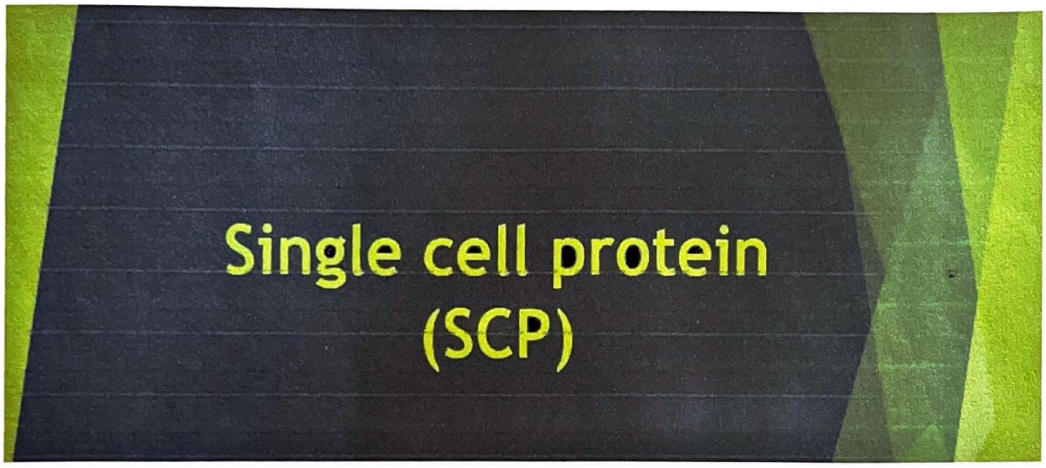
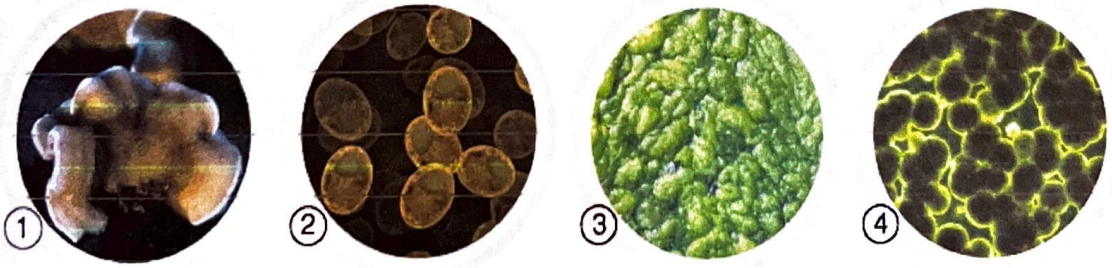
GOVERNMENT DEGREE COLLEGE, SHADNAGAR

DEPARTMENT OF BOTANY

PROJECT WORK





1 Fungi | 2 Yeast | 3 Algae | 3 Bacteria

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DECLARATION

We the following students studying B.Sc. II Yr. at Government Degree College, Shadnagar during the academic year 2021-22 here by declared that it is our original project work on **Single Cell Protein** submitted under the guidance of Dr.T.Uttara Phalguni.

Sr. No.	Name of the Student	Hall Ticket No.	Sign. of the Student
1	B. Uma	20033067 904 001	B. uma.
2	B.Sheelu	20033067 904 003	B. Sheelu
3	D. Mahipal	20033067 904 004	D. mahipal
4	K. Vamshi Krishna	20033067 904 010	K. Vamshi krishna.
5	M.Mahesh	20033067 904 011	M. Mahesh
6	P. Ravinder	20033067 904 017	P. Ravinder
7	U.Sandhya Rani	20033067 904 020	U. Sandhya Rani

Guided by

Dr. T. Uttara Phalguni

Department of Botany.

