

THESIS INFORMATION

INTRODUCTION

PhD student: **TRẦN THỊ THU TRÀ**

Thesis topic: **APPLICATION OF ULTRASOUND TO IMPROVE THE CASSAVA STARCH HYDROLYSIS YIELD**

Major: **Food and beverage processing**

Major code: **62540201**

Training institute: **Ho Chi Minh City University of Technology, VNU-HCMC**

Scientific supervisor: **Associate Prof. Dr. Lê Văn Việt Mẫn**

CONTENT

The objective of this research was to improve hydrolysis efficiency of cassava starch by ultrasound-assisted treatments.

The research subjects included α – amylase preparation (Termamyl 120L), glucoamylase preparation (Dextrozyme GA) and cassava starch.

Scientific contributions:

From the fundamental science point of view:

- Ultrasound-assisted treatment changed secondary structure of α – amylase in Termamyl 120L and improved the catalytic activity. In addition, the sonication also increased maximum reaction rate (v_{max}), Michaelis – Menten constant (K_m), reaction rate constant (k_{cat}) and reduced activation energy (E_a), enthalpy (ΔH), entropy (ΔS), Gibbs energy (ΔG). Both sonicated and non – sonicated enzymes exhibited similar optimal pH and temperature; but the sonicated enzyme was more thermo-sensitive and showed lower half-life than the non-sonicated enzyme.
- Ultrasound-assisted treatment of starch gelatinization and liquefaction decreased starch particle size, enhanced soluble starch content and resulted in higher hydrolytic degree in comparison with the control. Sonication at the temperature for gelatinization initiation (T_{paste}) generated maximum increase in hydrolytic degree in comparison with the control.

From the applied science point of view:

- Appropriate conditions of the ultrasonic treatment for improvement in catalytic activity of amylase preparations were determined:
 - At frequency of 20 kHz, sonication temperature of 30°C, power of 25W/mL and time of 75 s, maximal activity of Termamyl 120L achieved 152 ± 1 KU/mL and this value was 47.3% higher than the control.
 - At frequency of 20 kHz, sonication temperature of 30°C, power of 20W/mL and time of 33 s, maximal activity of Dextrozyme GA was 83.2 ± 0.3 KU/mL and this value was 11.1 % higher than the control.
- Five technical solutions for improvement in hydrolysis efficiency were compared on starch suspension with 35% solid content. These solutions decreased the enzyme content by 28% or decreased the hydrolytic time by 33 – 69% or increased the hydrolytic degree by 12.6 – 14.5% in comparison with the control. Among them, the ultrasonic treatment of mixture of starch and α – amylase during the liquefaction and then saccharification with glucoamylase resulted in maximal hydrolytic degree (98.5%) and this value increased by 14.5% in comparison with the control. Nevertheless, the energy consumption of this solution was the highest. The ultrasonic treatment of both α – amylase and glucoamylase and subsequent use in starch hydrolysis resulted in the hydrolytic degree of 96.8% and this value increased by 12.6% in comparison with the control. The last solution was potential for industrial application due to low energy consumption.

Scientific supervisor

PhD student

Associate Prof. Dr. Lê Văn Việt Mẫn

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