PUMS 99:1

UNIVERSITI MALAYSIA SABAH

BORANG PENGESAHAN STATUS TESIS

UDUL: EFFICACY OF BANANA (Musa paradisiaca cv. Mysore) INFLORESCENCE AGAINST FOODBORNE PATHOGENS IN FOOD MODEL SYSTEM

AZAH: The Degree of Bachelor of Food Science with Honours (Food Technology and Bioprocess)

SESI PENGAJIAN: 2009/2010

aya CHUAH POH LAY

(HURUF BESAR)

engaku membenarkan tesis (LPS/ Sarjana/ Doktor Falsafah) ini di simpan di Perpustakaan Universiti Malaysia Sabah engan syarat-syarat kegunaan seperti berikut:

1. Tesis adalah hakmilik Universiti Malaysia Sabah.
2. Perpustakaan Universiti Malaysia Sabah dibenarkan membuat salinan untuk tujuan pengajian sahaja.
3. Perpustakaan dibenarkan membuat salinan tesis ini sebagai bahan pertukaran antara institusi pengajian tinggi.
4. ** Sila tandakan (/)

[ ]	SULIT	(Mengandungi maklumat yang berdarjah keselamatan atau kepentingan Malaysia seperti yang termaktub di dalam AKTA RAHSIA RASMI 1972)
[ ]	TERHAD	(Mengandungi maklumat TERHAD yang telah ditentukakan oleh organisasi/badan di mana penyelidikan dijalankan)
[✓]	TIDAK TERHAD	

Disahkan oleh

(TANDATANGAN PENULIS)

(TANDATANGAN PUSTAKAWAN)

lamat Tetap: 30, Jalan Belimbing, Kampung Jambu, 34000 Taiping, Perak.

Assoc. Prof. Dr. Chye Fook Yee

Nama Penyelia

arikh: 11 August 2010

Tarikh: 11 August 2010

TATAN: * Potong yang tidak berkenaan.

* Jika tesis ini SULIT atau TERHAD, sila lampiran surat daripada pihak berkuasa/organsasi berkenaan dengan menyatakan sekali sebab dan tempoh tesis ini perlu dikelaskan sebagai SULIT dan TERHAD.

* Tesis dimaksudkan sebagai tesis bagi Ijazah Doktor Falsafah dan Sarjana secara penyelidikan, at disertasi bagi pengajian secara kerja kursus dan penyelidikan, atau Laporan Projek Sarjana Muda (LPSM)

EFFICACY OF BANANA (*Musa paradisiaca cv.* Mysore) INFLORESCENCE AGAINST FOODBORNE PATHOGENS IN FOOD MODEL SYSTEM

CHUAH POH LAY

THESIS SUBMITED IN PARTIAL FULLFILLMENT FOR THE DEGREE OF BACHELOR OF FOOD SCIENCE WITH HONOURS (FOOD TECHNOLOGY AND BIOPROCESS)

SCHOOL OF FOOD SCIENCE AND NUTRITION
UNIVERSITI MALAYSIA SABAH

2010

DECLARATION

I hereby declare that the materials in this thesis are my own except for quotations, excerpts, summaries and references, which have been duly acknowledged.

10 August 2010

Chuah Poh Lay
HN2006-3148

CERTIFICATION

NAME	:	**CHUAH POH LAY**
MATRIC NO.	:	**HN2006-3148**
TITLE	:	**EFFICACY OF BANANA (*Musa paradisiaca cv.* Mysore) INFLORESCENCE AGAINST FOODBORNE PATHOGENS IN FOOD MODEL SYSTEM**
DEGREE	:	**BACHELOR OF FOOD SCIENCE WITH HONOURS (FOOD TECHNOLOGY AND BIOPROCESS)**
VIVA DATE	:	**14 MAY 2010**