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CERTIFICATE

This is to certify that

1. B. Uma ---20033067 904 001
2. B.Sheelu--- 20033067 904 003
3. D. Mahipal ---20033067 904 004
4. K. Vamshi Krishna ---20033067 904 010
5. M.Mahesh ---20033067 904 011
6. P. Ravinder ---20033067 904 017
7. U.Sandhya Rani ---20033067 904 020

Have successfully completed their project work on **Single Cell Protein.**

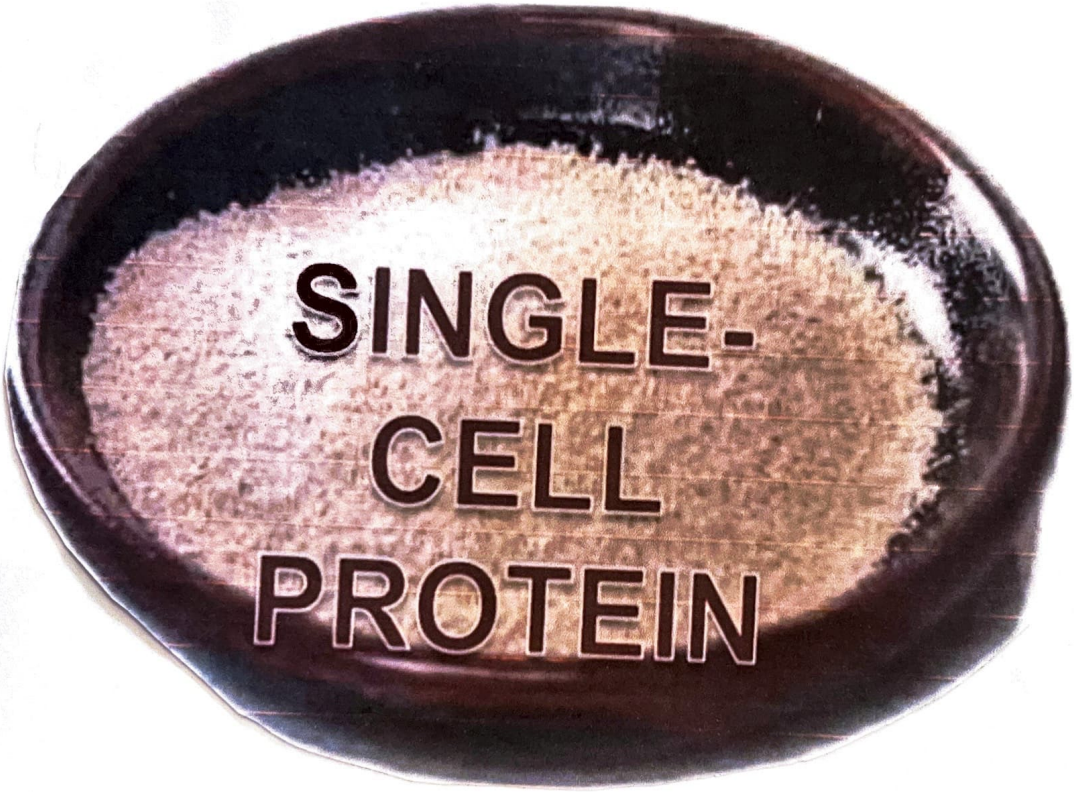
Signature of Supervisor

Signature of Principal

Principal
GOVT. DEGREE COLLEGE
SHADNAGAR
Ranga Reddy Dist.

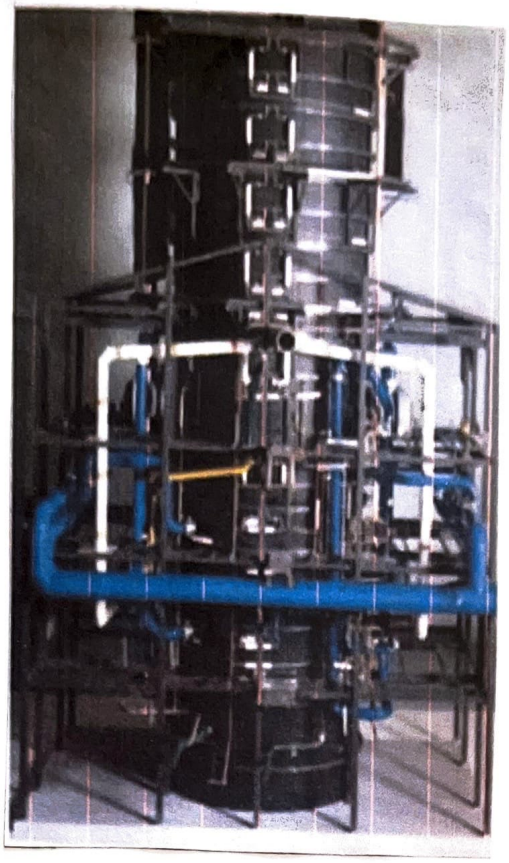
What are the single cell proteins ?

