Research Article

Production of Single Cell Protein Using Bengal Gram Husk by Yeast

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ABSTRACT

The crude protein derived from the unicellular microbial biomass grown on biological waste has been used for the production of Single Cell Protein extensively in industry. The bioconversion of different waste into SCP has great potential to solve the world wide protein deficiency. Many raw material materials used for the production of Single Cell Protein have been considered as carbon and other energy sources. The main objective was this to extract a single cell protein (SCP) from Bengal gram husk using yeast. The maximum yield of crude protein was observed in nitrogen enriched medium when compared to carbon enriched medium. The high yield of crude protein was observed in 15days of fermentation.

Keywords: biomass, single cell protein, carbon, nitrogen, fermentation.

INTRODUCTION

The rapid rate of population growth and rapidly dwindling of natural resources have showed in drought, infertile soil and scarcity of food, specifically protein shortages in third world countries since the latter half of 20th century. Single cell protein (SCP) production has evolved as an excellent alternative protein rich food.

The dried cells of unicellular microorganisms produced commercially as 'microbial protein' or 'single cell protein[1]. SCP can be produced from cheap waste material available in large quantities which minimize the environmental pollution.

A lot of research work revealed that the production of SCP from carbohydrate and liquid waste of plant origin.

Single cell proteins develop when microbes has fermenting waste materials (including wood, straw, cannery and food processing wastes, residues from alcohol production, hydrocarbons, or human and animal excreta).

The problems with extracting single-cell proteins from wastes in the dilution and cost[2]. Microbes having high protein content.

Several microbes like algae, yeast and bacteria showed high intensive growth of biomass on fermentation. The SCP showed 55-60% of crude protein, which has good amino acid balance except sulphur containing amino acids. Yeasts occupy a unique place in science and technology: being a unicellular microorganism readily amenable to cultivation and to manipulation to reflect process needs[3,4,5].

Thus in the wake of considerable advancement in biotechnology yeast based single cell protein production stands as the best alternative to supplement the requirements of food and feed-grade protein, vitamins and amino acids[6,7].

The main objective of this work was to compare the production of SCP from Bengal gram husk can be used as substrate for fermentation using yeast.

MATERIALS AND METHODS

The green gram husk Waste was collected from dal processing industry.

This was used as substrate for submerged fermentation using yeast to extract single cell protein.

Isolation of the yeast

Isolation technique for mixed cultures

All the initially isolated yeasts of the current experiment were contaminated in the mixed culture.

The pure culture was obtained by Serial dilution method.

Followed by spread plate technique and confirmed by Lacto phenol blue staining. The sub culturing procedures were described by kreger-vanrij[8].

Carbon source

To determine the best biomass yield in different carbon sources like sucrose, glucose and maltose were dissolved separately in bengal gram husk - nutrient media and maintained at pH 6 then sterilized and placed in the rotary shaker incubator for 48 hrs.

Nitrogen source

Except for yeast extract and urea, all other chemicals of husk nutrient medium were dissolved separately in peptone, sodium nitrate, beef extract and ammonium sulphate, maintaining pH at 6 and then after inoculation of *Saccharomyces cerevisiae* all the flasks were placed in rotary shaker incubator for 48hrs[9].

Media Preparation

Fermentation and harvesting of single cell protein Submerged fermentations were carried out in Erlenmyer flasks with different carbon sources –Glucose, fructose, Lactose and Maltose. The nitrogen sources such as Urea and Peptone. All trials has the following composition of $(NH4)_2SO_4$ (2 gm), KH_2PO_4 (1gm), $MgSO_4.7H_2O$ (0.5 gm), NaCl (0.1 gm), $CaCl_2$ (0.1 gm) (pH-5.5) made up to 1 liter with two types of husk waste. In the media, initial pH was adjusted to 5.5 using 1N H_2SO_4 and/or 1N NaOH**.** Each medium (98 ml) was transferred into 250 ml Erlenmeyer flask and sterilized at 121°C for 15mins. Inoculums of 2 ml from suspension of *Saccaharomyces cerevisiae* was aseptically transferred into each medium. Fermentation was carried out at 28°C under static condition followed by determination of biomass and other parameters after 6-day intervals[11,12]. The biochemical changes during the production of single cell protein in fermentation process True protein content was determined by the lowry method[13,14]. Total sugars were estimated using anthrone method[15].