DECLARED BY

1. **SUPERVISOR**
   Assoc. Prof. Dr. Chye Fook Yee

2. **EXAMINER 1**
   Pn. Nor Qhairul Izzreen Mohd Noor

3. **EXAMINER 2**
   Dr. Muhammad Iqbal Hashmi

4. **DEAN**
   Assoc. Prof. Dr. Mohd Ismail Abdullah

ACKNOWKLEDGEMENT

First and foremost, I would like to express my greatest thankful to School of Food Science and Nutrition (SSMP), Universiti Malaysia Sabah for the resources and facilities provided which has helped in the completion of my thesis. I would like to express my deepest appreciation and gratitude to my supervisor, Associate Professor Dr. Chye Fook Yee for his guidance, advices and support throughout this past year that lead to the completion of this thesis. Besides, I wish to thank Mr. Birdie Scott for his help and advices throughout the progress of this thesis. My special thanks are also dedicated to all SSMP laboratory assistants and staffs especially Mr. Taipin Gaidot for his kindly assistance and helpfulness. Nevertheless, my deepest thanks to my sincere family especially my parents for their understanding, cares, mentally and financial support throughout my university life, as well as my beloved sisters and brother. Last but not least, my sincere thanks are also extended to my dear friends who always giving me supports and encouragement. Once again, I would like to express my deepest appreciation to everyone who had been helping me in completing my final year project. Thank you.

Chuah Poh Lay
10 August 2010

ABSTRACT

Musa paradisiaca cv. Mysore inflorescence was investigated for its potential antimicrobial activity and the efficacy of its isolated fraction was evaluated in different models of food components and food properties *in vitro* against selected foodborne pathogens. The isolated water fraction of methanolic extract exhibited the most potent antimicrobial activity as compared to other fractions, with the inhibition zones of 16.10±0.14 mm, 14.90±0.14 mm, 13.00±0.00 mm and 11.75±0.35 mm against *Bacillus cereus, Staphylococcus aureus, Listeria monocytogenes* and *Vibrio parahaemolyticus* respectively. Water fraction showed the lowest Minimum Inhibitory Concentration and Minimum Bactericidal Concentration (MIC : MBC) for *Bacillus cereus* (8mg/ml : 10mg/ml), *Staphylococcus aureus* (12mg/ml : 16mg/ml), *Listeria monocytogenes* (22mg/ml : 26mg/ml) and *Vibrio parahaemolyticus* (24mg/ml : 27mg/ml) respectively. The results in broth model system indicated that high concentration of proteins (>5%) and oils (>10%) significantly decreased the antimicrobial activity of water fraction by 2 times ($p<0.05$). However, the addition of starches at concentration up to 30% adds to the water fraction efficacy, whereby the percentage of reduction was significantly higher (10%) as compared to starch concentrations of 1%. Similarly, high concentration of NaCl (>8%) also aids to the further reduction of *Listeria monocytogenes* by water fraction, while *Staphylococcus aureus* is optimally inhibited at low concentration of NaCl (<0.5%). The antimicrobial activity of water fraction was found to be most efficient at pH 4.0. Incubation temperature did not reveal any significant effect on the efficacy of water fraction. Overall, this study has shown that *Musa paradisiaca* water fraction could be potential source of natural antimicrobials to be used in foods when applied to foods containing a lower levels of proteins and fats, at pH 4.0-7.0, as well as moderate levels of carbohydrates.

ABSTRAK

KEBERKESANAN JANTUNG PISANG (Musa paradisiaca cv. Mysore) TERHADAP PATOGEN BAWAAN MAKANAN DALAM SISTEM MODEL MAKANAN

Jantung pisang (Musa paradisiaca cv. Mysore) dikajikan untuk mengetahui aktiviti antimikrobialnya serta keberkesanannya dalam model berlainan yang mengandungi komponen makanan dan sifat makanan terhadap pathogen bawaan makanan juga dikenalpastikan. Pecahan air daripada ekstrak methanol menunjukkan aktiviti antimikrobial yang paling kuat berbanding dengan pecahan lain, dengan mempamerkan zon penyekatan 16.10±0.14 mm, 14.90±0.14 mm, 13.00±0.00 mm dan 11.75±0.35 mm terhadap Bacillus cereus, Staphylococcus aureus, Listeria monocytogenes dan *Vibrio parahaemolyticus masing-masing. Pechan air menunjukkan "Minimum Inhibitory Concentration" dan "Minimum Bactericidal Concentration" (MIC : MBC) bagi Bacillus cereus (8mg/ml : 10mg/ml), Staphylococcus aureus (12mg/ml : 16mg/ml), Listeria monocytogenes (22mg/ml : 26mg/ml) dan Vibrio parahaemolyticus (24mg/ml : 27mg/ml) masing-masing. Keputusan menunjukkan bahawa tahap protein (<5%) dan minyak (<10%) yang tinggi menyebabkan aktiviti antimickrobial bagi pechan air menurun dengan signifikasi sebanyak 2 kali ganda (p<0.05). Akan tetapi, penambahan kanji pada kepekatan 30% menambahkan keberkesanan pecahan air, di mana peratus pengurangan adalah lebih tinggi (10%) berbanding dengan kepekatan kanji pada 1%. Selain itu, tahap NaCl yang tinggi (>8%) juga membantu dalam pengurangan bagi Listeria monocytogenes, manakala Staphylococcus aureus disekat optimal pada tahap NaCl yang rendah (<0.5%). Aktiviti antimikrobial bagi pecahan air didapati paling efisien pada pH 4.0. Suhu pengeraman tidak menunjukkan sebarang pengaruh yang signifikasi terhadap keberkesanan pecahan air. Keseluruhannya, kajian ini menunjukkan bahawa pecahn air Musa paradisiaca merupakan sumber berpotensi sebagai antimikrobial natural untuk digunakan dalam makanan apabila diaplikasikan ke dalam model makanan yang mempunyai kandunagan protein dan minyak yang rendah, pada pH dalam lingkungan 4.0-7.0, serta kandungan sederhana tinggi dalam karbohidrat.*

