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# Efficacy of sodium hexadecyl sulfate on $H_3$Cit by *Aspergillus niger* T-918

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**Abstract**: The efficacy of Sodium hexadecyl sulfate on LSF bioproduction of citric acid by *Aspergillus foetidus* T-501, *Aspergillus fischeri* T-611 6.968, *Aspergillus geganticus* T-715 , *Aspergillus oryzae* T-816, *Aspergillus niger* T-918 has been assessed. It has been observed that the fungal strain *Aspergillus niger* T-918 has been found most significant and effective for the citric acid fermentation process. It has been found that the compound, i.e., sodium hexadecyl sulfate has stimulatory effect on bioproduction of citric acid by *Aspergillus niger* T-918 and enhances the yield of citric acid to an extent of 18.646 % higher in comparison to control fermenter flasks, i.e., 11.116g/100 ml under the optimized conditions.

(**Keywords:** Citric acid fermentation, Sodium hexadecyl sulfate and *Aspergillus niger* T-918)

## Introduction

Micelles are nanosized colloidal dispersions prepared from amphiphilic molecules, with a hydrophobic tail and a hydrophilic head. The hydrophobic core acts as a reservoir for hydrophobic drugs and the hydrophilic shell stabilizes the hydrophobic core.[1-10] The investigation concerns chemical reactions occurring inside the particular type of biologically important aggregate, the micelles[11-12].

Micelles either accelerates or retards the organic reactions depending on its nature[13-20]. It is assumed that micelles are moderators of enzyme actions in some biological systems. There are several known micelles, but a very few micelles have been used in submerged fermentation processes. Since micellar effect on fermentation studies especially citric acid fermentation is relatively new and almost unexplored it needs careful and specific experimentations. In the present investigation the author has made an attempt to study the effect of sodium pentadecyl sulfate on bioproduction of $H_3$Cit by *Aspergillus niger* T-918.

## Experimental

The influence of sodium hexadecyl sulfate on bioproduction of $H_3$Cit by *Aspergillus niger* T-918.

The composition of production medium for the bioproduction of $H_3$Cit by *Aspergillus niger* T-918 is prepared as follows:

Molasses - 30% w/v, Ammonium nitrate- 0.55%
Potassium dihydrogen phosphate-0.55%
Magnesium sulphate-0.55%, Distilled water to make up 100 ml, pH -2.0

The pH of the production medium was adjusted to 2.0 by adding requisite amount of KCI-HCI buffer solution, and this pH was also ascertained by a pH meter. The above composition medium represents volume of a fermentor flask, i.e., "100ml" on bioproduction of $H_3$Cit by *Aspergillus niger* T-918. Now, the same production medium of citric acid ($H_3$Cit) by *Aspergillus niger* T-918 was prepared for 99-fermentor flask, i. e; each contained '100ml' of production medium.

The above 99-fermentor flasks were then arranged to 11-sets each comprising of 9-

**Table - 1**
**Efficacy of Sodium hexadecyl sulfate on $H_3Cit$ by *Aspergillus niger* T-918**

| Concentration of micell used A X $10^{-x}$ M | Incubation Period in days | Yield of citric acid*in ml/100ml | Molasses* left unfermented in g/100 ml | % of citric acid increased after 13 days |
|---|---|---|---|---|
| Control | 11 | 7.896 | 5.592 | - |
| (-) Micelle | 13 | 9.369 | 4.519 | - |
| | 15 | 6.357 | 4.385 | - |
| $1.0x10^{-5}$M | 11 | 7.998 | 5.490 | - |
| (+) Micelle | 13 | 9.493 | 4.395 | +1.323 |
| | 15 | 6.439 | 4.278 | - |
| $2.0x10^{-5}$M | 11 | 8.069 | 5.419 | - |
| (+) Micelle | 13 | 9.577 | 4.311 | +2.220 |
| | 15 | 6.496 | 4.209 | - |
| $3.0x10^{-5}$M | 11 | 8.156 | 5.332 | - |
| (+) Micelle | 13 | 9.684 | 4.204 | +3.362 |
| | 15 | 6.566 | 4.115 | - |
| $4.0x10^{-5}$M | 11 | 8.417 | 5.071 | - |
| (+) Micelle | 13 | 9.990 | 3.898 | +6.628 |
| | 15 | 6.566 | 3.687 | - |
| $5.0x10^{-5}$M | 11 | 8.630 | 4.858 | - |
| (+) Micelle | 13 | 10.242 | 3.646 | +9.317 |
| | 15 | 6.948 | 3.542 | - |
| $6.0x10^{-5}$M | 11 | 8.883 | 4.605 | - |
| (+) Micelle | 13 | 10.544 | 3.344 | +12.541 |
| | 15 | 7.151 | 3.281 | - |
| $7.0x10^{-5}$M** | 11 | 9.364 | 4.125 | - |
| (+) Micelle | 13 | 11.116*** | 2.772 | +18.646 |
| | 15 | 7.539 | 2.681 | - |
| $8.0x10^{-5}$M | 11 | 8.590 | 4.898 | - |
| (+) Micelle | 13 | 10.200 | 3.688 | +8.869 |
| | 15 | 6.916 | 3.715 | - |
| $9.0x10^{-5}$M | 11 | 8.235 | 5.253 | - |
| (+) Micelle | 13 | 9.778 | 4.115 | +4.365 |
| | 15 | 6.630 | 4.004 | - |
| $10.0x10^{-5}$M | 11 | 7.982 | 5.506 | - |
| (+) Micelle | 13 | 9.476 | 4.412 | +1.142 |
| | 15 | 6.426 | 4.310 | - |

