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OPTIMIZATION OF SINGLE CELL PROTEIN USING CASSAVA WASTE BY YEAST

S.Anbuselvi*, Manas Jha and Aneesh
Department of Industrial Biotechnology,Bharath University, Chennai-73.
Email:anbuselvichennai@yahoo.com

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Abstract

Food protein deficiency occurs in animal feed and food shortage for world' expanding population. Non conventional food sources like single cell proteins are used to meet the nutritional requirement at a cheaper rate. The present work deals the maximum yield of single cell protein from Cassava waste using fungi. The optimization of single cell protein was carried out with different carbon and nitrogen sources. The high amount of carbon utilization occurred in fructose enriched medium. The peptone enriched medium showed higher yield of SCP than urea enriched medium. The present study helps in single cell protein production from cheap inexpensive agro waste.

Keywords: Single cell protein, cassava waste, fungi, carbon sources

Introduction

Due to world's expanding population have led to scarcity of non conventional food sources to human being and animals. Single cell protein shows the best chances for the development of unique independence of agriculture crop based food supply .The protein extracted from microbes may provide good nutritive value results in a higher cost of animal feeding. In recent years, waste such as bagasse, rice straw ,rice husk and starch residues has been used as substrates for growing microbes[1]. The single cell protein is a dehydrated cell which consists of protein s, liplds, carbohydrates ,Nucleic acids, inorganic compounds and vitamins. The single cell protein should be non toxic,non-exotic, cheap and high quality biomass[2].

Algal single cell protein needs warm temperature, plenty of sunlight in addition to carbondi oxide and algal cell wall shows indigestion. Bacteria can grow on wide range of substrates but they have a short generation time and high nucleic

acid on dry weight basis. Yeasts are widely accepted and used for single cell protein production[3,4]. A good knowledge of growth conditions and medium formulations are necessary to obtain more biomass for feeding[5].

Cassava is used as staple food in India. It shows high amount of protein which useful for animal feed production. Cassava pulp can be used as a raw material for starch and mono sodium glutamate. This is a root crop that high yield with little to input, increases the economy value of the country[6,7]. Scp cannot show any imbalance in natural ecosystems. Scp processes are new technological solution for waste water treatment. The main objective of this work was to optimize the production of single cell protein from cassava waste using fungi.

Materials and methods

Cassava pulp was collected from starch Industry. The physical parameters like pH and temperature were analyzed by pH meter and thermometer. The turbidity of cassava pulp was measured by nephlometry.

The yeast culture of Saccharomyces cerevisiae MTCC 463 was obtained from Microbial Type Culture Collection (MTCC,Chandighar,India). The culture was maintained on slant of Yeast Peptone Dextrose medium and stored at 4ºC[8].

Fermentation

20 ml of YPD media was taken and maintained at pH 6 before autoclaving. Then inoculation was done in a broth media and placed in a room temperature. Cassava enriched media were sterilized and cooled for 30 minutes. Submerged fermentations were carried out in Erlenmyer flasks[9,10] .

Cassava enriched medium had the following composition: Glucose(1g). (NH4)2SO4 (2 gm), KH2PO4 (1gm), MgSO4.7H2O (0.5 gm), NaCl (0.1 gm), CaCl2 (0.1 gm) (pH-5.5) made up to 1 litre with cassava pulp water. The second and third medium contains lactose and fructose instead of glucose in media. Similarly different nitrogen sources of peptone and urea were added instead of glucose in above media. In all the media, initial pH was adjusted to 5.5 using 1N H_2 SO4 and/or 1N NaOH. Each medium (98 ml) was transferred into 250 ml Erlenmeyer flask and sterilized at 121ºC for 15mints.

Inoculums of 2 ml from suspension of Saccaharomyces cerevisiae was aseptically transferred into each medium. Fermentation was carried out at 28ºC under static condition followed by determination of biomass and other parameters after 6-day intervals. Bioconversion of cassava waste and proximate analysis of SCP was carried out(Dubey,1995).

After fermentation biomass was separated from culture broth by vacuum filtration and washed with sterile water. 10 ml of the solution was fermented and after that centrifuged at 6000rpm for 20 minutes. Then the supernatant was collected. Before taking the weight of the biomass, it was transferred into an aluminum disk and was oven dried at 105ºC for one hr followed by cooling in desiccators to balance the temperature and weight. The biochemical constitutes of separated biomass (both wet and dry) such as crude protein, total carbohydrate content[11,12] were studied.

Results and discussion

The initial pH and temperature of cassava were 4.6 and 28ºC.The turbidity of cassava pulp was found to be 5.8 and 79.8% of moisture .Similar results were observed by Anbuselvi et.al,2013[13]. Renata et.al , 2012 has been implied that moisture and ash content of cassava were found to be 75% and 0.7% for wet samples[14]

Figure 1: Carbohydrate content of SCP production using different carbon and nitrogen sources.

