

## Efficacy of CKs on biotic production of bioethanol a renewable energy sources

Shilpi Singh

Department of Chemistry, Doranda College, Ranchi-834002, Jharkhand  
Email : ssinghchemru@gmail.com

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**Abstract :** Cytokinins (CKs) are plants hormones that promote cell growth and division, while there is limited direct research on cytokinins efficiency in bioethanol production. Cytokinins might influence microorganisms growth and fermentation efficiency. However, more research is needed to fully understand the efficacy of cytokinins (CKs) in bioethanol production. In the present communication the impact of some cytokinins, ie; zeatin (ZEA) on biotic production of bioethanol by some bioethanol producing microorganisms such as *Saccharomyces cerevisiae* SS-116 *Zymomonas mobilis* SS-325 and *Aspergillus niger* SS-180 has been assessed. It has been found that the yeast strain of *Saccharomyces cerevisiae* SS-116 has been found most promising and best bioethanol producing strain of yeast microbe. The compound zeatin was found stimulatory and effective when 30% molasses solution (w/v) is allowed to ferment at pH 5.1, temperature 30°C and incubation period of 50 hrs. It has been found that there is a gradual increase in the biotic production of bioethanol with stepping of compound zeatin till the maximum yield of bioethanol, ie; 8.75 mL/100 mL was obtained at its molar concentration of  $6.0 \times 10^{-3}$  M which is 12.179% higher a comparison to control, ie; 7.80 mL/100 mL.

**(Keywords :** Cytokinins, Zeatin bioethanol, *Saccharomyces cerevisiae* SS-116.

### Introduction

Zeatin is a plant growth hormone in the cytokinin family, consisting of a purine ring structure with a side chain containing hydroxyl, amino, and olefin groups. Its molecular formula is  $C_{10}H_{13}N_5O$ , and it has a molecular weight of 219.24 g/mol

Plant growth hormones called cytokinins promote cell division in roots and shoots. Adenine-type and phenyl urea-type cytokinins are the two categories into which they fall. Applications for cytokinins are numerous and include biomedicine, pharmacology, and agriculture.

Advances in botany are driving up demand for cytokinins on the global market. The rise of the worldwide market has been significantly aided by the superior qualities of cytokinin extracts. Furthermore, a significant component of botanical research and analysis is the study of plant cell division.

The characteristics of cytokinins are the subject of much investigation by the medical community. Numerous investigations have discovered the therapeutic benefits of cytokinins. However, the former's claims are questioned by other schools of thought. However, in the upcoming years, the global market for cytokinins is anticipated to grow quickly.

A class of plant growth chemicals known as phytohormones, cytokinins encourage cytokinesis, or cell division, in plant roots and shoots. They mostly influence cell development and differentiation, but they also have an impact on leaf senescence, axillary bud growth, and apical dominance.

In general, cytokinins are important because they facilitate the progression of several

**Table - 1**  
**Efficacy of CKs on biotic production of bioethanol a renewable energy sources**

Concentration of cytokinin used A X 10 <sup>-x</sup> M	Incubation Period in hours	Yield of bioethanol*in ml/100ml	Molasses* left unfermented in g/100 ml	%Diff. in the yield of bioethanol in 50 hrs
Control	50	7.80	1.225	-
1.0 x 10 <sup>-5</sup> M	50	7.90	1.126	(+) 12.179
2.0 x 10 <sup>-5</sup> M	50	8.05	0.975	(+) 8.974
3.0 x 10 <sup>-5</sup> M	50	8.10	0.926	(+) 3.846
4.0 x 10 <sup>-5</sup> M	50	8.21	0.816	(+) 5.256
5.0 x 10 <sup>-5</sup> M	50	8.43	0.595	(+) 8.076
6.0 x 10 <sup>-5</sup> M**	50	8.75**	0.275	(+) 12.179
7.0 x 10 <sup>-5</sup> M	50	8.50	0.526	(+) 8.974
8.0 x 10 <sup>-5</sup> M	50	8.31	0.716	(+) 6.538
9.0 x 10 <sup>-5</sup> M	50	8.15	0.877	(+) 4.487
10.0 x 10 <sup>-5</sup> M	50	7.95	1.076	(+) 1.923

\* Each value represents mean of three trials.\*\*Optimum concentration of cytokinin used.  
 \*\*\* Optimum yield of bioethanol in 50 hours. (+) Values indicate % increase in the yield of bioethanol after 50 hours. Experimental deviation ( $\pm$ ) 1.5-3%.

biochemical activities. Adenine derivatives called cytokinins have a number of significant and common functions in addition to promoting cytokinesis<sup>1-5</sup>. Thus, cell expansion is necessary for overall growth, and cytokinin-induced growth promotion entails quicker cell expansion and the generation of bigger cells. Cytokinins promote cell division<sup>6-12</sup> and may typically be necessary for several biological functions. Cytokinins are thought to have a promotion effect on the creation of RNA and enzymes, in part because RNA or protein synthesis inhibitors typically impede their effects.