LIST OF TABLES

LIST OF FIGURES

LIST OF SYMBOLS

mm	millimeter
µl	microliter
ml	milliliter
L	liter
µg	microgram
mg	milligram
g	gram
min	minute
hr	hour
w	weight
v	volume
CFU	colony forming unit
CFU/ml	colony forming unit/ml
°C	degree Celcius
%	percentage

LIST OF ABBREVIATIONS

BC	*Bacillus cereus*
SA	*Staphylococcus aureus*
LM	*Listeria monytogenes*
VP	*Vibrio parahaemolyticus*
ATCC	American type of culture collection
MIC	Minimum Inhibitory Concentration
MBC	Minimum Bactericidal Concentration
DRT	Decimal reduction time
OD	Optical density
TSA	Tryptic soy agar
TSB	Tryptic soy broth
SPSS	Statistical Package of Science Social
ANOVA	Analysis of Variance
NCCLS	National Committee for Clinical Laboratory Standards
WHO	World Health Organization
MOH	Ministry of Health

LIST OF APPENDIX

TABLE OF CONTENTS

CHAPTER 1

INTRODUCTION

The microbiological safety of foods is a major concern to consumers, regulatory agencies and food industries throughout the world due to its wide economic and public health impact. Thus, many food preservation systems have been developed to overcome the illness caused by the consumption of contaminated foods or food products (Mead *et al.*, 1999). Apart from various foods processing such as thermal or cooling process, addition of preservatives is one of the most commonly used systems to enhance microbiological safety and stability of food products (Guillier *et al.*, 2007).

A variety of different chemical and synthetic compounds have been used as antimicrobial agents to inhibit bacteria in foods (Rahman & Kang, 2008). Synthetic antimicrobial agents such as organic acids, nitrite and sulfides were used for years to control the growth of microorganisms in foods (Kim *et al.*, 2001; Moosavy *et al.*, 2008). However, due to the identified and potential toxicity of chemical food preservatives, there has been increased demand on food preservatives from natural sources (Rahman & Kang, 2008). Therefore, a wide range of natural systems from animals, plants and microorganisms is being studied for the use in food preservation to replace the synthetic antimicrobial agents. The consumer demands for more natural antimicrobial agents have driven food scientists to investigate the effectiveness of extracts from plants (Nguefack *et al.*, 2004; Shin *et al.*, 2004).

Plants, including herbs and spices are widely used in the food industry as flavors and fragrances and some of them also exhibit useful antimicrobial properties. Many plant-derived antimicrobial compounds exhibited a wide spectrum of activity against bacteria, yeast and molds which has lead to suggestions that they could be used as natural food preservatives (Cho *et al.*, 2008). Wilkins & Board (1989) has been reported that 1340 plants are known to be potential sources of natural antimicrobial compounds. The major components with antimicrobial activity found in plants, herbs and spices are phenolic compounds, terpenes, aliphatic alcohols, aldehydes, ketones, acids and isoflavonoids (Davidson *et al.*, 2005).

Generally, the antibacterial efficacy of antimicrobial agents may reduce when apply in multiple food system as compared to the microbiological system (Naitali *et al.,* 2009). Additionally, the antimicrobial activity of these plant extracts toward foodborne pathogens which is manifested in microbiological system is inadequate to give the justification that the similar antimicrobial activity shall be obtained when it had been incorporated into a real food system (Ferrer *et al.,* 2009). Therefore, the application of antimicrobials using food model system is still essential due to the results obtained from the *in vitro* study could be hardly incorporated to a complex food system. The presence of various food components may influence the growth and behavior of microorganisms, and consequently affect the antimicrobial efficacy of the antimicrobial agents (Devlieghere *et al.,* 2004). In previous studies, it has been found that the antimicrobial efficacy of essential oils was reduced considerably when added to food system due to the high level of fat and protein content (Aureli *et al.*, 1992; Pandit & Shelef, 1994; Tassou *et al.*, 1995; Garcia-Gonzalez *et al.,* 2009).

