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Biosynthesis of Lactic Acid in SmF System by Facultative Aerobe Exposed to Some Trace Elements

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ABSTRACT

The study on Biosynthesis of lactic acid in SmF system by facultative aerobe exposed to some trace elements. The influence of Uranyl sulphate, thorium sulphate , zirconium sulphate and thallus sulphate on lactic acid fermentation by L. bulgaricus MG. It has been found that thorium at lower experimental concentrations and ziroconium at higher experimental concentrations stimulate the bacterial activity of producing acid, while uranium and thallium at all concentrations have an inhibitory effect on the same. For maintaining the life processes, the microorganisms need essential elements in large amounts, which help in the formation of cells. Besides, they also require some elements in very small amount which have profound effect on their growth and metabolic activity.

KEYWORDS: Uranyl sulphate, thorium sulphate , zirconium sulphate and thallus sulphate

Introduction

Today fermentation has a much broader meaning. It may be defined as a process in which chemical changes are brought about in an organic substrate through the action of enzymes elaborated by micro-organism. It applies to both the aerobic and the anaerobic metabolic activities of micro-organism. Still in a simpler ways fermentation may be defined as the chemical break down of the complex molecules into simpler one through biological activities. According to Scheele (1780) first isolated and identified the acid of sour milk as lactic acid. The identification and association of lactic acid producing organisms which fermentation was established by Blondeau and by Pasteur, Schultze and Lister. Since 1880 A. D., when the first commercial fermentations were initiated, the production of lactic acid by fermentation has become an important industry. On the basis of scientific knowledge any biological life almost all the elements of the periodic are present in them leaving aside the organic substances which can be burnt off. The beneficial and adverse effects of quite a number of the trace elements as cobalt known for centuries and they can be classified on their basis of requirement as (i) essential micronutrient (ii) essential macronutrient (iii) non – essential and non – toxic elements (iv) non essential and toxic toxic element primarily arising as a result of environmental contamination.

Experimental

54 flasks were prepared as described in experimental chapter these were sterilized, cooled and arranged into six sets each set consisting of nine flasks.

M/100 solutions of sulphate of Uranyl, thorium, Zirconium and Thallus were prepared and 1,2,3,4 and 5ml of these solutions separately were added in the flasks of the first to fifth sets, respectively. The flasks of sixth set were kept as control. All the flasks after inoculation with L äbulgaricus MG, were inculated at 47 degree, PH was maintained between 5.8 – 6.0 with CaCO3 and contents of flasks were analysed colorimetrically for lactic acid (produced) and sugar (left unfermented) after 2, 4 and 6 days of incubation. In past recent some workers 202 – 214 have also studied the influence of Cobalt as a trace element on different microbial processes and found most of them very effective and useful for fermentation processes.

Result and Discussion

The results of the colorimetric analysis are given in Tables (1 to 4). The values reported are the mean values of three observations in each case.

Table - 1: Fermentation production of lactic acid in presence of uranyl sulphate

S. No.	Concentration of uranyl sulphate a× 10^{-5} M	Yield of lactic acid g/100ml*			**Sugar left unfermented g/100ml***		
		2 days	4 days	6 days	2 days	4 days	6 days
1	1.0	1.00232	1.48598	1.90265	3.24164	2.60547	2.27265
2	2.0	1.02256	1.50368	1.90355	3.24568	2.59564	2.28564
3	3.0	1.01569	1.40235	1.80316	3.25676	2.64436	2.38458
4	4.0	1.00234	1.38266	1.67132	3.26577	2.69578	2.43658
5	5.0	1.00235	1.40235	1.67223	3.26458	2.73685	2.45687
6	Control	1.03568	1.45265	1.94265	3.22657	2.62543	2.27467

- Each value represents the mean of three trials
- Experimental deviation 1.5 – 3%

Table – 2. Fermentation production of lactic acid in presence of Thorium sulphate

