



UNIVERSITI PUTRA MALAYSIA

**CHARACTERIZATION AND POTENTIAL USE OF LACTIC ACID
BACTERIA ISOLATED FROM CORN SILAGE**

AIDA ZAKARIA

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**MASTER OF SCIENCE
UNIVERSITI PUTRA MALAYSIA**

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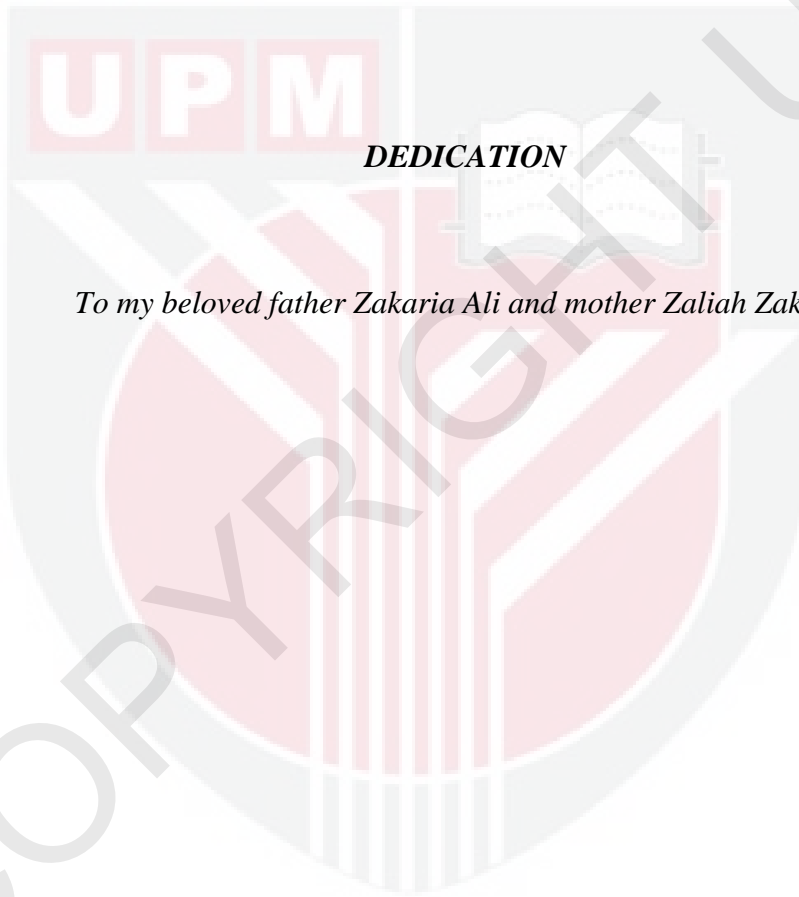
**CHARACTERIZATION AND POTENTIAL USE OF LACTIC ACID
BACTERIA ISOLATED FROM CORN SILAGE**

By

AIDA ZAKARIA

**Thesis Submitted to the School of Graduate Studies, Universiti Putra Malaysia,
In Fulfilment of the Requirements for the Degree of Master of Science**

2011



DEDICATION

To my beloved father Zakaria Ali and mother Zaliah Zakaria

Abstract of thesis presented to the Senate of Universiti Putra Malaysia in fulfilment of the requirement for the degree of Master of Science

**CHARACTERIZATION AND POTENTIAL USE OF LACTIC ACID
BACTERIA ISOLATED FROM CORN SILAGE**

By

AIDA ZAKARIA

December 2011

Chairman: Assoc. Prof. Halimatun Yaakub, PhD

Faculty : Agriculture

Silage, a fermented and high-moisture fodder is an important fodder for large ruminants. Chopped fresh grass, sorghum or whole corn plants were kept under anaerobic conditions to allow the bacteria to convert water-soluble carbohydrates into organic acids. The first objective was to isolate and identify bacteria from corn silage. Taking into consideration the probability and similarity index in the determination of the identification process, five isolates bacteria were isolated and identified by Total Plate Count Technique and Biolog Identification System, respectively. Five isolates are *Lactobacillus buchneri*, *Lactobacillus hilgardii*, *Lactobacillus kefir*, *Lactobacillus oris* and *Lactobacillus rhamnosus*.