Banana (*Musa sp.*) is one of the most common of the edible tropical fruits from the order *Zingiberales* and family *Musaceae* (Fereidoon & Marrian, 2004). Referring to FAO statistic database (FAOSTAT, 2008), the world's annual production in the year 2008 was 90 million tonnes for bananas and 34 million tonnes for plantains. In Malaysia, the production of banana and plantains is the second highest among all fruit crops with the total production of 325,353 tonnes in 2007 (MOA, 2007). According to Julies & Robert (2008), edible banana and plantain are divided into dessert bananas, cooking bananas, and beer bananas and plantains categories. Dessert bananas are eaten raw, while the other types are processed for cooking or beer before consumption. Additionally, other parts of the banana such as banana inflorescence or banana heart which is the male buds that removed from the centre of pseudostem can also be eaten. In India and Ethiopia, people consume the heart of the stem as a food delicacy and in the Far East and Sri Lanka consumers eat the male buds as salads (Kamatou *et al.,* 2007).

The major phenolics compounds of banana pulp include catecholamines, naringin and rutin (Griffiths, 1959; Drell, 1970; Kanazawa & Sakakibara, 2000). Dopamine and norepinephrine (α-(aminomethyl)-3,4-hydroxybenzyl alcohol) are the predominant catecholamines in banana peel and pulp; phenolics accumulate mainly in the peel (Kanazawa & Sakakibara, 2000). Dopamine displays anti-inflammatory activity and protects against intestinal injury as modulator for eicosanoid synthesis (MacNaughton & Wallace, 1989; Alanko *et al.*, 1992).

Bananas and plantains are multipurpose perennial plants which offer a wide range of uses with its fruits, leaves, flowers and stalks (Fagbemi *et al.*, 2009). Various parts of banana plant have been reported posses antimicrobial activities as well as antioxidant activities. According to Gurumaa (2008), the banana fruit has been used as part of anti-ulcer diet in combination with pineapple, blueberries, cloves, ginger and cinnamon. Besides, previous study showed that extract from *Musa, AAA cv Cavendish* fruits peel posses antibacterial and antioxidant properties capable to against pathogens (Mokbel & Hashinaga, 2005). The banana *Musa Paradisiaca* juice is being verified to have anti-venom properties by Someya *at al.* (2002). The antioxidant power of banana peel and banana pulp extract was also studied by Haruhiro *et al.* (1998).

Previous studies have been done on the various parts of banana plant in which performed the inhibitory effects towards foodborne pathogens, hence banana plant should be considered to be a potential natural source of antimicrobial as well as antioxidant compounds. However, there is still lack of information and studies on the functional properties and antimicrobial effectivesness of banana and plantain inflorescences, as opposed to its fruits and peels. Therefore, the aim of this study is performed to evaluate the antibacterial activity of banana by-product, which is the banana inflorescences and to investigate the antibacterial efficacy of banana inflorescences against foodborne pathogens in broth model system.

The specific objectives of the study are:

1. To evaluate the antimicrobial activity of banana inflorescence.
2. To determine the Minimum Inhibitory Concentration (MIC) and Minimum Bactericidal Concentration (MBC) of banana inflorescence water fraction against foodborne pathogens.
3. To investigate the influence of various food components and food properties towards the antimicrobial efficacy of banana inflorescence water fraction in broth model system.

CHAPTER 2

LITERATURE REVIEW

2.1 Banana and Plantain

Banana and plantain (*Musa spp.*) are major food crops in the humid and sub-humid parts over the world and also a major source of energy for millions of people (Adenji *et al.*, 2006). Bananas are widely consumed, primarily because of their low cost and their potential as functional and nutraccutical food (Reddy *et al.*, 2003). They are considered to be one of the health promoting fruits since it consist of beneficial nutrients such as vitamin A, B, C and fibre which are essential for maintaining good health, improve digestion and prevent constipation (Ismail, 2000; Rukayah, 2000; Torre-Gutierrez *et al.,* 2008).

