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Production of Single Cell Protein from Fruits waste by using Saccharomyces cerevisiae.

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ABSTRACT:

The worldwide food protein deficiency is becoming alarming day to day and with the fast growing population of world,pressure is exerted on the feed industry to produce enough animal feed to meet the region's nutritional requirements.Single-Cell Protein (SCP) represents microbial cells (primary) grown in mass culture and harvested for use as proteinsources in foods or animal feeds. In the present study, Pomegranate waste, Orange waste, Banana waste, Watermelon waste was used as sole carbon source for preparation of fermentation media on which strains of yeasts, *Saccharomyces cerevisiae*used. The increased incubation time of different fruits hydrolysate enhanced the biomass yield andthe protein formation within the yeast cells. Increasing the economic value of the waste obtained after 7-day fermentation.The present finding helps in SCP production from cheap, inexpensive agro waste material.

Key words: Yeast, SCP, Pomegranate waste. Orange waste, Banana waste, Watermelon waste, *Saccharomyces cerevisiae.*

INTRODUCTION

The continual population growth in developing countries has required an increase in animal and human food supply. The increasing world demand for protein rich food led to the search for the formulation of alternative protein sources to supplement the conventional protein sources. Single Cell Protein (SCP) is one of the most important steps for this goal and is an alternative and an innovative way to successfully solve the global food problem.

The term SCP refers to dead, dry microbial cells or total proteins extracted from pure microbial cell culture and is produced using a number of different microorganisms including bacterium, fungus and algae. It can also be called biomass, bioprotein or microbial protein. The word SCP is considered to be appropriate since most of the microorganisms grow as single or filamentous individuals. Besides high protein content (about 60-82% of dry cell weight), SCP also contains fats, carbohydrates, nucleic acids, vitamins and minerals. Another advantage with SCP is that it is rich in certain essential amino acids like lysine, methionine which are limiting in most plant and animal foods. This protein can be used as additive added to the main diet instead of sources known very expensive such as soybean and fish.

India is the second major producer of fruits and vegetables in the world. It contributes 10% of world fruit production. According to India Agricultural Research Data Book 2004, the total waste generated from fruits and vegetables comes to 50 million tons per annum. Fruit wastes rich in carbohydrate content and other basic nutrients could support microbial growth Thus fruit processing wastes are useful substrates for production of microbial proteins. The utilization of fruit wastes in the production of SCP will help in controlling pollution and also in solving waste disposable problem to some extent in addition to satisfy the world shortage of protein rich food.

Different types of microbes such as bacteria, fungi, mold, algae and yeasts can be used as the sources of SCP. Algal single cell protein has limitations such as the need for warm temperatures and plenty of sunlight in addition to carbon dioxide, and also that the algal cell wall is indigestible. Bacteria are capable of growth on a wide variety of substrates, have a short generation time and have high protein content. Their use is somewhat limited by poor public acceptance of bacteria as food, small size and difficulty of harvesting and high content of nucleic acid on dried weight basis. Yeasts are probably the most widely accepted and used microorganism for single cell protein. So it will be beneficial to focus on yeast single cell protein rather than bacterial and algal single cell protein.

Over the last few years, a lot of research has been done for reprocessing and reuse of different fruit wastes for the conversion of valuable and nutritive products. Therefore the present investigation was carried out to assess the potential of various fruit wastes for cost effective yeast biomass production. In this work banana peel, pomegranate peel, and orange peels, watermelon peel were introduced as a potential substrate for fermentation to produce bioprotein which can be used in food as such or as animal feed.

MATERIALS AND METHODS

1. **Sample collection:-** From the local market(Pomegranate , Banana , Orange , Watermelon)
2. **Culture:-**Saccharomyces cerevisiae
3. **Media:-**Potato dextrose broth, Potato dextrose agar

4.Chemicals:- HCl(10%), Sodium hydroxide(1 N & 0.1N), Copper sulphate(0.5%) , Potassium sodium tartarate (1%), Bovin albumin serum, Sodium chloride, Potassium chloride, Sodium carbonate, Di sodium hydrogen phosphate, Potassium di hydrogen phosphate, Lysis buffer.

