Research Article

Optimization of Single Cell Protein Using Green Gram Husk and Bengal Gram Husk Using Yeast

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ABSTRACT

Proteins are macromolecules made up of amino acids which are highly essential for the existence of the living system. The Single Cell Protein is used as the protein source in animal feed and protein rich food for humans. The mixed protein derived from the unicellular microbial biomass grown on biological waste has been used for the production of Single Cell Protein extensively in industry. People in third world and developing countries are suffering from menace of protein deficiency in their diets resulting in serious protein-energy malnutrition problems. The situation, demands exploration of new un-conventional protein sources to fortify human food. The present study was planned to assess the feasibility of using agro-industrial wastes for *Saccharomyces cerevisiae* production and to evaluate protein quality of produced single cell protein (SCP) biomass. 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 green gram husk and 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: Carbon sources, Fermentation, Single cell protein, Yeast.

INTRODUCTION

The alarming high rate of population growth and rapidly dwindling of natural resources has resulted 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. The dried cells of unicellular microorganisms produced commercially as source of protein and used as human food or animal feed are collectively known as 'microbial protein' or 'single cell protein'.[1]

Single cell proteins develop when microbes ferment waste materials (including wood, straw, cannery and food processing wastes, residues from alcohol production, hydrocarbons, or human and animal excreta).The problem with extracting single-cell proteins from wastes in the dilution and cost.[2]

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] 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[5]. Green gram husk and Bengal gram husk are rich source of protein which increases the quality of proteins.

MATERIALS AND METHODS

Waste of green gram and Bengal gram husk were collected from dal processing industry. This was used as substrate for submerged fermentation using Saccaromyces cerevisae to extract single cell protein. Isoation of yeast and sub culturing procedures were described by kreger-vanrij.[6]

The green grams and Bengal gram husk were used as a substrate for production of SCP. Then the seeds were powdered. The 50 ml of 10% (w/v) HCL was added to the each sample (40 gm) in conical flask respectively. The mixture/solution was placed in water bath at 100^{0}C for one hour. After being allowed to cool, it was filtered through whatman filter paper. The filtrates were diluted with sterile distilled water at varying concentrations and autoclaved at 121^{0}C for 15 mins. The sterile solution/broth thus prepared was used as carbon and nitrogen source for biomass production.[7]

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 greengram waste. All 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.[8] The biochemical changes during the production of single cell protein in fermentation process

True protein content was determined by the lowry method.[9,10] Total sugars were estimated using anthrone method.[11]

RESULTS AND DISCUSSION

Protein are rich in legumes were subjected to submerged fermentation for production of singe cell protein (SCP) from green gram husk using yeast.[12] 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.[13]

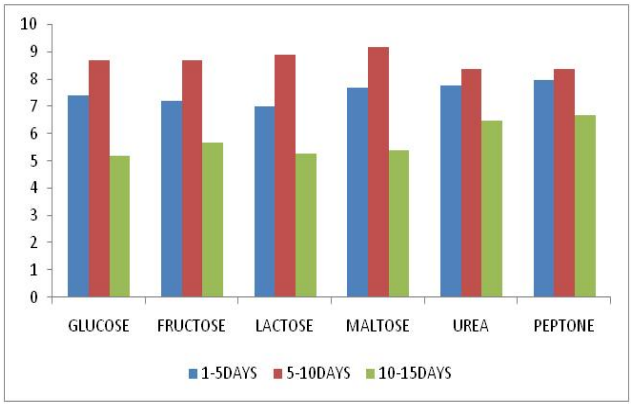

Figure 1: Protein content of green gram(mg/100ml) in single cell protein using carbon and nitrogen sources.