* Single cell proteins are dried cell of micro organisms which can be used dietary protein supplement.
* They are used in as animal feed & can be used for human feed as protein suppliment.
* Also called Novel food & Minifood



History :-

* Part of our diet since ancient times
* Earlier known as **Microbial Protein**.
* Name was introduced by Prof. Scrimshaw of MIT in 1967.
* In 1950's British Petroleum initiated production of Single Cell Protein on commercial basis.
* **Pruteen** was the 1st commercial Single Cell Protein used as animal feed additive.
* Pruteen was produced from bacteria *Methylophilus methylotrophus* cultured on methanol & had 72% protein content.

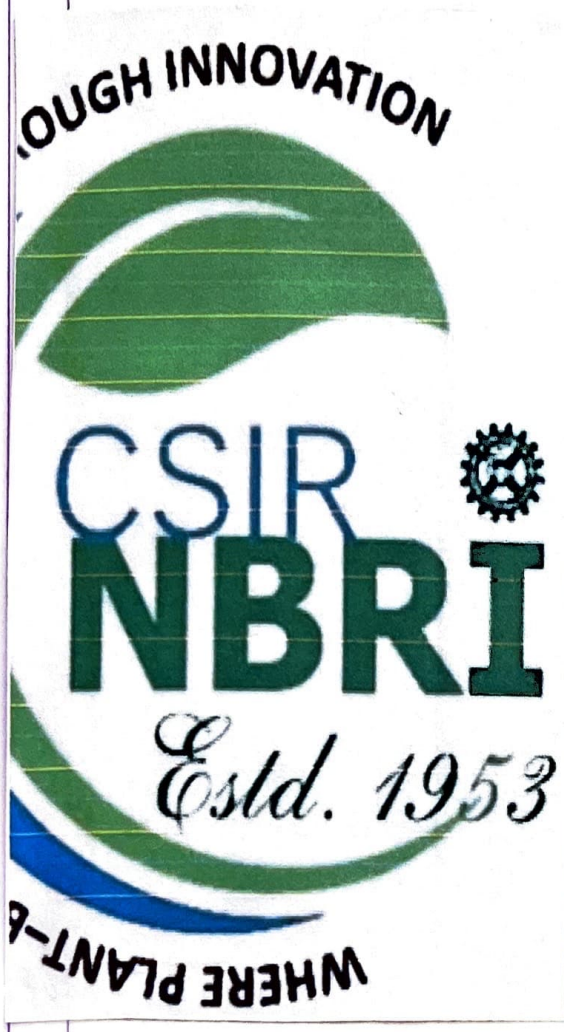


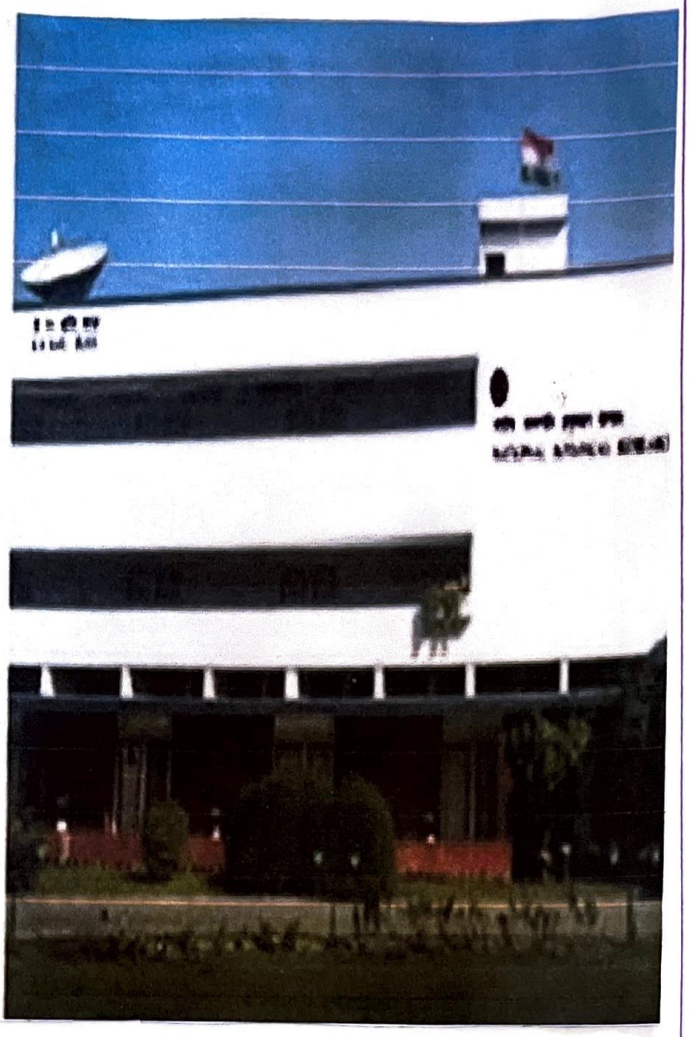
Fermenters which is in Single Cell proteins