Preparation of fruit Extracts:-

The fruit peels were used as substrate for production of SCP. 50 ml of 10% (w/v) HCl was added to the each waste (40 gm) in conical flask respectively. The mixture/solution was placed in water bath for one hour. After being allowed to cool, it was filtered through Whattman filter paper. The filtrates were diluted with sterile distilled water at varying concentrations and autoclaved at121^{0}C for 15 mints. The sterile solution/broth thus prepared was used as carbon and nitrogen source for biomass production.

CHEMICAL ANALYSIS:-

The protein estimation was determined according to the methoddescribed by Follin- Lowry et al.

Fermentation and harvesting of single cell protein:-

Submerged fermentations were carried out in Conical flasks with three trial media.One of these designated Supplemented Fruit Hydrolysate (SFH) had the following composition a$(NH_4)_2SO_4$ (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 litre with Fruit Hydrolusates (FH). The second medium designated GlucoseSupplemented Fruit Hydrolysate (GFH) had all the compositions of SFH and glucose (2 gm/l).The third had the Fruit

Hydrolysate medium (FHM) only.In all the media, initial pH was adjusted to 5.5 using 1N H2SO4 and/or 1N NaOH. Eachmedium (98 ml) was transferred into 250 ml Erlenmeyer flask and sterilized at 1210C for 15mints. Inoculums of 2 ml from suspension of Saccaharomycescerevisiae was asepticallytransferred into each medium. Fermentation was carried out at 28^0C under static conditionfollowed by determination of biomass and other parameters after 4-6-8 day intervals.

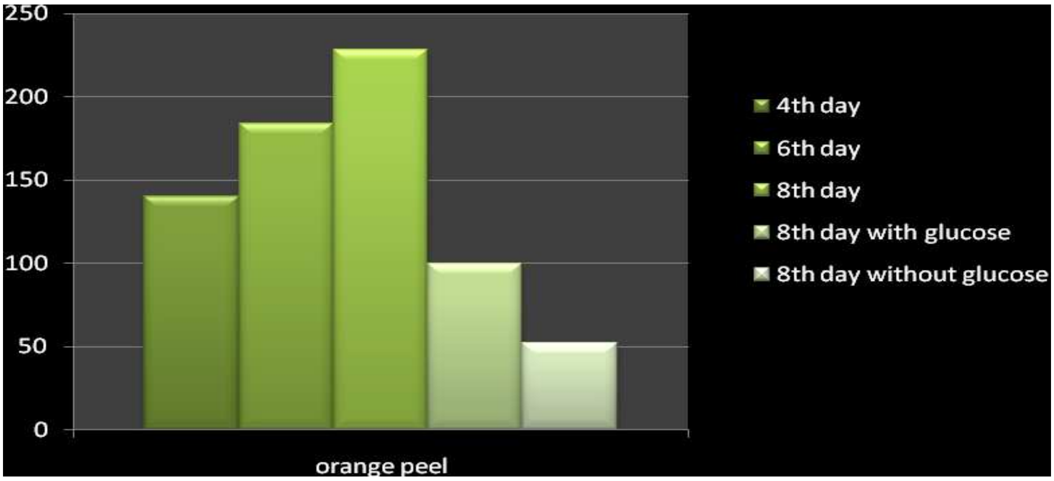
Bioconversion of fruit waste and proximate analysis of SCP:

After fermentation biomass was separated from culture broth by Wattmann filtration.

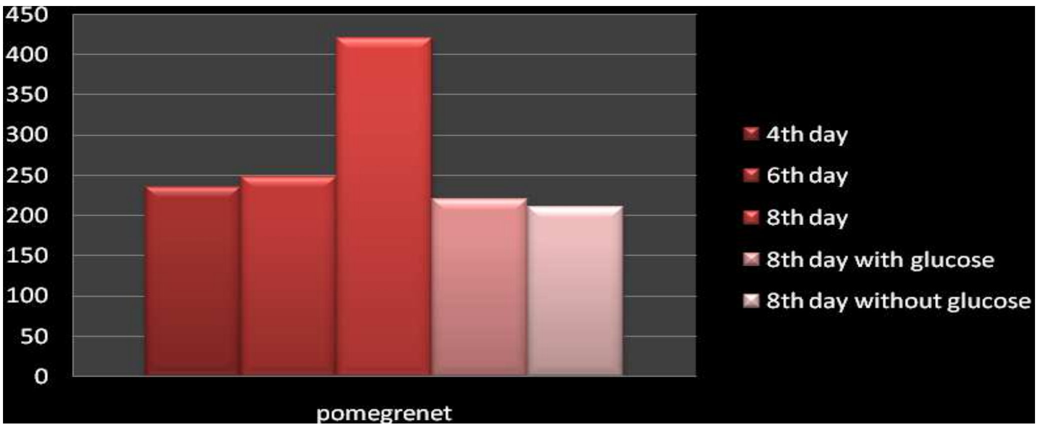
After taking the weight of wet the biomass, it was transferred into an oven dried at 100^0C for one hr followed by cooling in desiccators tobalance the temperature and weight. The biochemical constitutes of separated biomassprotein estimated.