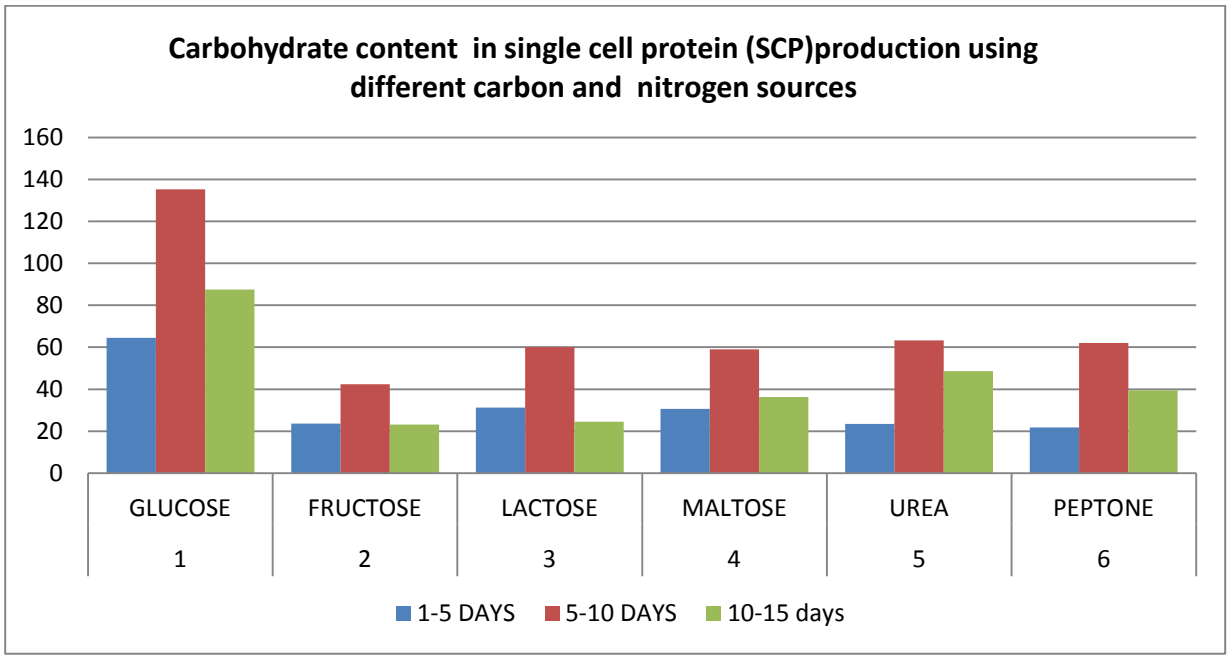

Table 1: Production of single cell protein from cassava waste using different carbon and nitrogen sources.

PROTEIN CONTENT(mg/100ml) IN SINGLE CELL PROTEIN USING CARBON AND NITROGEN SOURCE				
S.NO	**SOURCE**	**1-5 DAYS**	**5-10 DAYS**	**10-15DAYS**
1	**GLUCOSE**	10	15.6	23.6
2	**FRUCTOSE**	12.4	16	24.8
3	**LACTOSE**	11.6	12.4	22
4	**MALTOSE**	11	14.4	19.2
5	**UREA**	19.6	25.6	30.4
6	**PEPTONE**	13.1	16.4	20

The carbohydrate and protein content of cassava was analyzed by biochemical assay. The high amount of carbohydrate was found in glucose enriched medium (138mg/100ml) in 5-10days of fermentation. The carbohydrate content was gradually increased at 6-10days and slowly declined at10-15days of fermentation. The low amount of carbohydrate was observed in fructose enriched medium. The minimum carbohydrate content was found in nitrogen enriched sources such as urea and peptone at early stages of fermentation but rapidly increased upto 63.2mg in 6-10days of fermentation (Table2). These changes indicated the utilization of carbon and nitrogen sources for production of biomass in fermentation medium[15].

The nutritive content of cassava pulp was changed when subjected to fermentation using yeast. The maximum amount of protein content in cassava pulp was observed in fructose enriched medium (16mg). It attain maximum yield of 24.8mg in 10-15days of fermentation, The nitrogen enriched source of urea showed high yield of 25.6 mg in 6-10 days of fermentation and gradually increased to 30.4 mg at the end of the process. Peptone enriched medium also yield 20.4 mg of protein .Monosaccharides enriched medium yield more amount of single cell protein when compared with disaccharides. The carbon, hydrogen, oxygen and nitrogen are the structural backbone of protein. The nitrogen rich peptone enhances the protein production upto the maximum yield of 30.4mg.Thus the optimization of SCP was achieved by using different carbon and nitrogen sources

Conclusion

The yield of single cell protein from cassava pulp using *Saccaharomyces cerevisiae* was possible by submerged fermentation. The degree of SCP production depends on the type of substrate used and also on media composition. The optimization of single cell protein provided with different carbon and nitrogen source for the organisms thereby enhancing SCP production. The present finding reveals that cassava pulp 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 the wastes to proteinaceous feed and food.

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Corresponding Author:

S.Anbuselvi,

Email:*anbuselvichennai@yahoo.com*