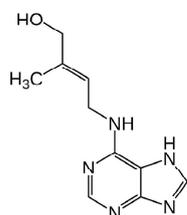
When yeasts ferment sugar, bioethanol is naturally created. It is employed as an alternative fuel source, a chemical solvent, and in the production of organic molecules. Bioethanol is the main fuel used to replace gasoline in road transport vehicles. The manufacturing of bioethanol is revolutionizing the sector.

Many studies have been conducted on the function of cytokinins in fermentation technology, particularly in alcoholic fermentation, which is essentially an enzyme-catalyzed reaction<sup>13-16</sup>. The authoress has attempted to investigate alcoholic fermentation exposed to a cytokinin, specifically zeatin, as there has been relatively little research on this topic.

#### Experimental

Zeatin ; Chemical formula. C<sub>10</sub>H<sub>13</sub>N<sub>5</sub>O ;  
 Molar mass, 219.248 g·mol<sup>-1</sup> ;  
 Appearance, Off-white to yellow crystalline powder ; Melting point, 208 to 210 °C

The impact of zeatin (ZEA) on *Saccharomyces cerevisiae* SS-116's biotic synthesis of bioethanol from molasses.



### Structure of Zeatin

The following is the preparation of the production medium composition for *Saccharomyces cerevisiae* SS-116's natural bioethanol production:

Molasses :30%; Malt extract : 0.285%; Yeast extract : 0.285%; Peptone : 0.5%;  $(\text{NH}_4)_2\text{HPO}_4$  : 0.285%, 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.

Now, 99 fermentor-flasks, each holding 100 ml of the production medium, were produced using the same production medium for the biotic synthesis of bioethanol by *Saccharomyces cerevisiae* SS-116. Following that, these fermentor-flasks were grouped into ten sets, each of which contained nine fermentor-flasks. Out of the 99 fermentor flasks, the remaining 9 were retained as controls and were likewise rearranged into three subgroups, each with three fermentor flasks.

M/1000 solutions of Zeatin were now produced, and the fermentor-flasks of the first 10 sets received 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, respectively. Cytokinin was absent from the control fermentor-flask. The necessary amount of distilled water was added to each fermentor-flask until the total volume reached "100 ml."

As a result, the cytokinin concentrations under investigation in the first, second, third,

fourth, fifth, sixth, seventh, eighth, ninth, and tenth subgroups were roughly as follows:

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

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

Following steam sterilization, cooling, inoculation, and incubation at 30°C, the fermentor-flasks were colorimetrically analyzed after 50 hours to check for the formation of bioethanol<sup>17</sup> and unfermented molasses<sup>18</sup>.

### Results and Discussion

#### The impact of Zeatin on biotic production of bioethanol

The results clearly show that the cytokinins under investigation are a moderate stimulant for the *Saccharomyces cerevisiae*-SS-116 yeast strain's biotic production of bioethanol, increasing the yield of bioethanol by up to  $1.0 \times 10^{-5} \text{M}$  to  $6.0 \times 10^{-5} \text{M}$ . In 50 hours of optimal incubation, the highest production of bioethanol,

Zeatin has a stimulatory effect on *Saccharomyces cerevisiae* SS-116's biotic synthesis of bioethanol, according to the results in Table 1. According to the data (see table 1), the cytokinin zeatin promotes the fermentation of bioethanol and increases its output up to  $1.0 \times 10^{-5} \text{M}$  and  $10.0 \times 10^{-5} \text{M}$  zeatin concentrations. 8.75 ml/100 ml, was recorded at a molar concentration of  $6.0 \times 10^{-5} \text{M}$  of zeatin. This is 12.179% greater than that of control fermentor flasks, which produced 7.80 mL/100 mL.

But when zeatin is added to the production medium at concentrations ranging from  $1.0 \times 10^{-5} \text{M}$  to  $10 \times 10^{-5} \text{M}$ , it increases the production of bioethanol. In each case, the yield of bioethanol was higher than the control in 50 hours of optimal incubation under the same experimental conditions.

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