RESULTS:-

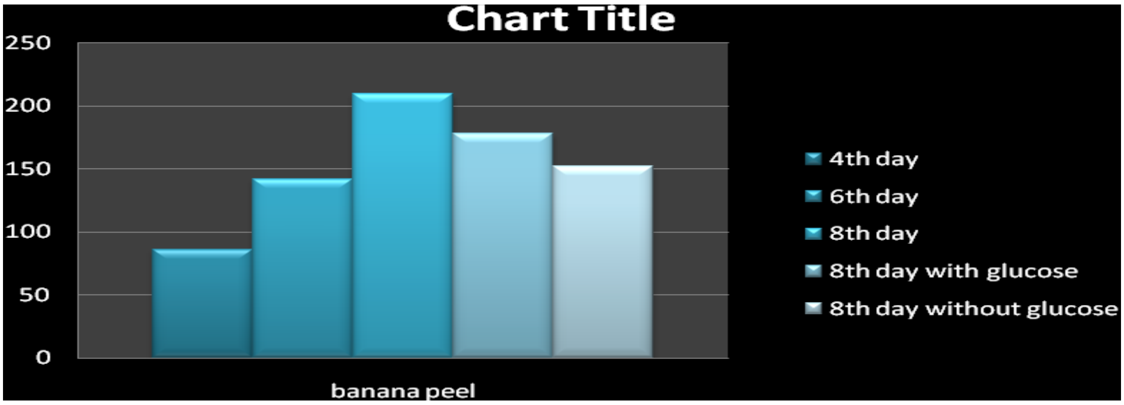
The results of the chemical analysis of the fruit peel extracts were presented in Figure. The composition of all the waste samples was significantly different for all the tested parameters



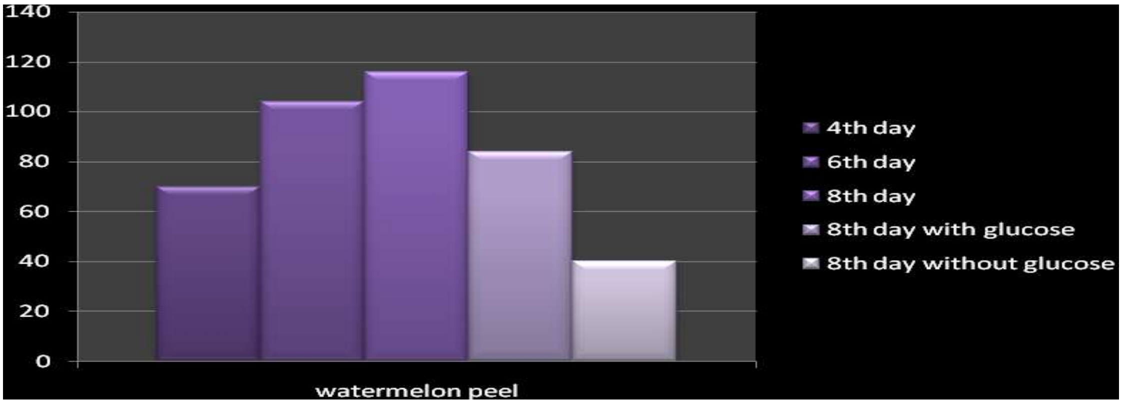
Graph1:-Production of protein from orange waste



