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TO DETERMINE PROTEIN CONTENT OF SINGLE CELL PROTEIN PRODUCED BY USING VARIOUS COMBINATIONS OF FRUIT WASTES AND TWO STANDARD FOOD FUNGI

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ABSTRACT:

A huge quantity of fruit waste is discarded by fruit juice bars throughout the world. The disposal of fruit waste in environment can pose health hazard to living beings. Taking this into consideration the present investigation was undertaken to explore the use of fruit wastes in combinations as substrate to produce single cell protein. The various fruit wastes used in the present study included apple waste, papaya waste, orange waste, pomegranate rind, watermelon skin, pineapple skin, mango peel, guava peel and banana peel. A total of 36 different combinations of fruit wastes inoculated with two standard food fungi i.e. *Aspergillus oryzae* and *Rhizopus oliogosporus* were investigated in the present investigation. The maximum protein content with *Apergillus oryzae* was obtained to be 57.3 mg per 100 g of substrate on the combination of pomegranate rind & guava peel and with *Rhizopus oligosporus* was obtained to be 61.2 mg per 100 g substrate on the combination of pineapple skin and pomegranate rind.

Keywords: Fruit wastes, Single cell protein, *Aspergillus oryzae*, *Rhizopus oliogosporus*, Protein Content, Biomass Production

[I] INTRODUCTION

Proteins are present in all living tissues as building block components of the body. Proteins are therefore also called as building blocks of life. Proteins are important dietary constituent for the supply of nitrogen as well as sulfur. Proteins are major structural components that provide mechanical support to the body. In other words proteins are the essence of life processes and are important for proper growth and development of all the living beings. Its deficiency may lead to a number of health disorders. A large population of the world, especially those who are living below poverty line is suffering from malnutrition. There is a big gap between the demand of protein rich food and its supply to the ever increasing world population. In order to bridge this gap, single cell protein (SCP) is an innovative and an alternative way to this direction. SCP may be used as human food supplement or it may be used as animal feed, Singh [15] 1998. Khan *et. al*., 1992 [10] described single cell protein production by *Penicillium javanicum* from pre-treated rice husk. The protein from microbes is easy to obtain in crude form and nutritive. In year 2000 Anupama and Ravindra [2] studied the bioconversion of agricultural and industrial wastes to protein rich food and fodder stock. Microorganisms can utilize waste materials that cause pollution problem and also sanitary hazards. The use of wastes would help in controlling pollution and also in solving waste disposal problem to some extent. SCP production has the potential for feeding the ever increasing world population at cheaper rates. Najafpur, 2007 [13] suggested the potential of SCP to overcome shortage of food in the world. The present investigation was carried out to utilize various combinations of fruit wastes in the production of single cell protein by using two standard food fungi viz. *Apergillus oryzae* and *Rhizopus oligosporus*.

[II] MATERIAL AND METHODS

2.1. Fruit wastes used :

Different fruit wastes used in the present investigation include apple waste, papaya waste, orange waste, pomegranate rind, watermelon skin, pineapple skin, mango peel, guava peel and banana peel. These fruit wastes were collected from local fruit juice bars of Bhopal (M.P) India.

2.2. Procedure for SCP production:

The collected fruit wastes were subjected to washing under running tap water. Thereafter, different combinations of fruit wastes were prepared in the ratio of 1:1 and transferred in different conical flasks respectively. A total of 36 different combinations of fruit wastes were prepared. The flasks containing different fruit wastes combinations were then autoclaved at standard temperature of 121 ^{0} C, pressure of 15 psi for a time period of 15 minutes. After autoclaving the sterilized fruit wastes combinations were aseptically transferred in pre- sterilized Petri plates. Then upon cooling, in aseptic conditions the Petri plates containing different combinations of fruit wastes were inoculated with two standard food fungi i.e. *Apergillus oryzae* and *Rhizopus oligosporus* respectively. These Petri plates were then incubated at 28 ^{0} C for 7 days. After the growth of fungal biomass the mycelia were transferred on a filter paper (Whatmann filter paper No. 1) and washed with distilled water to remove adhering particles if any. The filter papers containing the mycelia were dried at 90 ^{0} C for 24 hours to get moisture free fungal contents.

2.3. Estimation of Protein content:

The protein content of the fungal biomass was estimated by AOAC method, 1984 [3].

[III] RESULTS

3.1 Protein content obtained :

It was determined that the maximum protein content with *Apergillus oryzae* was obtained to be 57.3 mg per 100 g of substrate on the combination of pomegranate rind & guava peel and with *Rhizopus oligosporus* it was obtained to be 61.2 mg per 100 g substrate on the combination of pineapple skin and pomegranate rind. The minimum protein content with *Apergillus oryzae* was obtained to be 24.2 mg per 100g substrate on the combination of apple waste & watermelon skin and with *Rhizopus oligosporus* it was obtained to be 29.1 mg per 100 g substrate on the combination of orange waste & mango peel [Table 1].