RESULTS AND DISCUSSION

Protein enrichment in legumes were subjected to submerged fermentation for production of singe cell protein (SCP) from green gram husk using yeast.

The different carbon sources such as glucose, fructose, lactose and maltose were enriched with fermentation medium. Production of SCP is enhanced with nitrogen sources of urea and peptone[16].

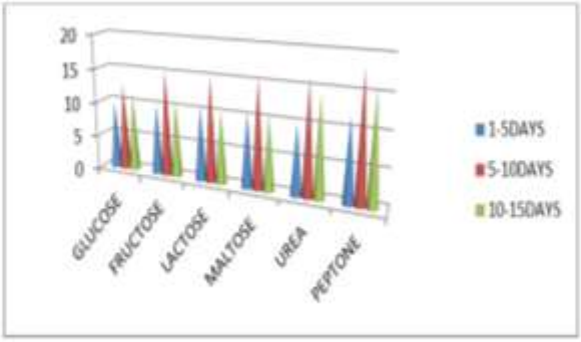

Figure 1: Protein content (mg/100ml) in single cell protein using carbon and nitrogen source in Bengal gram husk

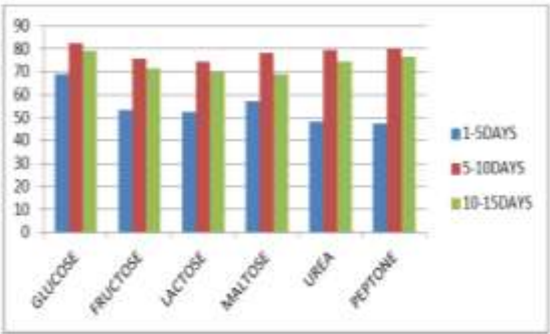

Figure 2: Carbohydrate content (mg/100ml) in single cell protein using carbon and nitrogen source in chick pea husk

The carbohydrate and protein content of Bengal gram husk was analyzed by biochemical assay.

The nutritive content of pulses was changed when subjected to fermentation using yeast[17].

The maximum amount of protein content in cow pea husk was observed in fructose enriched medium (8.2mg).

It attain maximum yield of 9.7mg in 6-10days of fermentation, but rapidly declined to 4.2mg of protein (Figure 1). The nitrogen enriched source of peptone showed high yield of 8.5mg in 6-10 days of fermentation. Similar results were also observed in green gram husk[18].

The high amount of carbohydrate was found in glucose enriched medium (56.8mg) in 5-10days of fermentation.

The carbohydrate content was gradually increased upto 83mg at 6-10days and slowly declined at10-15 days of fermentation. The minimum carbohydrate content was found in malitose enriched medium.

The nitrogen enriched sources such as urea and peptone showed little amount of carbohydrate at early stages of fermentation but rapidly increased up to 63.6mg and70.4mg in 6-10days of fermentation (Figure 2).

These changes indicated the utilization of carbon and nitrogen sources for production of biomass in fermentation medium[19]. The carbon, hydrogen, oxygen and nitrogen are the structural backbone of protein. The nitrogen rich peptone enhances the protein production which reaches the maximum yield of 18.2mg.

Glucose enriched medium showed high amount of carbohydrate (83.8mg) in 5-10days of fermentation.

The low amount of carbohydrate was observed in lactose enriched medium.

The peptone and urea enriched medium showed 40.5mg of carbohydrates than carbon enriched medium.

Thus the optimization of SCP was achieved by using different carbon and nitrogen sources.

CONCLUSION

The yield of single cell protein production from waste of chickpea and cow pea using *Saccaharomyces cerevisiae* was possible by submerged fermentation of both substrates.

The degree of SCP production based on the type of substrate used and media composition. The addition of glucose provided available carbon source for the organisms thereby enhancing SCP production. The present finding reveals that these husk waste were used as potential source for product with higher protein content by utilizing various ingredients present in them and by converting these husk to proteinaceous feed and food.

This helps to reduce the environmental pollution by avoiding waste dump and burning.

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