Bananas (*Musa spp.*) belong to the order *Zingiberales* and family *Musaceae*. Members of this *Musaceae* family are large plants in 2-9 metres tall with aerial trunk consisting compacted leaf sheaths which grow directly from the top of corm (Anon, 1992). Upon flowering, the true stem emerges from the centre of tightly rolled bunch of leaves. The pseudostem supports a canopy consisting of 6-20 or more varying sizes of leaves (Rieger, 2006). According to Somson (1992), *Musaceae* consists of two types of genera which are *Musa* and *Ensete*. The genus of *Musa* will produces suckers and having small seeds. On the other hand, the genus *Ensete* is monocarpic, non-sucker and have large size seeds.

2.1.1 Differences between Banana and Plantain Cultivars

Banana (*Musa spp.*) cultivation is exclusively tropical and suited to the warm, high-rainfall regions of the lowland tropics (Lassoudiere, 2007). The banana plants are large fruit-bearing herb with great biodiversity due to the plenty types of cultivars found worldwide. The different edible fruit cultivars are a man-made complex based on cross-breeding two wild diploid species originating from regions around South-East Asia (Aurore *et al.,* 2009). These two wild diploid species refer to *Musa acuminata* Colla (AA), which is highly polymorphous with spindly plants that grown in clumps and *Musa balbisiana* Colla (BB), a homogeneous hardy plant with a massive pseudo-trunk. The next generations of diploid, triploid and tetraploid genome groups can be produced through such cross-breeding. The main genome groups include AA, AB, AAA, AAB and ABB as classified in Table 2.1. All varieties derived from *Musa acuminate* are more sugary and mainly eaten raw as a dessert fruit. On the other hand, the varieties of *Musa Balbisiana* have a slower process of ripening characteristics when starch is converted into sugar (Bakry *et al.,* 1997; Robinson, 1996; Stover & Simmonds, 1987).

Besides differentiating by types of genus, it can also be differentiated as banana and plantain. Plants of banana and plantain are alike physiologically. The main difference between banana and plantain is in the fruit itself. The term banana is typically used to describe sweet dessert banana cultivars (AA or AAA) that usually eaten raw when ripen while plantains (AAB, ABB or BBB) are generally the larger and more angular starchy cultivars which intended for cooking prior to consumption, but also edible raw when fully ripe (Nogrove & Hauser, 2002; Zhang *et al.*, 2005).

According to Rukayah (2000), there is about 70 banana cultivars have planted in Malaysia with different nutritional values and classified into banana that being eaten raw and cooking or processed bananas which known as plantain. Banana that are being eaten as raw in Malaysia are pisang mas, pisang rastali, pisang embun, pisang berangan and pisang lemak manis. The varieties that are being subjected to cook or processing are pisang tanduk, pisang awak, pisang abu, pisang raja and pisang nangka (Zainun, 1992).

Table 2.1: The main cultivars of banana and plantain.

Group	Subgroup	Cultivar	Fruit usage	Geographic distribution
AA	Sucrier	Frayssinette Figue sucree	Sweet dessert	All continents
	Pisang Lilin		Dessert	Indonesia, Malaysia
	Pisang Berangan		Dessert	
	Lakatan		Dessert	
AAA	Gros Michel	Gros Michel	Dessert	All continents
	Cavendish	Locatan, Poyo, Grand Nain, Williams	Dessert	Exported countries
	Figue rose	Figue rose	Dessert	
	Lujugira	Intuntu	Cooking, Beer	East Africa. highland
		Mujuba	Cooking, Beer	
AAAA	Champa Nasik		Dessert	
AAAB	Goldfinger	Goldfinger	Dessert	America, Australia
AB	Ney Poovan	Safet Velchi Sukari	Dessert acid Dessert acid	India, East Africa
AAB	Figue Pomme	Maca, Silk	Dessert acid	All continents
	Pome	Prata	Dessert acid	Brazil, India
	Mysore			India
	Plantain	French, Horn Corne	Cooking Cooking	Africa, Caribbean
ABB	Bluggoe	Bluggoe	Cooking	Philippines, America
	Poteau		Cooking	
	Pisang Awak	Fougamou	Dessert	
ABBB		Klue Terapod		
BBB	Saba	Saba	Cooking	Indonesia, Malaysia

Source: Bakry *et al.,* 1997; Nakasone & Paull, 1999; Rieger, 2006; Aurore *et al.,* 2009

