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Research Article

Production of Tartaric Acid by LSCF Process

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ABSTRACT

The present investigation deals with the determination of right conditions for tartaric acid fermentation using molasses as the Basal fermentation media by the fungal strain of *Aspergillus niger* NCIM-114. This strain was subjected to studies effects were caused due to pH values, temperature, incubation period and concentration of the molasses. It has been observed that optimum conditions for tartaric acid fermentation has been found when molasses solution 30% (w/v) is allowed to ferment for 15 days at 30^0C by maintaining the pH value of the fermentation medium at 2.0 in the presence of fungus *Aspergillus niger* NCIM -114.

Keywords: Tartaric acid: Fermentation, Molasse: *Aspergillus niger* NCIM -114.

INTRODUCTION

The studies of tartaric acid fermentation is virtually as important to the success of an industrial fermentation as in the selection of an organism to carry out the fermentation[1-10] . The fermentation medium supplies nutrients for growth, energy, building of cell substances and biosynthesis of microbial products[11-15]. A poor choice of fermentation medium components can cause limited cellular growth and little if any yield of fermentation products[16-20]. Thus, parametric studies of tartaric acid fermentation are critical.

EXPERIMENTAL

Study the concentration of substrate: The concentration of sugar substrates (molasses) in fermentor flasks of 1st to 10th sets were 3% , 9%, 18%, 30%,40%, 45%, 55%, 60%, 65% and 70% respectively. The fermentor flasks were sterilized, cooled and inoculated with 0.05 ml conidial suspension of *Aspergillus niger* NCIM -114 and incubated at 30^0C in an incubator for 15 days. The broth contents of the fermentor flasks were estimated for tartaric acid produced.

Study of pH of production medium:. The first five sets desired amount of KCI-HCI buffer-solution were added to adjust the pH at 1.2, 1.4, 1.6, 1.8 and 1.9 respectively. Similarly the pH value 2.0, 2.5, 2.6, 2.8 and 3.0 were kept in the sets from 6-10 respectively. The pH adjusted in each set was also ascertained by the pH meter. Then the total volume in each fermentor flask was made upto 100 ml by adding requisite amount of distilled water. Now, the fermentor flasks were plugged with non- absorbent cotton wool and were sterlized in an autoclave maintained at 15 Ibs steam pressure for 45 minutes. Afer sterilization the fermentor flasks were allowed to cool at room temperature and then inoculated with 0.05 ml conidial broth suspension of *Aspergillus niger* NCIM -114.

The fermentator flasks were then incubated at 30 ^{0}C for 15 days in an incubator. The fermented broth contents of the fermentor flasks were estimated after 15 days for the tartaric acid produced

Study of temperature :. These fermentor flasks were sterilized, cooled and inoculated with 0.05 ml conidial broth suspension of *Aspergillus niger* NCIM -114. 1st to 10th sets of fermentor flasks were incubated at 10, 15, 20, 28, 30, 36, 38, 40, 45, and 50^0C respectively for 15 days. The fermented broth contents of the fermentor flasks were estimated for the tartaric acid produced.

Study of incubation period : The fermentor flasks were sterlized, cooled and incubated with 0.05ml conidial broth suspension of *Aspergillus niger* NCIM -114 and were incubated at 30^0C in an incubator. The fermented broth contents of the fermentor flasks were estimated after 2, 4, 6, 8, 10, 12, 15, 22, 25 and 30 days of incubation period for tartaric acid produced.

