

Title of thesis:

STUDIES ON THE MICROBIAL PRODUCTION OF CITRIC ACID

The Researcher:

SHERIF MOHAMED EL-KADY

Approval committee:

No	Name	Position
1	Prof. Dr. Mohamed S.A. Safwat	Prof. of Microbiology - Faculty of Agriculture – El-Menia University
2	Prof. Dr. Abd Alla E.I. Selim	Prof. of Microbiology - Faculty of Agriculture – Mansoura University
3	Prof. Dr. Mohamed M. Kassem	Prof. of Microbiology - Faculty of Agriculture – Mansoura University
4	Prof. Dr. Mahmoud M. A. El-Sawah	Prof. of Microbiology - Faculty of Agriculture – Mansoura University
5	Prof. Dr. Fathi I. A. Hauka	Prof. of Microbiology - Faculty of Agriculture – Mansoura University

sherifelkadi@du.edu.eg

5. SUMMARY

Citric acid is one of the most important organic acids in the foods and pharmaceutical industries, citric acid had extracted from natural resources specially citrus fruits, then citric acid was begin to produced with using *Aspergillus niger*.

This study aim to use *Aspergillus niger* to produce citric acid by screening some strains which can produce citric acid and screening some media which used for citric acid production, then to reach the maximum citric acid production were studied some factors affected on citric acid production.

This study divided into four sections :-

The first section :-

Screening the most active strains which can produce citric acid, and to achieve this propose nine stains of *Aspergillus niger* were used, six of it were local CA1, CA2, CA3, CA4, CA5, CA6 and three of it were exported from the Microbial Properties Research Unit, National Center for Agricultural Utilization Research, Agricultural Research Service, USA. It were namely NRRL 2270, NRRL 3 NRRL 67. Six cultural media were used as basal media for citric acid production cultivation was made in 250 ml. Erlenmeyer flasks, each containing 100 ml of sterile medium. Inoculum containing 5×10^6 spores was transferred to the culture medium. The flasks were incubated at 30°C on a rotary shaker at 160 r.p.m. for incubation period 6 days.

It could observe that the best strain of citric acid producer was *A. niger* CA2 on medium No.2, which had cane molasses, and the production was 22.9 g/L citric acid.

The second section :-

Study the facores affecting on citric acid productionas follows:-

- 1- The best time course was after eight days of fermentation and the production was 23.2 g/L citric acid.
- 2- The optimumpH was 5.5 and the production was 29 g/L citric acid.
- 3- Total sugars was 15% and the production was 29.3 g/L citric acid.
- 4-The production of citric acid wes 29.84 g/L when 1.5 g/L $K_4Fe(CN)_6$ was used.
- 5- 10 g/L ammonium oxalate was used and the citric acid concentration was 29.88 g/L.

6- The effect of nitrogen sources were investigated and the best source was ammonium phosphate and the production was 31.4 g/L citric acid.

7-The optimum concentration of ammonium phosphate was 2 g/L and the production was 32.03 g/L citric acid.

8- The effect phosphorus sources were investigated and the best source was phosphoric acid and the production was 31.78 g/L citric acid.

9-The highest amount of citric acid was 32.88 g/L when the concentration of phosphoric acid was 0.3 ml/L.

10- 0.2 g/L magnesium sulfate was used and the production was 32.2 g/L citric acid.

10-The optimum inoculum volume was 5×10^6 Spores/ 100 ml and the citric acid production was 32.88 g/L.

11-Several trace metal ions such as Fe^{++} , Cu^{++} , Zn^{++} , Mn^{++} , Ca^{++} , Ba^{++} , K^+ , Mo^{++} , Co^{++} and Ni^{++} was studied and the addition of ethanol were investigated and there were no effect on the production citric acid.

The third section :-

In this section we study the use of best factors affecting on citric acid production, and used it to produce the citric acid using the fermenter, and 51.1 g/L citric acid after eight days of fermentation was recorded.

The fourth section :-

In this section we study the effect of immobilized the spores with calcium alginate, and use this immobilized spores as an inoculum to produce citric acid. The best results were:-

- The best day was the sixth the best pH was 5.5 and the production of citric acid was 35.71 g/L.

The possibility of citric acid production was 51.1 g/L in fermentor by the selected stain No, 2, medium which containing (g/L): sugar cane molasses 272, ammonium phosphate 2, phosphoric acid 0.3 ml, magnesium sulfate 0.2, pH 5.5, at 30°C, after eight days of fermentation.