2.1.2 Production of Banana and Plantain

Banana and plantain are important starchy foods, reported as being the fourth most produced global food group after rice, wheat and milk in terms of gross value (FAO, 2007). They are major crops of west and central Africa and grown in 120 developing countries throughout the world (Qi *et al.*, 2000). According to the Food and Agriculture Organization of the United Nations Statistics (FAOSTAT, 2008), the annual world production of banana accounted for 90 million tonnes and estimated a total of 34 million tonnes for plantains in year 2008. As can be seen from the Table 2.2, the world banana and plantain production quantity was increased steadily between 2004-2008 periods. The main producing countries for banana were India, China, Brazil, Philippines and Ecuador which alone produced more than 60% of total world banana production. While Uganda was the top producing country for plantain accounted for more than 20% of the world production (Appendix B). The *Cavendish* variety is the most exploited, corresponding to about 1/3 worldwide production (FAOSTAT, 2006) (Appendix B).

Table 2.2: The world's annual production of bananas and plantains.

	2004	2005	2006	2007	2008
Bananas					
Production (Tonnes)	75680849	78861753	84320784	89099503	90705922
Average yield (Tonnes/Hectares)	163749	169091	171954	176942	188282
Area harvested (Hectares)	4621741	4663837	4903676	5035499	4817511
Plantains					
Production (Tonnes)	33972622	33499339	33945755	34670709	34343343
Average yield (Tonnes/Hectares)	62323	62405	63217	64114	63708
Area harvested (Hectares)	5358704	5368037	5369708	5407644	5390731

Source: Food and Agriculture Organization of the United Nations Statistics, 2008

Although countries like India and Brazil are the major producers in the world, however they are not the top exporters due to the fact that most bananas are planted for sale in local markets or self-consumption, and only a small fraction produced are traded in the global market (FAO, 2003). The four leading banana exporting countries in 2006 were Ecuador, Costa Rica, Philippines and Colombia (Appendix B). Meanwhile the main importing areas are the European Union, the United States of America and Japan,, which accounted for more than 70% of world total imports in 2006 (Appendix B).

Banana and plantains are one of the major fruits which are planted in Malaysia and there are about 170 cultivars of bananas are found all over Malaysia (Ahaidah & Samaludin, 1993). According to FAO (2007), bananas graded as 7th among top 20 important food and agricultural commodities in Malaysia in 2007 (Appendix B). According to Ministry of Agriculture Malaysia (MOA, 2007), banana is ranked as second high production among various fruits as followed by the production of durian in Malaysia. As shown in Table 2.3, banana production has found to be increased from year 2004 to year 2007, which are 317,104 tonnes and 325,353 tonnes respectively. During the year 2007, the total hectarage of banana plantation was 26,079 hectares and 21,540 hectares were producing areas. From the statistics of MOA (2003), the Johor state has shown to contribute the main production of banana and plantain in Malaysia with 124,307 tonnes, followed by Sarawak with 28,854 tonnes and Sabah with 26,364 tonnes (Table 2.4). During the year 2007, 41,852 tonnes of banana and plantain was produced in Sabah, which is 28.8% of the total fruit crops production (Department of Agriculture, Sabah, 2007) (Appendix B). When the production of banana was being reviewed according to districts in Sabah, it was found that Kota Belud, Tawau, Tuaran were the three districts providing the highest banana production sequentially throughout year 2007 (Appendix B).

REFERENCES

Adams, M. R. 1980. *The small-scale production of vinegar from bananas.* Tropical Products Institute. 56/62 Grays Inn Road London WC1X8LU. Overseas Development Administration.

Adenji, T. A., Sanni, L. O., Barimalaa, I. S. & Hard, A. D. 2006. Determination of micronutrients and color variability among new plantain and banana hybrids flour. *World Journal of Chemistry.* **1**(1): 23-27.

Ahaidah, A. & Samaludin, K. 1993. *Pisang Berangan*. Kota Kinabalu: Jabatan Pertanian Sabah.

Ahmad, I. & Beg, A. Z. 2001. Antimicrobial and phytochemical studies on 45 Indian medicinal plants against multi-drug resistant human pathogens. *Journal of Ethnopharmacology.* **74**: 113-133.

Ahmedna, M., Marshall, W. E., Husseiny, A. A., Rao, R. M. & Goktepe, I. 2004. The use of nutshell carbons in drinking water filters for removal of trace metals. *Water Resource.* **38**(4): 1062-1068.

Ahn, J., Grun, I. U. & Mustapha, A. 2007. Effects of plant extracts on microbial growth, color change, and lipid oxidation in cooked beef. *Food Microbiology.* **24**: 7-14.