RESULTS AND DISCUSSION

The results obtained in the study of different carbohydrate fermentation using the fungal strain of *Aspergillus niger* NCIM - 114 for the biosynthesis of tartaric acid by LSCF-process is tabulated in the Table -1. From the results it is evident that fermentability of carbohydrate substrate becomes very easier and frequent as the molecular size and complexity of the sugar (carbohydrate substrate) molecule decreases. Monosaccharide glucose and fructose has been found most fermentable amongst the sugars due to the presence of carbonyl group. The degree of fermentability of galactose was nearly close to glucose and fructose. The fermentability of arabinose, rhamnose, and sorbose were almost (in less amount) insignificant. Amongst disaccharides, sucrose has been found only suitable sugar substrate for significant yield of tartaric acid. Lactose did not give significant yield of tartaric acid during the biosynthesis of tartaric acid by LSCF-process by *Aspergillus niger* NCIM 114. The mannitol was also found less fermentable to give tartaric acid. In the case of polysaccharides:starch, inuline and dextrine were found very much insignificant and unfavourable for biosynthesis of tartaric acid by LSCF-process by *Aspergillus niger* NCIM – 114. In the case of molasses yield of tartaric acid has been found on the basis of fermentable sugars present in molasses, it has been found approximately 54.70% in 15 days of incubation period. Thus, molasses has been employed as a richest economical and cheapest source of energy during present investigation for biosynthesis of tartaric acid by LSCF-process by *Aspergillus niger* NCIM – 114. The organism *Aspergillus* has been tested for the typical production medium. It was considered worthwhile to vary the concentration of carbohydrate substrate to study the effect on tartaric acid fermentation. The concentrations thus optimized are with a substrate concentration of 30% molasses (w/v) under the optimized conditions developed and different molasses concentrations used are recorded in the Table - 1. Maximum conversion of molasses into tartaric acid is obtained by using 30% molasses solution in 15 days of optimum incubation period for tartaric acid fermentation. The results of the effect of pH are recorded in the Table - 1. Literature available on tartaric acid and some other fermentations shows that fermentative production of tartaric acid and some other compounds were very less at lower- hydrogen ion concentrations. It was observed that at pH values 1.2 and 1.4 the production of tartaric acid was found to be insignificant. It was further found that at pH value of 1.6 the production of tartaric acid (2.51 g/100 ml) was found to be slight better than at the pH 1.2 and 1.4, at pH 2.0 the production of citric acid was found maximum, i. e., 8.09 g/100 ml. After this pH the production has been found in decreasing order for tartaric acid. It is thus, obvious that pH 2.0 is optimum for tartaric acid fermentation, therefore, this pH has been maintained in the production medium for biosynthesis of tartaric acid by LSCF-process throughout the present investigation.

The data recorded in the Table-1 indicates that lower temperature and higher temperatures both are deactivating for tartaric acid fermentation processes. At lower temperature, the yield of tartaric acid was minimum and it was 3.17 g/100 ml at 10^0C, while the maximum yield of tartaric acid; i.e., 8.12 g/100 ml was found at 30^0C and therefore, this temperature was selected and maintained throughout the investigation of this work for biosynthesis of tartaric acid by LSCF- process by *Aspergillus niger* NCIM – 114 The data given in the Table-1 indicates that the production of tartaric acid increases with the increase in incubation period. In the case of tartaric acid fermentation it increases from 2 to 15 days and then it drops gradually. However, incubation periods of 17, 17 and 20 days has marginal difference in the yield of tartaric acid by *Aspergillus niger* NCIM – 114. Thus, it was concluded that the incubation period of 15 days for biosynthesis of citric acid by LSCF-process is the best, significant and suitable for the maximum production of citric acid, i.e., 8.15 g/100 ml from 30% molasses solution using the fungal strain of *Aspergillus niger* NCIM – 114. Thus, it may be summarised that tartaric acid fermentation by the fungal strain of *Aspergillus niger* NCIM - 114 proceeds best when molasses solution 30% (w/v) is allowed to ferment for 15 days of incubation period at 30 ^{0}C temperature by mailtaining the pH value of fermenting medium at 2.o along with other nutrional ingredients required by the fungus *Aspergillus niger* NCIM - 114.

Table 1: Effect of concentration of molasses substrate, pH, temperature and incubation period on biosynthesis of citric acid by LSCF process

% of Molasses	pH values	Temp. in (^{0}C)	Incubation period in days	Corresponding yield of citric acid* in g/100 ml			
3	1.2	10	2	0.43	nd	3.17	2.51
9	1.4	15	4	0.010	nd	5.02	2.90
18	1.6	20	6	6.02	2.51	7.17	5.53
30	1.8	30	8	8.09	3.18	8.12	5.71
40	1.9	31	10	11.16	4.02	8.12	6.00
45	2.0	36	12	14.20	8.09	8.14	8.15
55	2.4	38	14	nd	8.22	7.88	7.84
60	2.6	40	22	nd	6.07	nd	nd
65	2.8	45	25	nd	4.35	nd	nd
70	3.0	50	30	nd	2.28	nd	nd

CONCLUSION

Fungal strain of *Aspergillus niger* NCIM-114 was subjected to studies effects were caused due to pH values, temperature, incubation period and concentration of the molasses. It has been observed that optimum conditions for tartaric acid fermentation has been found when molasses solution 30% (w/v) is allowed to ferment for 15 days at 30^{0}C by maintaining the pH value of the fermentation medium at 2.0

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