* Each value represents mean of three trials ** Optimum concentration of micelle used
*** Optimum yield of citric acid (+) values indicate % increase in the yield of citric acid after 13 days. Experimental deviation (±) 1.5-3%

fermentor flasks. Each set was then rearranged in 3-subsets, each consisting of 3-fermentor flasks. The remaining 9-fermentor flasks out of 99-fermentor flasks were kept as control and these were also rearranged in 3-subsets each consisting of 3-fermentor flasks.

After preparing the above sets of fermentor flasks M/1000 solution of sodium hexadecyl sulfate was prepared and from the above micell solution 1.0, 2.0, 3.0, 4.0, 5.0, 6.0, 7.0, 8.0, 9.0 and 10 ml was added to the fermentation flasks of above 1st to 10th sets respectively. The control fermentor flasks contained no micelle.

Now, the total volume in each fermentor flasks was made upto 100 ml by adding requisite amount of distilled water. Thus, the molar concentration of sodium hexadecyl sulfate in 1st, 2nd, 3rd, 4th, 5th, 6th, 7th, 8th, 9th and 10th subsets were approximately as given below :

$A \times 10^{-x}$ M i.e., $1.0 \times 10^{-5}$M to$10.0 \times 10^{-5}$M
Where :
A = amount of micelle, in ml, i.e. 1.0 ml ..... to 10 ml.,
x =Molarity of the micelle solution

The above fermentor flasks were then sterilized, cooled inoculated, incubated at $27^0$C and analysed after 11, 13 and 15 days for citric acid[22] formed and molasses[23] left unfermented.

**The influence of sodium hexadecyl sulfate**

The data given in the table -1 shows that the micelle sodium hexadecyl sulfate has also been found stimulatory for the bioproduction of $H_3Cit$ by *Aspergillus niger* T-918. From the data given in the table-1 it is obvious that sodium hexadecyl sulfate influences the citric acid fermentation process in different phases. The main characteristics of the sodium hexadecyl sulfate is as follows :

(i) Sodium hexadecyl sulfate is stimulatory at its all molar concentrations used during the course of fermentation for bioproduction of $H_3Cit$ by *Aspergillus niger* T-918 i. e., from $1.0 \times 10^{-5}$M to $10.0 \times 10^{-5}$M.

(ii) The molar concentration $1.0 \times 10^{-5}$M to $7.0 \times 10^{-5}$ M of sodium hexadecyl sulfate influence the yield of citric acid ($H_3Cit$) in a approximately regular increasing order after each state, i. e., 1.323%, 2.220%, 3.362%, 6.628%, 9.317%, 12.541% and 18.646%

(iii) The molor concentration $8.0 \times 10^{-5}$M to $10.0 \times 10^{-5}$M of sodium hexadecyl sulfate also influences the productivity of citric acid in a regular decreasing manner. The % increase in the yield of citric acid ($H_3Cit$) at respective molar concentration of Sodium hexadecyl sulfate has been found to be as follows : 8.869% , 4.365%, and 1.142%

(iv) The maximum yield of citric acid, ($H_3Cit$) i,e; 11.116g/100 jml in the presence of sodium hexadecyl sulfate was observed at $7.0 \times 10^{-5}$M molar concentration in 13 days of optimum incubation period which is 18.646% higher in comparison to control fermentor flasks, ie; 9.369g/100 ml in the same times course and other same experimental parameters.

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