The second objective was to determine the effect of potential bacterial inoculants on fermentation rate and quality of silages. The silage temperature, pH, nutrient

digestibility and aerobic stability test for 4 days were determined at 14, 21 and 28 days of ensiling process of the corn plant. Inoculation of lactic acid bacteria significantly improved the fermentation, increased nutrient digestibility and improved aerobic stability of corn silages. There were no significant differences ($P>0.05$) among the bacterial inoculants in decreasing the pH value of the silages. Addition of bacterial inoculants significantly increased the crude protein ($P<0.05$) but significantly decreased ($p<0.05$) the neutral detergent fiber contents with time. The process of fermentation was completed on day twenty-one in all treatment and control ($P>0.05$).

The third objective of this study was to evaluate the digestibility of corn silages treated with bacterial inoculants using *in-vitro* gas production technique. There were no significant differences in total gas production of 24 hours for 21 and 28 day old corn silages ($P>0.05$). It was expected that cellulose and hemicelluloses of corn silages crop could be decreased by the enzymes present in the original crop, bacterial action and hydrolysis by organic acid produced during fermentation. This study showed that corn silages inoculated with *L. rhamnosus*, *L. oris* and *L. buchneri* resulted in a higher increasing on the gas production ($P>0.05$).

It is concluded that bacterial inoculants could improve the quality, stability and increase fermentation rate of corn silages. Ensiling for twenty one days was suitable for this silage. Among the five lactic acid bacteria, *L. buchneri* was identified as the best inoculant to ensile corn forage.

Abstrak tesis yang dikemukakan kepada Senat Universiti Putra Malaysia sebagai memenuhi keperluan untuk ijazah Master Sains

**PENCIRIAN DAN PENGGUNAAN BAKTERIA ASID LAKTIK YANG
BERPOTENSI DARI SILAJ JAGUNG**

Oleh

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Silaj merupakan sumber makanan haiwan yang diperam dan berkelembapan tinggi. Rumput segar yang dipotong, sekoi atau keseluruhan pokok jagung disimpan dalam keadaan anaerobik bagi membolehkan bakteria menukarkan kandungan karbohidrat kepada asid organik. Objektif kajian pertama adalah untuk mengasingkan dan mengenal pasti bakteria daripada silaj jagung. Berdasarkan kepada kebarangkalian dan kesamaan indeks dalam menentukan proses pengenalpastian, lima bakteria yang diperolehi dan dikenalpasti melalui kaedah pengiraan piring dan Sistem Identifikasi Biolog. Lima bakteria yang dikenalpasti ialah *L. buchneri*, *L. hilgardii*, *L. kefir*, *L. oris* dan *L. rhamnosus*.

Objektif kedua ialah untuk menentukan kesan bakteria inokulasi yang berpotensi ini ke atas kadar masa fermentasi dan kualiti silaj. Suhu, pH, kandungan nutrien dan kestabilan aerobik silaj jagung selama 4 hari turut dikaji pada 14, 21 dan 28 hari proses fermentasi pokok jagung. Inokulasi bakteria asid laktik dapat meningkatkan kadar fermentasi, meningkatkan nilai cerna nutrien dan meningkatkan kestabilan aerobik pada silaj jagung. Tidak ada kesan yang beerti ($P>0.05$) di antara semua inokulasi bakteria asid laktik dalam menurunkan pH silaj. Penambahan inokulasi bakteria dalam pembuatan silaj dapat meningkatkan kandungan protin secara berkesan ($P<0.05$) tetapi mengurangkan kandungan NDF dengan berkesan ($P<0.05$) mengikut penambahan masa. Proses fermentasi berlaku secara lengkap pada hari ke 21 bagi semua bakteria inokulasi dan kawalan ($P>0.05$).