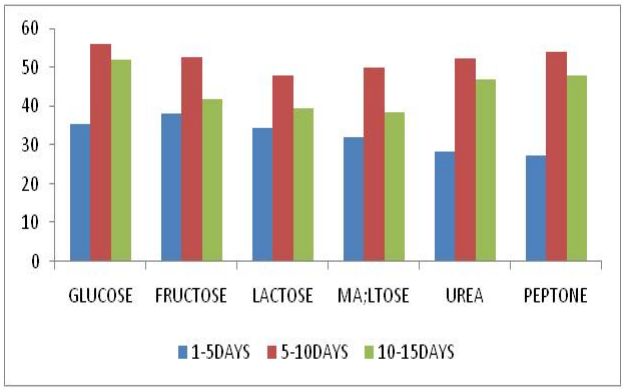

Figure 2: Carbohydrate content of green gram in single cell protein production using different carbon and nitrogen source

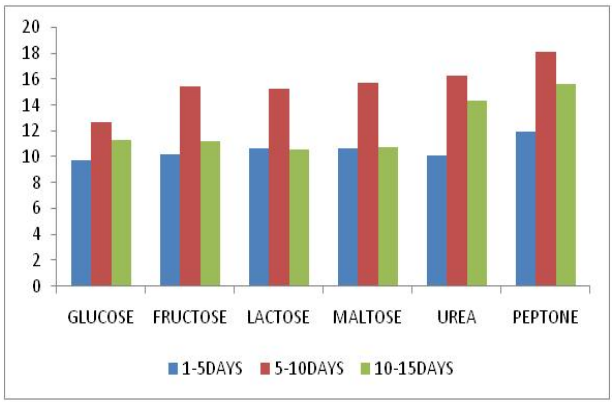

Figure 3: Protein content (mg/100ml) in single cell protein using carbon and nitrogen source

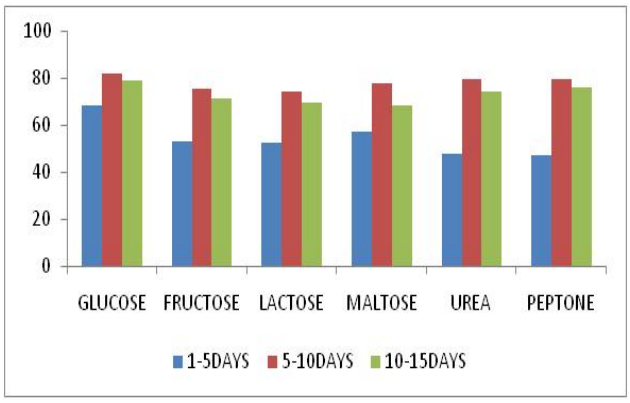

Figure 4: Carbohydrate content (mg/100ml) in single cell protein using carbon and nitrogen source

The carbohydrate and protein content of *Greem gram and Bengal gram* were analyzed by biochemical assay. The nutritive content of pulses was changed when subjected to fermentation using yeast. The maximum amount of protein content in green gram husk was observed in Maltose enriched medium (7.7mg). It attain maximum yield of 9.2mg in 6-10days of fermentation, but rapidly declined to 5.4mg of protein (Figure 1). The nitrogen enriched source of peptone showed high yield of 8.4mg in 6-10 days of fermentation.

The high amount of carbohydrate was found in fructose enriched medium (52.8mg) in 5-10days of fermentation. The carbohydrate content was gradually increased at 6-10days and slowly declined at 10-15days of fermentation. The minimum carbohydrate content was found in nitrogen enriched sources such as urea and peptone at early stages of fermentation but rapidly increased upto 54.4/100mg in 6-10days of fermentation (Figure 2). These changes indicated the utilization of carbon and nitrogen sources for production of biomass in fermentation medium.[14]

Similarly protein content of Bengal gram was gradually increased in 5-10days of fermentation. The carbon sources of disaccharides lactose and maltose showed high protein when compared with monosaccharides. The carbon, hydrogen, oxygen and nitrogen are the structural backbone of protein. The nitrogen rich peptone enhances the protein production up to the maximum yield of 18.2mg.

Glucose enriched medium showed high amount of carbohydrate (82.4mg) in 5-10 days of fermentation. The low amount of carbohydrate was observed in lactose enriched medium. The peptone and urea enriched medium showed 45-50mg of carbohydrates than carbon enriched medium. Thus the optimization of SCP was achieved by using different carbon and nitrogen sources

CONCLUSION

In conclusion higher yield of 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 green gram husk and Bengalgram husk 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 wastes to proteinaceous feed and food

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