Single Cell Protein production in India

* National Botanical Research Institute. (NBRI)
* Central (Food) Food Technology Research Institute
* In CFTRI, Single cell protein is produced from algae cultured on sewage.

Central Food Technology Research institute





National Botanical Research institute

Raw meterials:

* Production of Single Cell Protein requires micro-organism that serve as the protein source and the substract that is biomass on which they grow.
* There is variety of both the source that can be used for the production of Single Cell Protein.
* The biomass used can be plant biomass or organic biomass.
* The micro-organisms used belong to the group of Algae, Fungi and Bacteria.

Micro Organisms:

* Micro-organisms used are fungi, yeast, algae & bacteria.
* The following table shows average different composition of main group of micro-organisms.

Composition	Fungi	Algae	Yeast	Bacteria
Protein	30-40%.	40-60%.	45-55%.	50-60%.
Fat	9-14%.	8-10%.	5-10%.	3-7%.
Nuclic Acid	7-10%.	3-8%.	6-12%.	8-12%.

A list of the micro-organisms used for SCP Production

Fungi:

Aspergillus fumigatus

Aspergillus niger

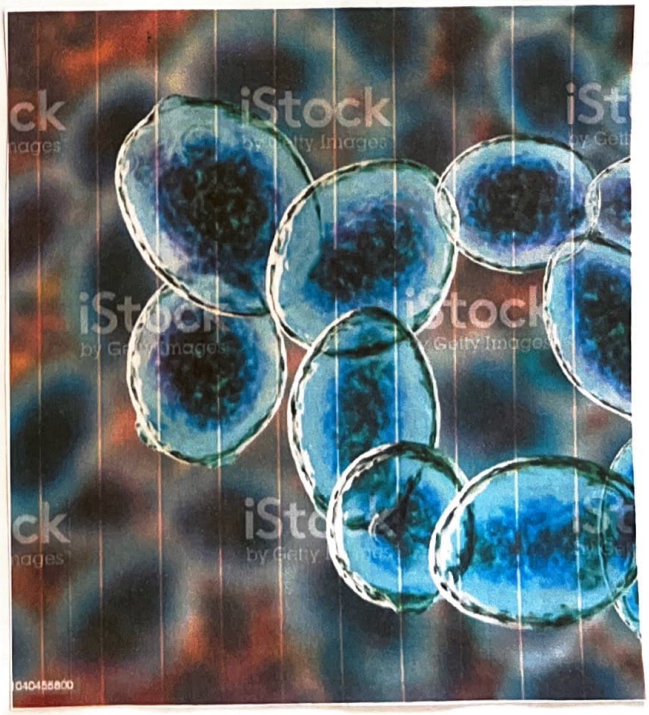
Rhizopus cyclopium

Yeast:

Saccharomyces cerevisae

Candida tropicalis

Candida utilis

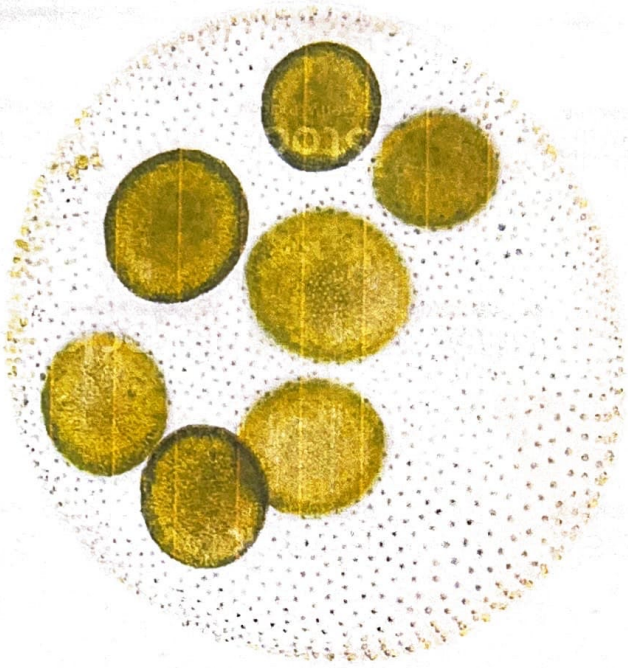


Algae:

