protein extracted from pure or mixed cultures of algae, yeasts, fungi or bacteria (grown on agricultural wastes) used as a substitute for protein-rich foods, in human and animal feeds. It is also known as novel protein, petro crop and minifood. SCPs are gaining popularity because they require a small amount of land to grow.

**Table 1. Efficiency of protein production of several protein sources in 24 hours**

Organism (1000 kg)	Amount of protein
Beef cattle	1 kg
Soybeans	10 kg
Yeasts	100 tn
Bacteria	100X 10000tn

Other advantages of SCP over conventional protein sources are:

- It works on a continuous basis;
- It can be genetically controlled;
- It causes less pollution;
- it is independent of land and climate;

**Table 2. Nutritional status of SCP obtain from microorganisms**

Nutrient	Fungi	Yeasts	Bacteria	Algae
Protein	55%	55%	83%	62%
Fat	1%	5%	7%	3%
Ash	6%	8%	9%	2%
Nucleic acids	7-15%	3-15%	10-20%	8-12%

### Advantages

Large-scale production of microbial biomass has many advantages over the traditional methods for producing proteins for food or feed.

- Microorganisms have a high rate of multiplication due to rapid generation time (algae: 2-6 hours, yeast: 1-3 hours, bacteria: 0.5-2 hours)
- They can be easily and genetically modified for varying the amino acids composition.
- A very high protein content 43-85 % in the dry mass.
- They can utilize a broad spectrum of raw materials as carbon sources.

5. Waste products. Thus they help in the removal of pollutants also.
6. Strains with high yield and good composition can be selected or produced relatively easily.
7. Microbial biomass production occurs in continuous cultures thus the quality is consistent.
8. The growth is independent of seasonal and climatic variations.
9. Land requirement is low and is ecologically beneficial.
10. High solar energy conversion efficiency per unit area.
11. Solar energy conversion efficiency can be maximized and yield can be enhanced.
12. Regulation of physical and nutritional factors.
13. Algal culture can be grown in space which is normally unused and so there is no need to compete for land.

### **Limitation**

There are five factors that impair the usefulness of SCP:

- a. Non digestible cell wall (mainly algae)
- b. High nucleic acid content
- c. Unacceptable coloration (mainly with algae)
- d. Disagreeable flavour (part in algae and yeasts)
- e. Cells should be killed before consumption

Thus SCP is treated with various methods in order to:

1. Kill the cells
2. Improve the digestibility
3. Reduce the nucleic acid content

### **Conclusion**

Single celled protein (SCP) production, referring to the fact that most of the microorganisms used as producers grow as single or filamentous individuals rather than as complex multi-cellular organism such as plants or animals. Use of microbes in the production of proteins gives many advantages over the conventional methods. Microbes have shorter generation time, allow easy transformation, utilize many substrates as substrate, have no requirements in arable land or any particular season to grow and have the possibility of continuous production in any part of the world. The cell yield varies according to the substrate and type of microorganism.