Available online at www.scholarsresearchlibrary.com

Scholars Research Library

Der Pharmacia Lettre, 2015, 7 (4):281-283
(http://scholarsresearchlibrary.com/archive.html)

ISSN 0975-5071
USA CODEN: DPLEB4

Optimization of single cell protein from Chinese potato by submerged fermentation

S. Anbuselvi, Avinash and Manas Jha

Department of Industrial Biotechnology, Bharath University, Chennai

---

ABSTRACT

The alarming rate of high population rate and rapid dwindling of natural resources have resulted in scarcity of food especially protein shortage in third world countries since the latter half of 20th century. Single cell protein production is an excellent alternative. The dried cells of microbes are commercially as source of proteins for food and animal feed. The extraction of single cell protein from coleus potato using fungi was analyzed. The optimum production of SCP was observed in nitrogen enriched medium than carbon enriched medium

Keywords: Singlecell protein, yeast, bacillus, biomass.

INTRODUCTION

P.rotundifolius is called as chinese potato or country potato. This is cultivated as root crop in Africa and Tamilnadu. Chinese potato is an erect, semi succulent annual herb. The tubers are raddish yellow dark brown and light grey flesh colors. Chinese potato plant is high temperature tolerant and rainfall (Lon,1977). The tubers are harvested about four to five months after planting. These tubers can be used in cooking. The leaves of Chinese potato can be used as a treatment for dysentery (Barret, 1910).

Single cell protein contains high amount of protein than protein derived from plant and animal sources. Single cell protein can be generated in a shorter period of time. They are flexible in use of variety of substrate. It yields high proportion of cell mass as protein. It shows desirable amount of amino acids. Hence it shows good performance in feeding livestock. Yeast based single cell proteins are best alternative to supplement the requirement of food and food grade proteins,vitamins and amino acids.

MATERIALS AND METHODS

P.rotundifolius was collected from the market in the month of January in Tamil Nadu. The physical characteristics of c

Optimization of culture media
Different media, such as sucrose, glucose and *Chinese potato* were optimized for different variable parameters such as pH, temperatures, carbon source and nitrogen source. Finally *Chinese potato* media was found to be the media with maximum growth.

Carbon source
Carbon source for determining the best biomass yield in different carbon sources such as glucose, fructose these were dissolved separately in *Chinese potato* nutrient media while maintaining pH at 6 and then sterilized and placed in the rotary shaker incubator for 48 hrs.

Preparation of production media
Pulp obtained from *Chinese potato* was taken and sterilized. After sterilization both Chinese potato pulp and nutrients for media were cooled and mixed properly and autoclaved.

Inoculation
In this process, both media were inoculated inside the laminar air flow using the culture slants previously maintained at 4^0C. All the flasks were kept in the rotary shaker incubator at 37^0C or room temperature for the growth yeast.

Mass production
Inoculum preparation for fermentation
20 ml of YPD media was taken and maintained at pH 6 before autoclaving. Then inoculation was done in broth media and kept at room temperature.

Optimization of culture media
Different media, such as sucrose, glucose and *Chinese potato* were optimized for different variable parameters such as pH, temperatures, carbon source and nitrogen source. Finally *Chinese potato* media was found to be the media with maximum growth.

Carbon source
Carbon source for determining the best biomass yield in different carbon sources such as glucose, fructose these were dissolved separately in *Chinese potato* nutrient media while maintaining pH at 6 and then sterilized and placed in the rotary shaker incubator for 48 hrs.

Bulk media preparation
One litre of pulp obtained from the *Chinese potato* processing industry was taken and sterilized inside the fermenter after autoclaving and cooled for 30 minutes

Fermentation
A batch fermenter was used for the production of SCP from the pulp of Chinese potato. The experiment set consisted of the fermenter, the air supply and the computer based data acquisition in control system. The fermenter and all accessories were chemically sterilized 2% potassium meta bisulphate solution and then washed with hot water for several times. The reactor was then filled with one litre of Chinese potato pulp and immediately inoculated with 20ml of the inoculum. Cell suspensions were prepared from 24hr old cultures in sterile media and transferred aseptically to the one litre flask containing *Chinese potato* wastewater and pH of the medium was adjusted at 6 before autoclaving. The pH was maintained at 6 with the addition of HCL and NaOH using computer based pH measurement and control system. Dissolved oxygen and temperature were continuously monitored and the reactor was operated at 2vvp, at mixing speed of 300rpm. The samples were taken after 48hrs for maximum yield of biomass.