Spirulina sps

Chlorella pyrenoidosa

Chondrus crispus



Bacteria:

Pseudomonas fluroescens

Lactobacillus

Bacillus megaterium

Comparsion of Micro-organisms

	Advantages	Dis Advantages
Fungi	Easy to grow & harvest	Lower growth rates & lower protein content.
Algae	Easy to grow & harvest & high quality protein	Non-digestible cellulosic cell wall, concentrate heavy metals.
Yeast	Larger in size, lower NA content, familarity & acceptability	Poor digestibility, low protein content, slow growth rate.
Bacteria	High protein content, digestible cellwall	High NA content, small in size, low density

Biomass:

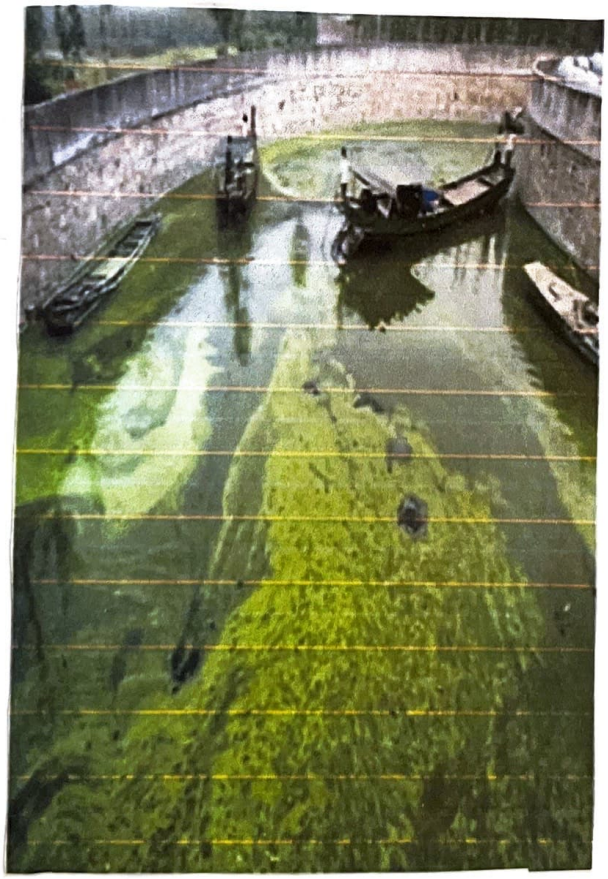
* Biomass also plays a very important role in the production of Single Cell Protein.

* Selection of biomass depends on the micro-organisms used for the production.

* For eg. Algae are cultivated on sewage whereas Yeast are cultured on agro-industrial wastes.

Algal Biomass:

* Algae grows autotropically.
* Requires low intensity of light.
* Temperature 35-40°C & pH 8.5-10.5
* Cultivated in large trenches of sewage oxidation ponds.



Algal biomass

Bacterial & Fungal biomass :

* Bacteria & fungi can be grown easily on a wide range of substrates.

* They require a minimum temperature of 15-30°C & a pH of 5-7.

