

Microbiological Sources and Nutritional Value of Single Cell Protein (SCP)

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Abstract

Working to achieve food security through the development of a food protein food renewable able to meet the daily dietary needs of protein and the production of food safe and healthy and healthy value added because of its production on the media (substrates) cheap and technological requirements available locally. It is a single-cell protein in addition to finding new and radical solutions to the problem of environmental pollution resulting from the dumping of large quantities of incidental substances, which cause a great deal of pollution and the destruction of useful microorganisms and useful and imbalance in the environmental balance, so it is possible to use microorganisms (bacteria, yeasts, fungi, algae) in the production of biomass It can be used to feed both humans and animals.

Key Words: single cell protein; nutrition; microorganisms

Introduction

The term single cell protein (SCP) refers to the dry cells of microorganisms such as algae, bacteria, filamentous bacteria, molds and fine fungi that grow in culture systems. The commercial scale for use as a source of protein in human and animal nutrition. Despite its high protein content in these organisms, they contain carbohydrates, fats, vitamins, mineral salts as well as non-protein nitrogenous substances (NPN) such as amino acids. Western mothers in animal and human nutrition, such as the algae of the genus *Spirulina*, where they were collected from ponds by people in Mexico for use in eating and still eaten the cells of this moss until today by the people of Lake Chad in Africa.

The first industrial production of this protein was used in nutrition in Germany during the First World War, where the yeast *saccharomyces cerevisiae* was developed and the use of molasses as a source of carbon, energy and ammonium salts. Germany used the yeast *candela utilis* as a source of protein in nutrition and its development on the fluid from paper mills and sugars resulting from acidic decomposition of wood, which produced about 15 thousand tons / year during World War II was the main use this yeast is added for special food soups. The production of *Torilla* yeast after World War II spread to the rest of the world so far for use in nutrition some oil companies developed in the 1960s industrial processes for the development of microorganisms on petroleum and its derivatives to produce single-cell protein. Protein yeast (*Candida lipolytic*) on alkanes and as a result of the development in In recent years, the genetics and physiology of microorganisms and the use of a wide range of raw materials such as the production of bacterial biomass with a high protein content of up to 72% or more and continuously and the use of methanol as a raw material as well as the production of special yeasts in the feed

Man with high concentrations and thus reduce the energy used in the drying cost.

Microbiology used in the Production of Single-Cell Protein:

Certain traits should be respected in microorganisms used in the production of unicellular protein for use in human or animal nutrition.

- (1) Does not cause plant or human diseases
- (2) Good nutritional value
- (3) Absence of toxic compounds
- (4) low cost and the cost of production depends on factors such as the rate of growth and protein content and the need for nutrients subsidized and the use of transitional food media and the process of separation and drying.

The Microorganisms used are:

1- Bacteria

It is preferable to use bacteria in the production of single-cell protein because the growth rates are high compared to other microorganisms, the number of bacteria used in the production of single-cell protein is rather large because of its ability to use a wide range of substances subject and must be maintained sterilization conditions during the production process because Most processes have pH = 5 - 7, which allows room for contamination of pathogenic bacteria to grow. Centrifugal cell separation is not without problems, so improved methods of protein production from bacteria are necessary. The protein produced by bacteria is characterized by a high concentration of about 80% and its content of nucleic acids,

especially RNA is very high up to 20%, so some transactions must be carried out on this protein to reduce the proportion of nucleic acids before being used in nutrition, and its content is good amino acids, but it is low Sulfur-containing amino acids should be considered for the possibility of producing endotoxins by certain types of Gram-positive bacteria.

2- Algae

Most of the algae used in the production of protein belong to the genus *Chlorella* and genus *Scenedesmus* and genus *Spirulina*. Algae is developed either through self-feeding process of photosynthesis (the use of organic carbon as a source of carbon and energy), and photosynthesis is the most used so the light is the limiting factor in the process. Commercial production, the best way to produce algae biomass as a source of protein is the use of open ponds and the presence of sunlight, but the problem of pollution is one of the most important problems where sterilization conditions cannot be maintained and at a reasonable cost under this system either problem. In the low density of these cells, ranging from 1-2 grams of dry matter per liter of commercial production medium, the process requires the use of large areas of water bodies up to 60% protein in algae and a good content of amino acids. Low sulfuric amino acids and algae contain high amount of photosynthetic dyes which are desirable in the preparation of compound feeds but are not desirable in case of use for human consumption. Special studies in feeding different animals have shown that the addition of micro algae to animal protein for diet was obtained good results as the condition used very high rates.

