J. Chemtracks 27 (1&2) 79-82, 2025

Abstracted / Indexed in
CAS
A division of the American Chemical Society
Chemical Abstract U.S.A.

ISSN 0973-239X
CODEN:JCOHF7
IMPACT FACTOR : 7.866

Micellar impact of potassium laurate on biotic production of ergot – alkaloids

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Manuscript received online 12 February 2025, accepted on 11 March 2025

Abstract : Ergot alkaloids, toxic compounds produced by fungus *Claviceps purpurea* have recently been at the centre of several food safety concerns and regulatory discussions. On going research aims to understand and control the biosynthesis of ergot alkaloids. Recent studies have focused on improving the detection and quantification of ergot alkaloids in food and pharmaceutical products. The micellar efficacy of potassium laurate on ergot alkaloids fermentation by *Claviceps purpurea* S -66 has been assessed. It has been found that potassium laurate under investigation has enhanced the yield of ergot alkaloids to an extent of 13.684% higher in comparison to control. i.e. 950 mg/per ltr.

(Keywords : Ergot alkaloids fermentation, *Claviceps purpurea* S -66, Potassium Laurate).

Introduction

Recent advancement in ergot alkaloids fermentation technology have focused on enhancing production efficiency, ensuring product consistency and reducing reliance on traditional fungal cultivation. The demand for ergot alkaloids in 2025 presents a nuanced landscape, influenced by evolving pharmaceutical applications shifting marked dynamics and regional consumption patterns. “Advancements in biotechnological processes are enhancing ergot alkaloids production. Techniques such as synthetic biology and microbial engineering are being employed to increase yields and ensure product consistency. Ongoing innovations in production and analysis are further supporting their relevance in the medical field.

Micelles are formed by the amphiphilic polymers at the CMC[1-3]. Micelles are widely used in industrial and biological fields. The carrying ability of micelles can be altered if parameters determining their size and shape are changed. However, the shape and size of the micelle are functions of the nature of the system[4-16] It is well known that nature provides some versatile compounds without which it would have been difficult for the life to persist. Surfactants are one such group of compounds which are used in various fields of science from electronics to biology.[17-20] Thus, from the above brief review it is evident that there is no definite opinion regarding the influence of micelles on the production of ergot alkaloids and in view of this the authors have studied the micellar efficacy of Potassium Laurate on bioconversion of sugar to ergot alkaloids.

Experimental

The micellar efficacy of potassium laurate on bioconversion of sugar to ergot alkaloids by *Claviceps purpurea* S-66 has been studied.

The experimental results have been described in table-1

Temperature : $28^0C \pm 1^0C$

Assay method : Evaluation of ergot alkaloids formed was made colorimetrically[21-25].

Sterilization : At 15 lbs steam pressure for 30 min. in an autoclave.

Organism used : *Claviceps purpurea* S-66 was used as source of enzymes for production of ergot alkaloids.

Table - 1
Micellar impact of potassium laurate on biotic production of ergot – alkaloids

Concentration of micelle a x 10^{-5} M	*Yield of Ergot -alkaloids in mg/litre			% of ergot alkaloids increase (+) in 8 days of incubation period
	6 days	8 days	10 days	
Control	729	950	815	-
1.0×10^{-5}M	****	****	****	-
2.0×10^{-5}M	734	962	819	+1.263
3.0×10^{-5}M	749	980	961	+3.157
4.0×10^{-5}M	799	1005	970	+5.789
5.0×10^{-5}M	819	1030	995	+8.421
6.0×10^{-5}M**	825	1080***	1012	+13.684
7.0×10^{-5}M	803	1065	999	+12.105
8.0×10^{-5}M	799	1040	986	+9.473
9.0×10^{-5}M	763	998	970	+5.052
10×10^{-5}M	756	990	947	+4.210

*Mean of three observations.**Optimum concentration of micelle used,*** Optimum yield of ergot alkaloids (+) values indicate % increase (+)after 8 days. Experimental deviation ($\pm$) 1.5% to 3.5%