Objektif ketiga daripada kajian ini ialah untuk menentukan nilai cerna silaj jagung yang telah diberi rawatan bakteria dengan menggunakan teknik penghasilan gas *in-vitro*. Keputusan menunjukkan tiada perbezaan yang berkesan ($P>0.05$) dalam penghasilan gas sepanjang 24 jam bagi silaj jagung hari ke 21 dan 28. Ianya adalah disebabkan kandungan selulosa dan hemiselulosa silaj telah dikurangkan oleh enzim yang terdapat pada tanaman tersebut, selain daripada tindakan bakteria dan hidrolisis oleh asid organik yang dihasilkan semasa fermentasi. Penambahan bakteria *L. rhamnosus*, *L. oris* dan *L. buchneri* telah menunjukkan peningkatan dalam penghasilan gas secara tidak berkesan ($P>0.05$).

Kesimpulan menunjukkan inokulasi bakteri dapat meningkatkan kualitas, kestabilan dan kadar fermentasi silaj jagung. Fermentasi hari yang ke 21 adalah masa yang paling sesuai untuk pembuatan silaj. Antara 5 spesies bakteri, *L. buchneri* adalah dianggap sebagai inokulan yang paling baik bagi penghasilan silaj jagung.



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I certify that an Examination Committee has met on 16th December 2011 to conduct the final examination of Aida Zakaria on her degree thesis entitled “**Characterization and potential use of lactic acid bacteria isolated from corn silage**” in accordance with the Universities and University Colleges Act 1971 and Constitution of the Universiti Putra Malaysia [P.U.(A) 106] 15 March 1998. The Committee recommends that the student be awarded the Master of Science.

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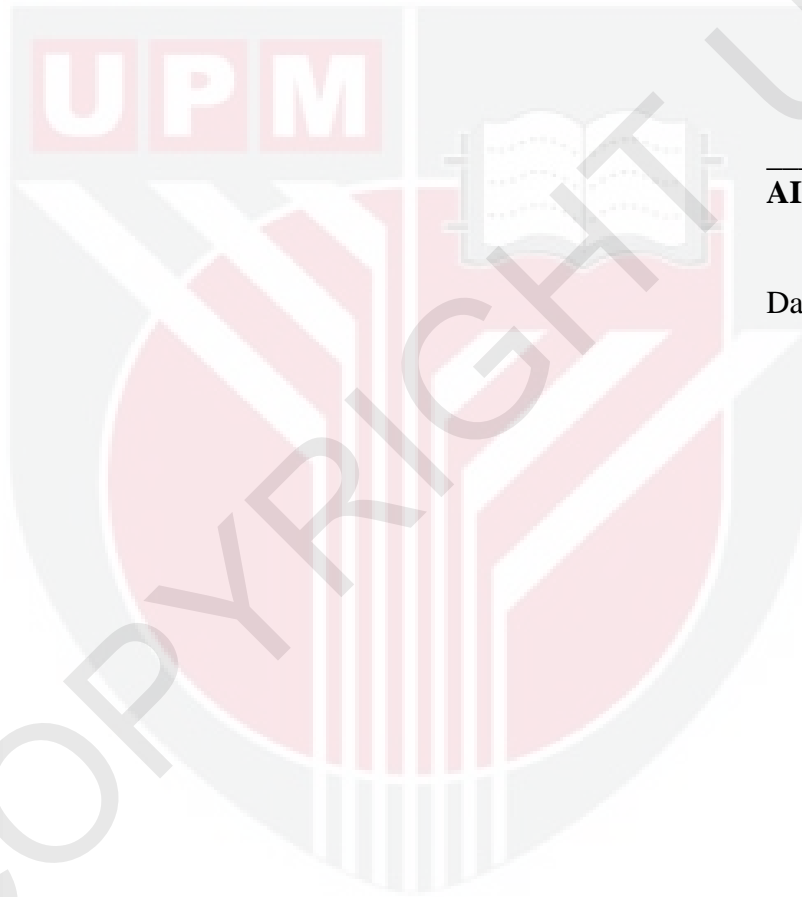
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DECLARATION

I declare that the thesis is my original work except for quotations and citations, which have been duly acknowledged. I also declare that it has not been previously, and is not concurrently, submitted for any other degree at Universiti Putra Malaysia or at any other institution.



AIDA ZAKARIA

Date:

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