Akmar, P. F. & Kennedy, J. F. 2001. The potential of oil and sago palm trunk wastes as carbohydrate resources. *Journal Wood Science Technology.* **35**(5): 467-473.

Akrem, H., Manaf, A., Marielle, B. & Moktar, H. 2007. The effects of solvents and extraction method on the phenolic contents and biological activities in vitro of Tunisian *Quercus coccifera* L. and *Juniperus phoenicea* L. fruit extracts. *Food Chemistry.* **105**: 1126-1134.

Akubor, P. I., Obio, S. O., Nwadomere, K. A. & Obiomah, E. 2003. Production and quality evaluation of banana wine. *Plant Foods for Human Nutrition.* **58**: 1-6.

Akyuz, M. & Yildiz, A. 2008. Evaluation of cellulosic wastes for the cultivation of *Pleurotus eryngii* (DC. ex Fr.) Quel. *African Journal Biotechnology.* **7**(10): 1494-1499.

Alanko, J., Riutta, A. & Vappatalo, H. 1992. Effects of catecholamines on eicosanoid synthesis with special reference to prostanoid/leukotriene ratio. *Free Radical Biology & Medicine.* **13**:677-688.

Alburquerque, J. A., Gonzalvez, J., Garcia, D. & Cegarra, J. 2006. Effects of bulking agent on the composting of "alperujo", the solid by-product of the two-phase centrifugation method for olive oil extraction. *Process Biochemistry*. **41**(1): 127-132.

Alisi, C. S., Nwanyanwu, C. E., Akujobi, C. O. & Ibegbulem, C. O. 2008. Inhibition of dehydrogenase activity in pathogenic bacteria isolates by aqueous extracts of *Musa paradisiaca* (*var sapientum*). *African Journal of Biotechnology*. **7**(12): 1821-1825.

Alzoreky, N. S. & Nakahara, K. 2003. Antibacterial activity of extracts from some edible plants commonly consumed in Asia. *International Journal of Food Microbiology*. **80**: 223-230.

Alzoreky, N. S. 2009. Antimicrobial activity of pomegranate (*Punica granatum* L.) fruit peels. *International Journal of Food Microbiology*. **134**: 244-248.

Amaranth, R. & Balakrishnan. 2007. Evaluation of banana (*Musa paradisiaca*) plant by-product's fermentation characteristics to acess their fodder potential. *International Journal of Dairy Science*. **2**(3): 217-225.

Amous, A., Makrins, D. P. & Kefalas, P. 2002. Correlations of pigments and flavonol content with antioxidant properties in selected aged regional wines from Greece. *Journal of Food Composition and Analysis*. **15**: 655-665.

Annadurai, G., Juang, R. S. & Lee, D. J. 2002. Use of cellulose-based wastes for adsorption of dyes from aqueous solutions. *Journal of Hazardous Materials*. **92**(3): 263-274.

Anon. 1992. INIBAP annual report. Montpellier, France: International Network for the Improvement of Banana and Plantain.

Apostolidis, E., Kwon, Y. I. & Shetty, K. 2008. Inhibition of *Listeria monocytogenes* by oregano, cranberry and sodium lactate combination in broth and cooked ground beef systems and likely mode of action through proline metabolism. *International Journal of Food Microbiology*. 128: 317-324.

Arts, I. C. W. & Hollman, P. C. H. 1998. Optimization of a quantitative method for the determination of catequins in fruits and legumes. *Journal of Agricultural and Food Chemistry*. **46**(12): 5156-5162.

Arvanitoyannis, I. S. & Kassaveti, A. 2007a. Current and potential uses of composted olive oil waste. *International Journal of Food Science Technology*. **42**(3): 281-295.

Arvanitoyannis, I. S., Kassaveti, A. & Stefanatos, S. 2007b. Current and potential uses of thermally treated olive oil waste. *International Journal of Food Science Technology*. **42**(7): 852-867.

Ascensao, A. & Dubery, I. A. 2003. Soluble and wall-bound phenolics and phenolic polymers in *Musa acuminata* roots exposed to elicitors from *Fusarium oxysporum f.sp. cubense*. *Phytochemistry*. **63**: 679-686.

Astroga-Solari, R., Santiesteben-Lopez, A., Palou, E. & Lopez-Malo, A. 2001. Antimicrobial spectrum of thymol, eugenol, potassium sorbate and sodium benzoate at selected pHs. Presented at 2001 International Association of Food Protection (IAFP) Annual Meeting. Minneapolis, MN.