Age of inoculum : 48 h
Quantum of inoculum : 10 ml
Incubation periods : 6, 8 and 10 days
Optimum incubation period : 8 days

Vegetative medium[26] The composition of the vegetative medium was as follows :
Dextrose : 150.00 g; Citric acid : 20.00 g; Yeast extract : 70 mg/100/ml ; KH_2PO_4: 0.70g; $MgSO_4.7H_2O$:0.45g; $FeSO_4.7H_2O$: 0.015g; $ZnSO_4.7H_2O$: 0.025g; pH : 5.4
Distil water : 1000 ml.

The pH of the medium was adjusted to 5.4 by adding requisite amount of NH_4OH solution.

Now 100 ml of the vegetative medium was taken into 250 ml conical flask. The flasks were then plugged and sterilised in an autoclave at 15 lbs steam pressure for 30 minutes. Inoculation of the vegetative medium The vegetative medium was inoculated by transferring 5 disc of mycelium (each of 10 mm dia) from 8 days old slant.

Preparation of the production medium

The composition of the production medium employed throughout the investigation was as follows :

Sugar : 250.00g; Citric acid : 30.00g; Yeast extract:0.30g;KH_2PO_4: 0.70g; $MgSO_4.7H_2O$: 0.70g; KCl : 0.15 g; $FeSO_4.7H_2O$: 0.020g; $ZnSO_4.7H_2O$: 0.008g; pH : 5.4; (Adjusted by NH_4OH solution) Distil water to make up 1000 ml.

Now from the above composition 100 ml of the production medium was taken into 250 ml conical flask. The fermentor flasks were plugged and sterilized in an autoclave. 100 ml of vegetative medium was taken into 250 ml fermentor flasks. The fermentor flasks were plugged with non-absorbent cotton and were sterilized in an autoclave at 15 lbs steam pressure for 30 minutes and were left for cooling at room temperature. Now, two flasks were inoculated each with 5 discs (each disc of 10 mm dia). of 8 days old *Claviceps purpurea* S-66. The flasks were kept on a rotary shaker (230 rpm) at $28^0C \pm 1^0C$ for 8 days. After 8 days the content of the flask was homogenised in a sterile mixer for 10 seconds. This is the vegetative stage-I. For second vegetative stage the flasks were taken each containing 100 ml of the same vegetative medium. Now, each fermentor flask was inoculated with 10ml of inoculum from vegetative stage-I. These flasks were put on a rotary shaker operating at 230 rpm for 50 hours. After 50 hours 10 ml of the inoculum was used to inoculate the production medium. 99- fermentor flasks, each containing 100 ml of the production medium was taken for production stage. These were arranged into 11 sets, each set consisting of 9-fermentor flasks. Now, M/1000 solution of potassium laurate 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 in the fermentor flasks from 1st to 10th set respectively. Remaining one set was kept as control and it contained no potassium laurate. Each fermentor flask was inoculated with 10 ml of the inoculum from IInd vegetative stage. The flasks were kept on a rotary shaker operating at 230 rpm at temperature $28^0C \pm 1^0C$. Colorimetric analysis were carried out after 6, 8 and 10 days of incubation period.

Results and Discussion

The influence of potassium laurate The data recorded in the table -1 shows that miceller efficacy of potassium laurate on production of ergot alkaloids by fermentation has also been found stimulatory and significant. It has been found that there is a gradual and mild increase in the production of ergot alkaloids by fermentation with the stepping up of the micelle potassium laurate till the maximum yield of ergot alkaloids, i.e., 1080 mg/litre was obtained at 6.0×10^{-5} M concentration of potassium laurate which is 13.684% higher in comparison to control fermenter flasks, i.e; 950 mg/litre in 8 days of optimum incubation period. It has also been recorded that production of ergot alkaloids exposed to potassium laurate, i.e; at 2.0×10^{-5} M the yield of ergot alkaloids has been found a negligable in comparison to control fermentor flasks.

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