



BIOTECHNOLOGICAL SIGNIFICANCE OF LACTIC ACID PRODUCTION FROM BEET MOLASSES IN ENSURING FOOD SECURITY

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Abstract

This article explores the role of biotechnological methods in addressing food security challenges, specifically focusing on the production of lactic acid from sugar industry by-products, namely molasses. The study analyzes the impact of fermentation conditions on product yield and evaluates the preservative properties of the resulting lactic acid for the food industry.

Keywords: Biotechnology, food security, lactic acid, fermentation, molasses, calcium lactate.

Introduction

The global surge in population necessitates the advancement of food security and long-term preservation technologies. Lactic acid (E270) holds strategic importance in the food industry as a natural preservative, acidity regulator, and antibacterial agent. Producing it from low-cost, secondary raw materials presents an effective, import-substituting solution for the national economy.

Materials and Methods

Beet molasses, a waste product from sugar factories in the Namangan region, was utilized as the primary substrate.

Fermentation: Conducted using the *Lactobacillus delbrueckii* strain at a temperature of 42–45°C for 48 hours.

Neutralization: To maintain the medium's pH within the range of 5.8–6.2, a calcium carbonate (CaCO_3) suspension was employed.

Results and Discussion

Chemical analysis of the beet molasses revealed that it contains not only carbohydrates (sucrose) but also nitrogenous compounds and vitamins essential for microbial growth. This significantly reduces the costs associated with preparing additional nutrient media.

During the fermentation process, the *Lactobacillus delbrueckii* strain hydrolyzes sucrose into glucose and fructose, subsequently converting them into lactic acid:



By refining the resulting calcium lactate and treating it with sulfuric acid, high-purity lactic acid ($\text{C}_3\text{H}_5\text{O}_2$) is obtained. This product has demonstrated effective results in preventing mold in bakery products and extending the shelf life of meat products.

Results indicated that at a 12% sugar concentration in the molasses, the theoretical yield of lactic acid reached 80–85%. At the conclusion of fermentation, the calcium lactate solution was filtered, and the lactic acid was isolated.

Key Performance Indicators of the Fermentation Process

Parameter	Value	Note
Sugar concentration in molasses	12%	Optimal concentration
Fermentation temperature	42-45	For thermophilic bacteria
Medium pH level	5.8-6.2	Post-neutralization
Process duration	48 hour	Full bioconversion period
Lactic acid yield (vs. theoretical)	80-85%	Average indicator
Calcium lactate formation	132g/l	Prior to crystallization

Significance in Food Security:

The biotechnological production of lactic acid addresses several strategic issues:

Microbiological Safety: Lactic acid acts as a natural barrier inhibiting the growth of pathogenic microflora (e.g., Salmonella and E. coli).

Import Substitution: Meeting the domestic food industry's demand for this reagent using local secondary raw materials (molasses).

Environmental Sustainability: Implementing "Zero Waste" technology by recycling sugar industry by-products.

Conclusion:

Conducted research confirms that beet molasses is a highly efficient substrate for lactic acid production. Peak productivity is achieved at a temperature of 45°C and a pH of approximately 6.0. The resulting product is intended to serve as a vital link in maintaining food quality and ensuring safety.

Foydalanilgan Adabiyotlar:

1. Hofvendahl K., Hahn-Hägerdal B. Factors Affecting the Fermentative Lactic Acid Production from Renewable Resources. *Enzyme and Microbial Technology*, 2000. Vol. 26(2-4). P. 87-107.
2. Datta R., Tsai S.P., Bonsignore P., Moon S.H., Frank J.R. Technological and Economic Potential of Poly(Lactic Acid) and Lactic Acid Derivatives. *FEMS Microbiology Reviews*, 1995. Vol. 16. P. 221-231.
3. Wee Y.J., Kim J.N., Ryu H.W. Biotechnological Production of Lactic Acid and Its Recent Applications. *Food Technology and Biotechnology*, 2006. Vol. 44(2). P. 163-172.
4. Narzullaev X.N., Rasulov A.A. Oziq-ovqat biotexnologiyasi. Toshkent: Fan va texnologiya, 2021.
5. Qodirov B.R. Fermentatsiya texnologiyasi asoslari. Toshkent: O'qituvchi, 2019.
6. Ghasemi M., Najafpour G.D., Rahimnejad M. Lactic Acid Fermentation from Sugar Beet Molasses Using Lactic Acid Bacteria. *International Journal of Biotechnology*, 2011.