S. No.	Concentration of thorium sulphate a× 10^{-5} M	Yield of lactic acid g/100ml*			**Sugar left unfermented g/100ml***		
		2 days	4 days	6 days	2 days	4 days	6 days
1	1.0	1.01125	1.50456	1.95125	3.26545	2.62365	2.26025
2	2.0	1.10262	1.50236	2.07235	3.11255	2.62586	2.09651
3	3.0	1.10125	1.50256	1.99568	3.10234	2.60235	2.19564
4	4.0	0.99256	1.49234	1.83577	3.27152	2.63545	2.37157
5	5.0	0.93125	1.30232	1.79285	3.33564	2.83164	2.40135
6	Control	1.02123	1.52125	1.94332	3.26351	2.70135	2.27143

- Each value represents the mean of three trials
- Experimental deviation 1.5 – 3%

Table -3. Fermentation production of lactic acid in presence of zirconium sulphate

S. No.	Concentration of zirconium sulphate a× 10^{-5} M	Yield of lactic acid g/100ml*			**Sugar left unfermented g/100ml***		
		2 days	4 days	6 days	2 days	4 days	6 days
1	1.0	1.01265	1.50265	1.89354	3.28454	2.69745	2.29465
2	2.0	1.02354	1.51235	1.94338	3.26455	2.71354	2.24135
3	3.0	1.03256	1.48753	1.95483	3.23546	2.64587	2.23646
4	4.0	1.06544	1.46581	2.01235	3.16542	2.65481	2.13246
5	5.0	1.07565	1.50325	2.00334	3.16547	2.60165	2.15642
6	Control	1.0032	1.50325	1.95324	3.27135	2.70315	2.27134

- Each value represents the mean of three trials
- Experimental deviation 1.5 – 3%

Table – 4. Fermentation production of lactic acid in presence of thallus sulphate

S. No.	Concentration of thallus sulphate a× 10^{-5} M	Yield of lactic acid g/100ml*			**Sugar left unfermented g/100ml***		
		2 days	4 days	6 days	2 days	4 days	6 days
1	1.0	1.05654	1.45621	1.90334	3.17357	2.61654	2.28671
2	2.0	1.03246	1.40134	1.92463	3.20334	2.67964	2.27164
3	3.0	1.00328	1.38467	1.80324	3.26547	2.70332	2.30135
4	4.0	1.00326	1.39745	1.78633	3.25644	2.71354	2.33648
5	5.0	1.00324	1.30246	1.72358	3.24566	2.70328	2.27135
6	Control	1.00234	1.40356	1.94833	3.23644	2.65783	2.26315

- Each value represents the mean of three trials
- Experimental deviation 1.5 – 3%

Discussion

The study of influence of uranium, thorium, zirconium and thallium on lactic acid fermentation of molasses by L. bulgaricus MG Presents a very interesting Picture. It is found that thorium at lower experimental concentrations and ziroconim at highere experimental concentrations stimulate the

bacterial activity of producing acid, while uranium and thallium at all concentrations have an inhibitory effect on the same.

The data given in table 1 indicate the action of uranium on the activity of L. bulgaricus. It appears that its presence, even in minimum experimental concentration of 1.0×10^{-5} M, causes depression in the yield of lactic acid. With the increase in concentration, there is a gradual decreased in the yield of lactic acid.

Although higher concentrations of thorium in fermentation medium made the bacteria inactive upto some extent from view point of production of lactic acid, its lower concentrations stimulated the bacterial activity and caused enhanced yield of lactic acid. Maximum acid has been produced at 2.0×10^{-5} M concentration which is about 47% of total sugar in comparison to 44 % in the control (cf. Table- 2). Sugar consumption was found to correspond with the yield of lactic acid.

Zirconium has a just reverse activity as compared to the activity of thorium on L. bulgaricus MG (cf. table 3). It has slight stimulatory effect on the the fermentative activity of the bacteria (when present in higher concentrations) and its lower concentrations produced an inhibitory effect on the bacteria. Maximum yield of the lactic acid has been obtained at 4.0×10^{-5} M experimental concentration which is 45.7% of total sugar in comparison to 44% that in control experiment. Sugar consumption in this case also corresponded with the yield of lactic acid.

The data of table 4 indicate the influence of thallium on the activity of L. bulgaricus MG. It is seen that presence of thallium at all the experimental concentrations, in the fermentation medium, inhibit the bacterial activity of producing acid. Higher concentrations are much toxic than the lower ones. At 0.005 M concentration, formation of nanlactic substaces increased and minimum yield of lactic acid has been obtained in this case.

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