

Bioconversion of molasses to ethanol exposed to sodium lauryl sulphate

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Abstract : The micellar action of sodium lauryl sulphate was studied on bioconversion of molasses to ethanol by *Saccharomyces cerevisiae* S-1605. It was found that sodium lauryl sulphate enhances the yield of ethanol to an extent of 5.50724% higher in comparison to control.

(Keywords : Micellar effect, sodium lauryl sulphate, ethanol, *Saccharomyces cerevisiae* S-1605).

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 micelles¹¹⁻¹².

Micelles either accelerates or retards the organic reactions depending on its nature¹³⁻²⁰. It is assumed that micelles are moderators of enzyme actions in some biological systems²¹⁻²³. There are several known micelles, but a very few micelles have been used in submerged fermentation processes²⁴⁻²⁷. Since micellar effect on fermentation studies especially lactic acid fermentation is relatively new and almost unexplored it needs careful and specific experimentations. In the present investigation the authors have made an attempt to study the effect of sodium lauryl sulphate on alcoholic fermentation by *Saccharomyces cerevisiae* S-1605

Experimental

The influence of sodium lauryl sulphate on bioconversion of molasses to ethanol by *Saccharomyces cerevisiae* S-1605

The composition of production medium for the bioconversion of molasses to ethanol by *Saccharomyces cerevisiae* S-1605 is prepared as follows : Molasses :25%; Malt extract : 0.40%; Yeast extract : 0.400%; Peptone : 0.60%; (NH₄)₂HPO₄ : 0.40%, pH : 5.0

Distilled water was added to make up the volume up to '100 ml'. The pH of the medium was adjusted to 5.0 by adding requisite amount of lactic acid.

Now, the same production medium for bioconversion of molasses to ethanol by *Saccharomyces cerevisiae* S-1605 was prepared for 99 fermentor-flasks, i.e., each containing 100 ml of the production medium. These fermentor flasks were then arranged in 10 sets each comprising 9 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.

Now, M/1000 solutions of sodium lauryl sulphate, was prepared and 1.0, 2.0, 3.0, 4.0, 5.0, 6.0, 7.0, 8.0, 9.0, and 10.0 ml of this solution was added to the fermentor-flasks of first 10 sets respectively. The control fermentor-flask contained no chemical micelle. The total volume in each fermentor-flask was made upto '100 ml' by adding requisite amount of distilled water.

Table - 1
Bioconversion of molasses to ethanol exposed to sodium lauryl sulphate

Concentration of micell used A X 10 ^{-x} M	Incubation Period in hours	Yield of ethanol*in ml/100ml	Molasses* left unfermented in g/100 ml	%Diff. in the yield of ethanol in 50 hrs
Control	25	3.70	3.90	-
(-) micelle	50	6.90	0.99	-
	75	5.90	0.95	-
1.0 x 10 ⁻⁵ M	25	3.76	3.88	-
(+) micelle	50	7.08	0.98	+ 2.60869
	75	6.00	0.94	-
2.0 x 10 ⁻⁵ M	25	3.77	3.86	-
(+) micelle	50	7.10	0.96	+ 2.89855
	75	6.02	0.95	-
3.0 x 10 ⁻⁵ M	25	3.79	3.84	-
(+) micelle	50	7.12	0.95	+ 3.18840
	75	6.04	0.94	-
4.0 x 10 ⁻⁵ M	25	3.81	3.83	-
(+) micelle	50	7.16	0.94	+ 3.76811
	75	6.05	0.93	-
5.0 x 10 ⁻⁵ M	25	3.84	3.81	-
(+) micelle	50	7.18	0.92	+ 4.05797
	75	6.10	0.90	-
6.0 x 10 ⁻⁵ M**	25	3.86	3.79	-
(+) micelle	50	7.28***	0.88	+ 5.50724
	75	6.13	0.85	-
7.0 x 10 ⁻⁵ M	25	3.85	3.80	-
(+) micelle	50	7.26	0.89	+ 5.21739
	75	6.12	0.86	-
8.0 x 10 ⁻⁵ M	25	3.84	3.81	-
(+) micelle	50	7.25	0.90	+ 5.027246
	75	6.10	0.88	-
9.0 x 10 ⁻⁵ M	25	3.82	3.83	-
(+) micelle	50	7.18	0.92	+ 4.05797
	75	6.08	0.89	-
10.0 x 10 ⁻⁵ M	25	3.80	3.85	-
(+) micelle	50	7.17	0.93	+ 3.91304
	75	6.06	0.90	-

* Each value represents mean of three trials., ** Optimum concentration of micelle used.

*** Optimum yield of ethanol in 50 hours. (+) Values indicate % increase in the yield of ethanol after 50 hours. Experimental deviation (±) 1.5-3%.

Thus, the concentration of sodium lauryl sulphate in first, second, third, fourth, fifth, sixth, seventh, eighth, ninth and tenth subsets were approximately as given below :

$a \times 10^{-x} \text{M}$, $1.0 \times 10^{-5} \text{M}$, $2.0 \times 10^{-5} \text{M}$, $3.0 \times 10^{-5} \text{M}$, $4.0 \times 10^{-5} \text{M}$, $5.0 \times 10^{-5} \text{M}$, $6.0 \times 10^{-5} \text{M}$, $7.0 \times 10^{-5} \text{M}$, $8.0 \times 10^{-5} \text{M}$, $9.0 \times 10^{-5} \text{M}$; and $10.0 \times 10^{-5} \text{M}$

Where, a =amount of micelles in ml, ie; from 1.0 ml to 10.0 ml., x = molarity of the solution respectively.

The fermentor-flasks were then steam sterilized, cooled, inoculated, incubated at 30°C and analysed colorimetrically after 25, 50 and 75 hours for ethanol²⁸ formed and molasses²⁹ left unfermented.

Results and Discussion

The influence of sodium lauryl sulphate on bioconversion of molasses to ethanol :

The data given in table - 1 shows that the micelle sodium lauryl sulphate is stimulatory for bioconversion of molasses to ethanol by *S. cerevisiae* S-1605 upto its concentration from $1.0 \times 10^{-5} \text{M}$ to $6.0 \times 10^{-5} \text{M}$, in different phases :

In the initial phase, ie., from $1.0 \times 10^{-5} \text{M}$ to $6.0 \times 10^{-5} \text{M}$ there has been a regular improvement in the production of ethanol being 2.60%, 2.89%, 3.18%, 3.76%, 4.05% and 5.50% in comparison to control fermentor flasks respectively. However, the maximum yield of ethanol was obtained at sodium lauryl sulphate micellar concentration of $6.0 \times 10^{-5} \text{M}$.

In the next phase, i.e., $7.0 \times 10^{-5} \text{M}$ to $8.0 \times 10^{-5} \text{M}$ micellar concentration of sodium lauryl sulphate the yield of ethanol was not encouraging as the product was found less in comparison to first phase. There has been a regular fall in the production of ethanol being 5.21% and 5.07% respectively.

However, the yield of ethanol in third phase, i.e., in between $9.0 \times 10^{-5} \text{M}$ and $10 \times 10^{-5} \text{M}$ micellar concentration of sodium lauryl sulphate the yield of alcohol has been found very less being 4.05% and 3.91% respectively in comparison to control fermentor flasks.

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