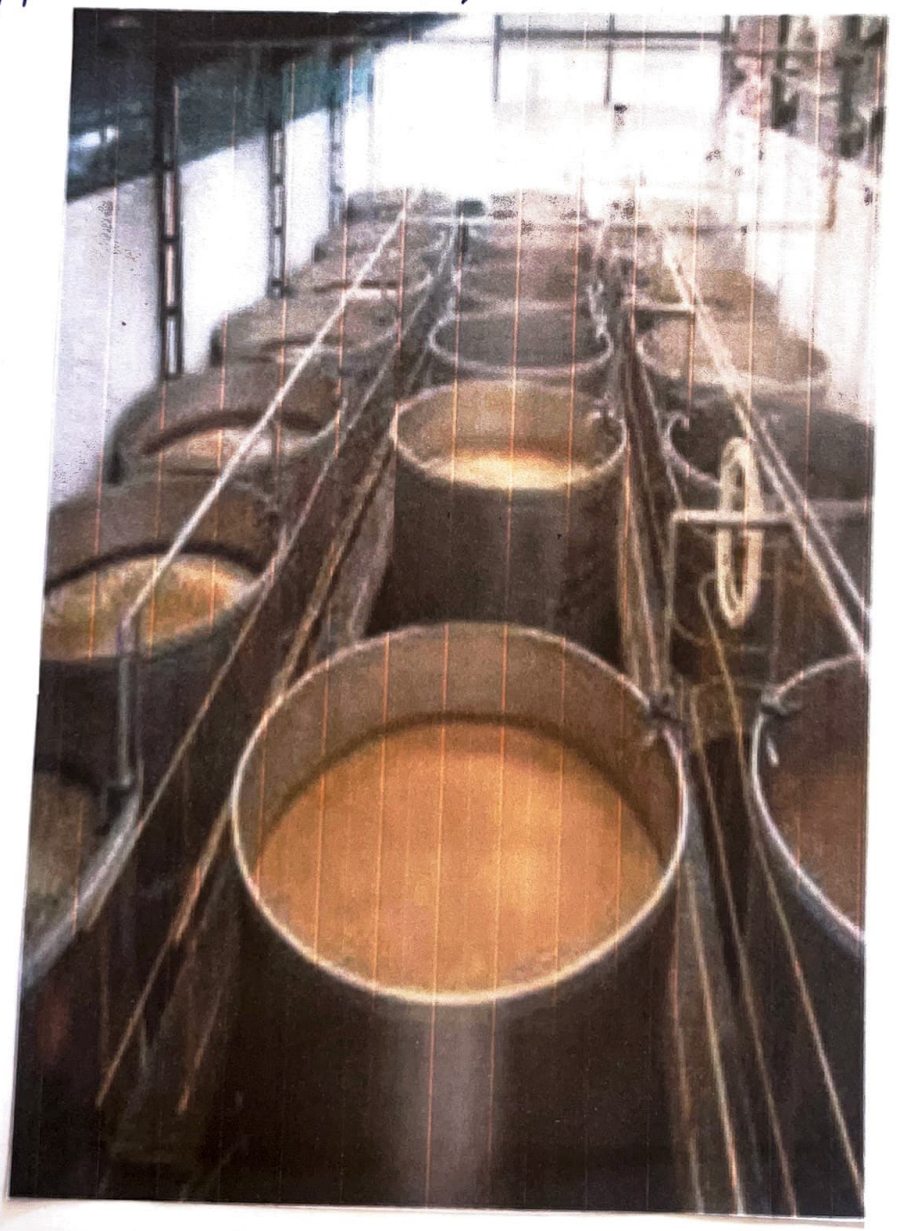
Bacteria & Fungal biomass

Yeast biomass:

* Cultivated on agro-industrial wastes such as molasses, starchy materials, fruit pup, wood pulp, etc.

* Requires a temperature of 30-34°C & pH of 3.5-4.5.

* Also requires addition of inorganic acids & sulphur supplements in the form of salts.



Yeast biomass

Factors Affecting Biomass Production

Illumination time

. pH

Temperature

Suitable strain

Agitation

Sterile condition

Single Cell Protein Production

Selection of suitable strain

Fermentation

Harvesting

Post harvest treatment

Single Cell Protein processing for food

Selection of strain

* It a very critical step as the quality of protein depends totally on the microbe that is used for the production.

* Thus (microbe) careful selection of the strain should be done.

* Care should be taken that the selected strain should not produce any toxic or undesirable in the consumer.

Fermentation:

* It can be carried out in the fermentor which is equipped with aerator, thermostat, pH, etc. or in the trenches or ponds.

* Microbes are cultured in fed-batch culture.

* Engineers have developed deep lift fermentor & air lift fermentor.