Isolation of single cell protein
10 ml of the solution was fermented and after that it was centrifuged at 6000rpm for 20 minutes. Then the supernatant was collected. The protein of biomass was measured by Lowry method(lowry) and carbohydrate content was analyzed by anthrone method (Hodge)

RESULTS AND DISCUSSION

The Chinese potato pulp was subjected to fermentation using and yeast in two different carbon sources. The composition of crude protein and total carbohydrate content of biomass were observed. The proximate composition of *yeast* biomass produced more single cell protein (27.6%) in glucose enriched medium. The *bacillus* showed 18.6% of SCP in glucose enriched medium than 16.4% of SCP in fructose medium (Table1). The minimum yield of SCP in fructose enriched medium than glucose enriched medium. The addition of glucose to the supplemented waste medium enhanced the protein content within the *yeast* cell.

Table:-1 Proteins of fermented medium using two different carbon sources

Sample I: Bacillus + Glucose + Chinese potato waste
Sample II: Bacillus + Fructose + Chinese potato waste
Sample III: Yeast + Glucose + Chinese potato waste
Sample IV: Yeast + Fructose + Chinese potato waste

Parameters	1-5 Days	5-10 Days	10-15 Days
Sample 1	14.8	16.2	18.6
Sample 2	14.2	15.7	16.4
Sample 3	16.8	24.2	27.6
Sample 4	15.3	20.3	24.5

Table:-2 Carbohydrates of fermented medium using two different carbon sources

Parameters	1-5 Days	5-10 Days	10-15 Days
Sample 1	23.5	28.7	26.4
Sample 2	21.7	23.5	24.7
Sample 3	24.8	36.5	30.2
Sample 4	22.6	28.9	26.5

The carbohydrate content was gradually increased in 5-10 days of submerged fermentation in all four samples. After 10 days of fermentation, carbohydrate content was slowly reduced to enrich the protein content of cell biomass. The maximum carbohydrate produced in glucose enriched medium than fructose. The high content of carbohydrate (36.5%) was observed in *yeast* cultured media than *bacillus* (28.7%) using glucose as enriched source. The keto component of fructose somewhat delay in supplying the carbon nutrient than aldoform. Thus aldoform of glucose enriched media supports the carbon source for production of SCP. The carbohydrates, fats, protein and minerals are essential for the growth of *yeast* in the production of SCP. The nutritive value of SCP depends on nutrient composition, aminoacid profile vitamins and other factors such as palatability,allergies and gastrointestional effects (Lichtfield,1968) .The SCP from yeast has to get 55% protein rich in lysine but poor in methionine and cysteine (adedayo,2011)

CONCLUSION

Today in most countries, SCP cannot compete with soya, alfaalfa or fish meal lignocellulose waste seems to be economical and promising use for single cell protein production from *Saccaharomyces cerevisiae* was possible by submerged fermentation of both substrates. The degree of SCP production depends on the type of substrate used and also on media composition. The addition of glucose provided available carbon source for the organisms thereby enhancing SCP production. The present finding reveals that chinese potato waste were used as potential source for product with higher protein content by utilizing various ingredients present in them and there is a possibility by converting these starchy wastes to proteinaceous feed and food. Thus Chinese potato wastes should be exploited properly as a substrate for the production of cellular biomass of edible yeast instead of dumping them. So they can be used as feed supplement with least expenditure of money. Thus potato waste should be exploited properly as a substrate for the production of cellular biomass of edible yeast instead of dumping them. So they can be used as feed supplement with least expenditure of money.

REFERENCES

[1] Burkill H.M (**1995**). The useful plants of Tropical West Africa.J.L Vol 3, Royal botanic Garden.
[2] Barret O.W and Cook O.F (**1910**). *Journal of Ethnopharmacology* 7–29.
[3] Lon(**1997**). Origin evolution and early dispersal of root and tuber crops Proceedings of the 4th symposium of international society for tropical crops.277.
[4] Nasseri,A.T, Rasoul Amini S Moromvat M.H and Ghasemi Y (**2011**) *American J of food technology* 6(2):103-116.
[5] Lichtfield (1983) Science 219;740-746.
[6] Adedayo M.R, Ajiboye E,A, Akintande JK AND Odaibo A (**2011**) *Advanced in applied science research*,2(5):396-409.
[7] Ware SA(**1977**) Single cell protein and other food recovery technologies from waste Municipal environmental research Laboratory U.S.E.P.A, cincinnat,ochio,4562
[8] Lowry,OH,Rosebrough,N J, Farr AL and Randall RJ, *J.Biol.Chem*,**1951**,93 – 195.
[9] JE Hodge and BT Hofreiter., Carbohydrate analysis:*Methods in Carbohydrate chemistry*,**1962**, New York.
[10] Nidhi Uppangala (**2010**) http:/www.biotecharticle.com.
[11] Olvera-Novoa MA, Martinz –Palacios CA and Olivera-Castillo (**2002**) *Aquacvulture Nutrition* 8:257-264.
[12] Ware (**1997**) *CRC Critical reviews in biotechnology* 1(1):21-58.