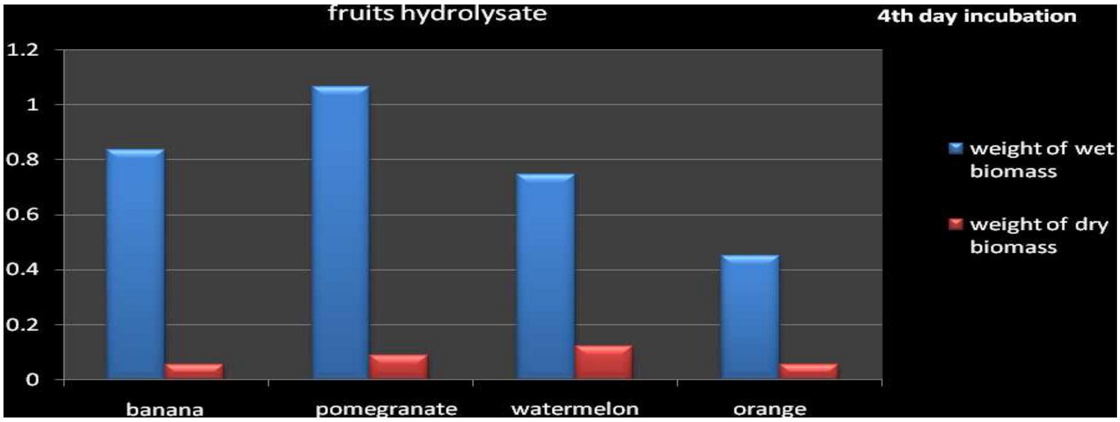
Graph2:-Production of protein from pomegranate peel



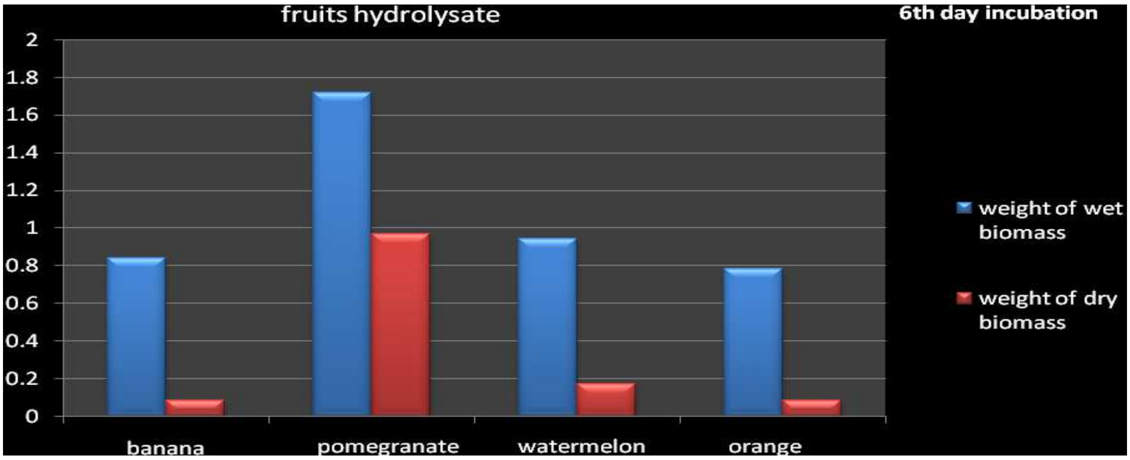
Graph3:-Production of protein from banana peel



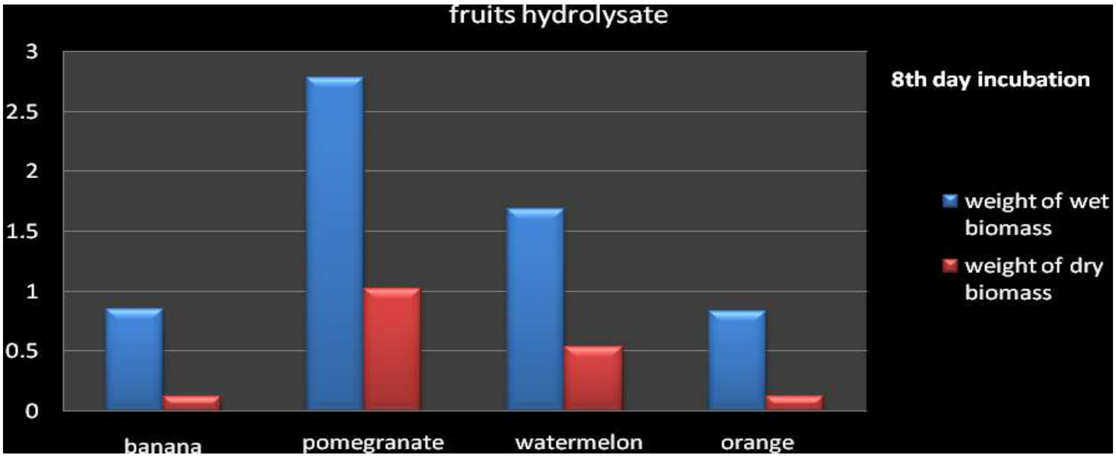
Graph4:-Production of protein from watermelon peel