Fermentors

Harvesting:

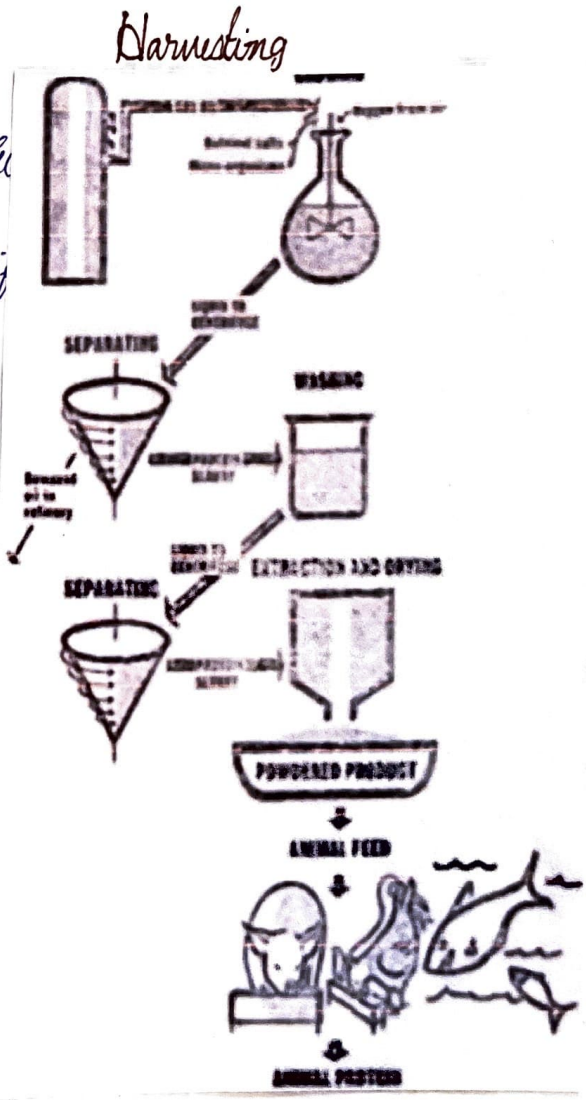
* When the colonies of microfes are fully developed, they are then harvested.

* The bulk of cells are removed from the fermentor by decantation.

Post harvest treatment:

* After harvesting, the cells are subjected to a variety of processes.

* Post harvesting treatments incl steps like separation by centri washing, drying etc.



Processing for food:

It includes

1 Liberation of cell proteins by destruction of indigestible cell wall.

A Mechanical methods:

Crushing, crumbling, grinding, pressure homogenization etc.

B Chemical methods:

* Enzymes & salts are used to digest or disrupt the cell wall.
* Salts like NaCl, sodium dodecyl sulfate, etc. whereas nucleases enzymes are used.

C Physical methods:

Freeze-thaw, osmotic shok, heating & drying

2 Reduction of nucleic acid content

* Chemical and enzymatic treatments are preferred.
* Chemical which are used includes acidified alcohol, salts, acids & alkalines.

* Use of such chemicals leads to formation of lysino-alanine which causes hypersensivity skin reactions

* Enzymes which are used include ribonuclease & nuclease enzymes.

* These enzymes can be used exogenously or can be induced endogenously.

Advantages:

* Rapid successions of generations.

* Easily modifiable genetically.

* High protein content of 43-85% in dry mass.

* Broad spectrum of orginal raw meterial used for production, which also includes waste products.

* Production in continuous cultures

* Consist quality not dependant on climate in determined -able amount.

* Low and requirements, economically beneficially.

* Utilization of solar energy.

* Cellular, molecule and genetic alteration.

Disadvantages :

* High content of nucleic acids leading to elevated levels of uric acid.

* Development of kidney stone and gout if consumed in high quality.

* Possibility for the presence of secondary toxic metabolites

* Poor digestability

* Stimulation of gastro-intestinal

* Hypersensitivity skin reactions.

Applications:

1 As protein supplemented food -

* Also source of vitamins, amino acids, minerals, crude fibers, etc.

* Supplemented food for undernourished children.

2 As health food -

* Controls obesity

* Provide instant energy.

* Example - Spirulina - a part of diet of US Olympic team.

4 In Cosmetics:

* Important role in maintaining healthy hair.

* Many herbal beauty products.

* Biolipsticks and herbal face cream

* Capable of replacing coal tar dye based cosmetics.

5 Poultry and cattlefeed -

* Excellent, convenient source of protein and other nutrients.

* Used to feed cattle, fishes etc.

Conclusion:

* At present Single Cell Protein production is in its infancy. One of the ways to enhance productivity and quality is genetic improvements of micro-organisms.

* Using microbial biomass as a food source deserves serious consideration because of inefficient world food supply and high protein content of most micro-organisms.