3.2 Best fruit waste combination:

The best fruit waste combination that produced maximum SCP was determined to be that of pomegranate rind & guava peel with *Rhizopus oligosporus*. However, with *Aspergillus oryzae* , the best fruit wastes combination was determined to be that of pineapple skin and pomegranate rind.

[IV] DISCUSSION

Many workers in their investigation have used inorganic supplements for the mycelium growth on waste materials. Dimmling and Seipenbusch 1978, [6] studied the raw material used for the production of SCP. Ojokoh and Uzeh, 2005 [14] utilized glucose (2%w/v) and $(NH_4)_2$ HPO_4 (0.25%w/v) as nitrogen source supplement for the production of *Sachharomyces cerevisiae* biomass in papaya extract medium. Adoki, 2008 [1] studied various factors influencing cell biomass production with *Candida* species. Several different fruit wastes have uitilized as substrate by a number of researchers such Kamel, 1979 [9] used dates, Ghanem,1992 [8] used beet pulp, Azin and Moazami, 1989 [4] used sugarcane bagasse, Enwefa, 1991 [7] used banana skins and Moharib, 2003, [12] used guava peel for the production of single cell protein. Yousufi *et.al.*, 2003 [18] studied effect of moisture content on the production of single cell protein using

Rhizopus oligosporus and Aspergillus oryzae grown on *okara* – wheat grit combinations. Bellamy, 1995 [5] studied the conversion of insoluble agricultural wastes to SCP by thermophilic microorganisms. Mahat and MacRae, 1992 [11] investigated on production of SCP on natural rubber waste serum using *Rhizopus oligosporus*. Yabaya and Ado, 2008 [17] studied the mycelial protein production by *Aspergillus niger* using banana peels. Steinkraus, 1986 [16] used edible substrates for the production of microbial biomass protein. The degree of mycelial biomass growth depends on the type of substrate used. Thus in the present investigation different combinations of fruit wastes were explored for biomass production (SCP) instead of dumping them.

[V] CONCLUSION

Fruit wastes can be used in different combinations to produce SCP. This SCP produced by using different combinations of fruit wastes can be further used as food or feed.

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Table 1. Protein content obtained with various combinations of fruit wastes.

S.No.	Combinations of fruit wastes	Combination ratio	Protein Content (SCP) (in mg/100 g of substrate)	
			Aspergillus oryzae	***Rhizopus oligosporus***
1	Apple waste & Papaya waste	1:1	50.1	49.3
2	Apple waste & Orange waste	1:1	55.2	51.2
3	Apple waste & Pineapple skin	1:1	41.6	33.2
4	Apple waste & Pomegranate rind	1:1	36.4	39.1
5	Apple waste & Watermelon skin	1:1	24.2	32.6
6	Apple waste & Mango peel	1:1	35.2	45.1
7	Apple waste & Guava peel	1:1	31.3	42.2
8	Apple waste & Banana peel	1:1	40.2	43.6
9	Papaya waste & Orange waste	1:1	25.2	51.3
10	Papaya waste & Pineapple skin	1:1	30.9	53.4
11	Papaya waste & Pomegranate rind	1:1	56.2	47.3
12	Papaya waste & Watermelon skin	1:1	40.3	43.9
13	Papaya waste & Mango peel	1:1	41.2	35.2
14	Papaya waste & Guava peel	1:1	49.6	36.2
15	Papaya waste & Banana peel	1:1	52.3	51.3
16	Orange waste & Pineapple skin	1:1	41.3	42.1
17	Orange waste & Pomegranate rind	1:1	30.1	40.3
18	Orange waste & Watermelon skin	1:1	36.7	42.3
19	Orange waste & Mango peel	1:1	42.1	29.1
20	Orange waste & Guava peel	1:1	53.1	31.3
21	Orange waste & Banana peel	1:1	52.2	37.5
22	Pineapple skin & Pomegranate rind	1:1	53.7	61.2
23	Pineapple skin & Watermelon skin	1:1	51.7	51.2
24	Pineapple skin & Mango peel	1:1	31.2	37.3
25	Pineapple skin & Guava peel	1:1	40.3	45.3
26	Pineapple skin & Banana peel	1:1	46.1	41.7
27	Pomegranate rind &Watermelon skin	1:1	55.7	58.3
28	Pomegranate rind & Mango peel	1:1	51.2	50.2
29	Pomegranate rind & Guava peel	1:1	57.3	58.1
30	Pomegranate rind & Banana peel	1:1	49.8	50.1
31	Watermelon skin & Mango peel	1:1	37.3	43.2
32	Watermelon skin & Guava peel	1:1	31.2	45.3
33	Watermelon skin & Banana peel	1:1	30.5	48.7
34	Mango peel & Guava peel	1:1	39.9	44.5
35	Mango peel & Banana peel	1:1	40.6	46.2
36	Guava peel & Banana peel	1:1	45.4	49.1