3- Yeasts

The production of yeast on a commercial scale has evolved over more than a century, especially species of *Saccharomyces*, *Candida* and *Torulopsis*.

The growth of some cells is high, although they are slower than some types of fast-growing bacteria and when the development of yeasts are adjusted pH 3.5 - 5.0, which reduces the risk of bacterial contamination can be separated yeast cells resulting easily from the growth medium using centrifuge range of protein in the yeast 55 - 60% and contain 15% nucleic acids on the basis of dry weight, so the resulting yeast should be treated to reduce the content of these acids and the yeast content of amino acids is good, although the lack of sulfuric amino acids more than in bacteria and can be fortified with methionine. It is common for most single-cell protein proteins used in animal feed, as well as a single-cell protein containing vitamin B group.

4- Filamentous Fungi

Although the growth rates of molds are lower than bacteria and yeasts, it is possible to isolate a number of micro-fungi with growth rates that approximate the growth rates of yeasts. Equal to 5, which leads to a reduction of bacterial contamination, but there may be a risk of contamination of yeasts unless development takes place under sterile conditions. Positively in the production of protea. Single-cell separation is much easier with filtration. When fungi grow in the form of filaments or pellets, the percentage of raw protein in molds may reach 50-55%. This is a component of the cell wall of a large proportion of total nitrogen. It is a single-cell fungal protein with a high content of amino acids in general. Feed of human or animal and make sure not to produce these toxins.

Nutritional Value of Single Cell Protein

Show in Table (1) the value of unicellular protein used to feed animals

and humans can be determined as the bacteria contain the highest amount of protein from 72 to 83%, while the mold contains the lowest amount of it (31-50%) while the algae and yeasts amount of protein from 47-63%. Nucleic acids in the animal feed is no problem as uric acid turns into a soluble substance excreted with urine because of the enzyme urate oxidase or called uricase. Uricase and this enzyme is missing in humans, therefore, an increase in the proportion of uric acid causes gout and the limit allowed to take nucleic acids not more than 2 grams in Today but are found in protein monoclonal Cell 2-16%, depending on the user object and most bacteria type containing 8-16% so allows humans to eat 10 grams of protein enzymes and bacteria per day so you must expose the protein single-cell shock thermal or extraction of nucleic acids in alkaline medium so as to minimize.

Unicellular protein lacks essential amino acids that cannot be synthesized, such as methionine, when feeding broilers and adjusting the amount of L-arginine and lysine. Some legislation in the United States permits the use of bread yeast, torilla yeast, fragrant, and Mycoprotein as a substitute for chicken meat in human feed.

What prevents single-cell protein from human consumption is that it contains large amounts of nucleic acids, especially RNA, which leads to disturbances in the metabolism of the human body as the products break down are nitrogen bases, which increase the concentration of uric acid in the blood serum and gout and therefore should be removed when These acids are removed by alkaline treatment but this will lead to the production of some substances such as Lysinoalanine (an unusual amino acid formed in proteins during alkaline treatment) and some destructive factors of the kidneys in the filtering units. S heat (64 m for a certain period) that lead to the inhibition of enzymes analyst proteins and then the enzyme RNAase allows to convert DNA to nucleotides that resides in the center of fermentation .

*Table (1) The average composition of the basic elements in the single-cell protein

Dry material %	Bacteria	Yeasts	Algae	Filamentous fungi
Protein	72 - 85	55 - 60	40 - 60	50-55
Fat	1.5 - 3.0	2 - 6	7 - 20	2 - 8
Ash	3 - 7	5 - 9.5	8 - 10	4 - 19
Free amino acids	8 - 12	6 - 12	3 - 8	7 - 10

* Harender *et al* 2007

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