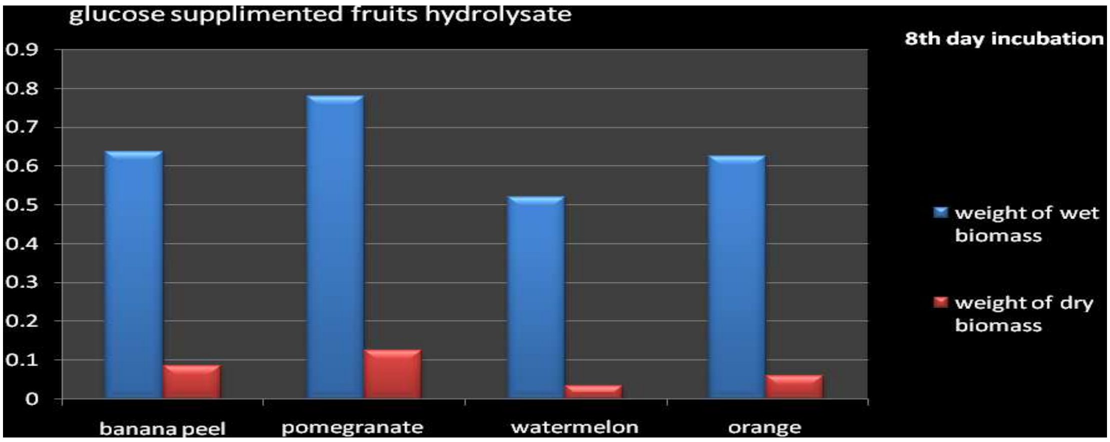
Graph5:- weight of wet and dry biomass of fruits hydrolysate after 4day incubation



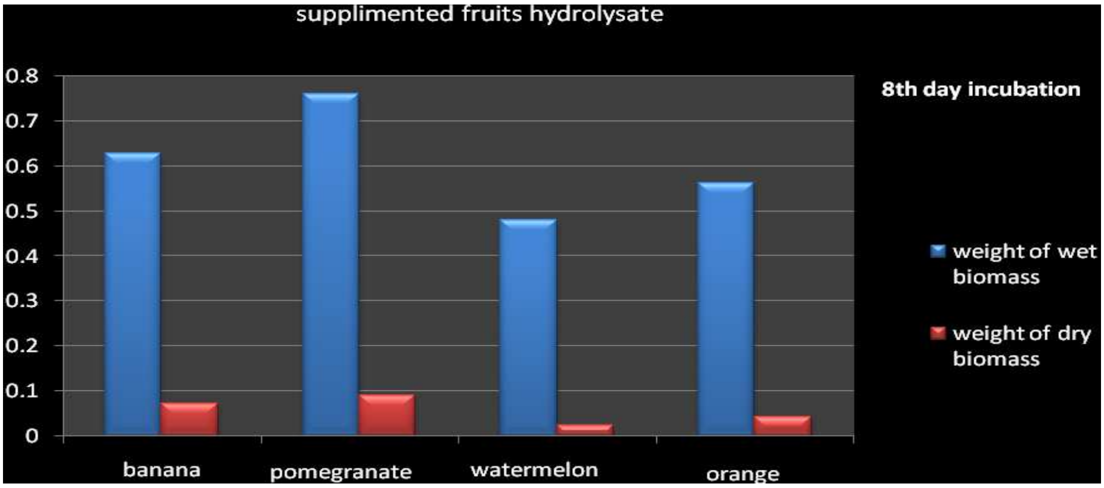
Graph6:- weight of wet and dry biomass of fruits hydrolysate after 6day incubation.



Graph7:-weight of wet and dry biomass of fruits hydrolysate after 8 day incubation



Graph8:-weight of wet and dry biomass of glucose supplemented fruits hydrolysate after 8 day incubation



Graph9:-weight of wet and dry biomass of supplemented fruits hydrolysate after 8 day incubation

CONCLUSION:

Fruit wastes can be used to produce SCP. This SCPproduced by using different fruit wastes can be further used as foodor feed.

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