

Efficacy of cytokinin on natural production of bioethanol

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Abstract : Fermentation of a micro organism is increased by including a cytokinin into the fermentation medium. In this communication we have studied the efficacy of dihydro-Zeatin, a cytokinin on natural production of bioethanol by *Saccharomyces cerevisiae* PK-255 and have found that it has got significant effect on natural production of bioethanol and could enhance the yield of bioethanol to an extent of 5.263% higher in comparison to control.

(Keywords : Cytokinins, dihydro-Zeatin bioethanol, *Saccharomyces cerevisiae* PK-255).

Introduction

Dihydrozeatin, which is zeatin with a saturated side chain, has also been identified in many species, whereas cis-zeatin and isopentenyladenine are generally

Cytokinins are plant growth hormones that stimulate cell division in shoots and roots. Cytokinins are classified into two types: adenine-type and phenyl urea-type. Cytokinins have a variety of applications, including biomedicine, pharmaceuticals, and agriculture.

The global cytokinins market is experiencing increased demand as a result of advances in botany. The excellent properties of cytokinin extracts have played an important role in the global market's expansion. Furthermore, cell division research and analysis in plants is an important part of botanical research and analysis.

The medical community is conducting extensive research into the properties of cytokinins. A

number of research studies have found that cytokinins have medical benefits. Other schools of thought, however, question the veracity of the former's claims. Nonetheless, the global cytokinins market is expected to expand at a rapid pace in the coming years.

Cytokinins are a class of plant growth substances (phytohormones) that promote cell division, or cytokinesis, in plant roots and shoots. They are involved primarily in cell growth and differentiation, but also affect apical dominance, axillary bud growth, and leaf senescence.

The cytokinins in general play a crucial role and promote the course of different biochemical reactions. Cytokinins are adenine derivatives and they have common and important effects in addition to promote cytokinesis¹⁻⁵. Therefore, overall growth requires cell expansion, and growth promotion by cytokinins involves faster cell expansion and production of larger cells. Cytokinins increase cell division⁶⁻¹² and might normally be required for different biological processes. Some promotive effect of cytokinins on RNA and enzyme formation is also suspected, partly because their effects are usually blocked by inhibitors of RNA or protein synthesis.

Bioethanol is naturally produced by the fermentation of sugar by yeasts. It is used as a chemical solvent and in the synthesis of organic compounds as well as an alternative fuel sources. The principal fuel used as a petrol substitute for road transport vehicle is bioethanol. Bioethanol

Table - 1
Efficacy of cytokinin on natural production of bioethanol

Concentration of cytokinin used A X 10 ^{-x} M	Incubation Period in hours	Yield of alcohol*in ml/100ml	Molasses* pollutant left unfermented in g/100 ml	%Diff. in the yield of alcohol in 48 hrs
Control	48	7.60	1.119	-
1.0 x 10 ⁻⁵ M	48	7.65	1.116	(+) 0.657
2.0 x 10 ⁻⁵ M	48	7.68	1.012	(+) 1.052
3.0 x 10 ⁻⁵ M	48	7.78	1.000	(+) 2.368
4.0 x 10 ⁻⁵ M	48	7.81	0.983	(+) 2.763
5.0 x 10 ⁻⁵ M	48	7.86	0.901	(+) 3.421
6.0 x 10 ⁻⁵ M	48	7.90	0.855	(+) 3.947
7.0 x 10 ⁻⁵ M	48	7.95	0.806	(+) 4.605
8.0 x 10 ⁻⁵ M**	48	8.00**	0.754	(+) 5.263
9.0 x 10 ⁻⁵ M	48	7.80	0.793	(+) 2.631
10.0 x 10 ⁻⁵ M	48	7.75	0.812	(+) 1.973

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

*** Optimum yield of alcohol in 48 hours. (+) Values indicate % increase in the yield of alcohol after 48 hours. Experimental deviation ($\pm$) 1.5-3%.

production is a game changer for the industry.

as follows :

The role of cytokinins in fermentation technology specially alcoholic fermentation which is basically enzyme catalysed reaction has been a subject of much investigation^{13,14}. Since a very little work has been observed on alcoholic fermentation exposed to cytokinins, the authors have made an attempt to study the alcoholic fermentation exposed to a cytokinin, ie; dihydro-zeatin

Molasses :28%; Malt extract : 0.280%; Yeast extract : 0.280%; Peptone : 0.5%; (NH₄)₂HPO₄ : 0.280%, pH : 5.1

Distilled water was added to make up the volume up to '100 ml'. The pH of the medium was adjusted to 5.1 by adding requisite amount of lactic acid.

Experimental

The influence of dihydro-Zeatin on natural production of bioethanol from molasses by *Saccharomyces cerevisiae* -PK-255.

The composition of production medium for the natural production of bioethanol by *Saccharomyces cerevisiae* PK-255 is prepared

Now, the same production medium for natural production of bioethanol by *Saccharomyces cerevisiae* -PK-255 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 dihydro-Zeatin 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 cytokinin. The total volume in each fermentor-flask was made upto '100 ml' by adding requisite amount of distilled water.

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

$a \times 10^{-8} \text{M}$, $1.0 \times 10^{-5} \text{M}$, $2.0 \times 10^{-5} \text{M}$, $3.0 \times 10^{-5} \text{M}$, $4.0 \times 10^{-5} \text{M}$, $5.0 \times 10^{-5} \text{M}$, $6.0 \times 10^{-5} \text{M}$, $7.0 \times 10^{-5} \text{M}$, $8.0 \times 10^{-5} \text{M}$, $9.0 \times 10^{-5} \text{M}$; and $10.0 \times 10^{-5} \text{M}$

Where, a=amount of cytokinin 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 31°C and analysed colorimetrically after 48 hours for alcohol¹⁵ formed and molasses¹⁶ pollutant left unfermented.

Results and Discussion

The influence of dihydro-Zeatin

The data recorded in the table-1 shows

that dihydro-Zeatin has stimulatory effect on natural production of bioethanol by *Saccharomyces cerevisiae* -PK-255.

The data (cf. table-1) reveals that the cytokinin isopentenyladenine stimulates the alcoholic fermentation process and enhances the yield of alcohol upto its (isopentenyladenine) concentrations from $1.0 \times 10^{-5} \text{M}$ to $10.0 \times 10^{-5} \text{M}$.

It is evident from the results that the cytokinins under trial is moderate stimulatory for the natural production of bioethanol by the yeast strain of *Saccharomyces cerevisiae*-PK-255 and enhances the production of bioethanol upto $1.0 \times 10^{-5} \text{M}$ to $8.0 \times 10^{-5} \text{M}$. The maximum yield of bioethanol, i.e. 8.00 ml/100ml was observed at the molar concentration $8.0 \times 10^{-5} \text{M}$ of isopentenyladenine which is 5.263% higher in comparison to control fermentor flasks, i.e., 7.60ml/100ml in 48 hrs of optimum incubation period.

However, addition of isopentenyladenine to the production medium in concentration between $1.0 \times 10^{-5} \text{M}$ to $10 \times 10^{-5} \text{M}$ enhances the production of alcohol and thus yield of alcohol was found to be higher in each case in comparison to control in 48 hrs of optimum incubation period and same experimental conditions.

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