Aureli, P., Costantini, A. & Zolea, S. 1992. Antimicrobial activity of some plant essential oils against *Listeria monocytogenes*. *Journal of Food Protection*. **55**(5): 344-348.

Aurore, G., Parfait, B. & Fahrasmane, L. 2009. Bananas, raw materials for making processed food products. *Trends in Food Science & Technology*. **20**:78-91.

Bagamboula, C. F., Uyttendaele, M. & Debevere, J. 2004. Inhibitory effect of thyme and basil essential oils, carvacrol, thymol, estragol, linalool and p-cymene towards *Shigella sonnei* and *S. flexneri*. *Food Microbiology*. **21**(1): 33-42.

Bahk, J., Yousef, A. E. & Marth, E. H. 1990. Behavior of *Listeria monocytogenes* in the presence of selected spices. *Lebensm Wiss Technology*. **23**: 66-69.

Bakry, F., Carreel, F., Caruana, M. L., Cote, F. X., Jenny, C., & Tezenas du Moncel, H. 1997. Les bananiers. *In* A. Charrier, M. Jacquot, S. Hamon, and D. Nicolas (Eds.). *L'ame´lioration des plantes tropicales*. France: CIRAD ORSTOM. pp. 109-139.

Bala, M. F. A. & Marshall, D. L. 1996. Use of double-gradient plates to study combined effects of salt, pH, monolaurin and temperature on Listeria monocytogenes. *Journal of Food Protection*. **59**: 601-607.

Baranauskien, R., Venskutonis, P. R., Dewettinck, K. & Verhe, R., 2006. Properties of oregano (*Origanum vulgare* L.), citronella (*Cymbopogon nardus* G.) and marjoram (*Majorana hortensis* L.) flavors encapsulated into milk protein-based matrices. *Food Research International*. **39**: 413-425.

Barmpalia-Davis, I. M., Ifigenia, G., Patricia, A. K. & John, N. S. 2009. Effect of fat content on survival of inoculated beef frankfurters stored at 7°C. *Food Microbiology*. **26**: 483-490.

Barry, A. L. 1986. *Procedure for testing antimicrobial agents in agar media: theoretical considerations*. In Antibiotics in Laboratory Medicine.

Basile, A., Sorbo, S., Giordano, S., Ricciardi, L., Ferrara, S., Montesano, D., Castaldo Cobianchi, R., Vuotto, M. L. & Ferrara, L. 2000. Antibacterial and allelopathic activity of extract from *Castanea sativa* leaves. *Fitoterapia*. **71**: 110-116.

Basso, M. C., Cerrella, E. G. & Cukierman, A. L. 2004. Cadmium uptake by lignocellulosic materials: Effect of lignin content. *Separate Science Technology*. **39**(5): 1163-1175.

Begnami, A. F., Duarte, M. C. T., Furletti, V. & Rehder, V. L.G. 2010. Antimicrobial potential of *Coriandrum sativum L.* against different Candida species *in vitro*. *Food Chemistry*. **118**: 74-77.

Bektas, T., Dimitra, D., Atalay, S., Munevver, S. & Moschos, P. 2005. Antimicrobial and antioxidant activities of essential oils and various extracts of Salvia tementosa Miller (*Lamiaceae*). *Food Chemistry*. **90**: 333-340.

Bello-Perez, L. A., Agama-Acevedo, E., Sayago-Ayerdi, S. G. & Moreno-Damian, E. 2000. Some structural, physicochemical and functional studies of banana starches isolated from two varieties growing in Guerrero. *Journal of Food Chemistry*. **52**(2–3): 68-73.

Ben-Arfa, A., Combes, L., Preziosi-Belloy, N., Gontard. & Chalier, P. 2006. Antimicrobial activity of carvacrol related to its chemical structure. *Letter Applied Microbiology*. **43**: 149-154.

Beuchat, L. R., Brackett, R. E. & Doyle, M. P. 1994. Lethality of carrot juice to *Listeria monocytogenes* as affected by pH, sodium chloride and temperature. *Journal of Food Protection*. **57**: 470-474.

Beuchat, L. R. 1994. Antimicrobial properties of spices and their essential oils, In Dillon, V. M. & Board, R. G., Eds, *Natural Antimicrobial Systems and Food Preservation*. England, Wallingford: CAB Intl. pp. 167-179.

Bhavsar, K., Shah, P., Soni, S. K. & Khire, J. M. 2008. Influence of pretreatment of agriculture residues on phytase production by *Aspergillus niger* NCIM 563 under submerged fermentation conditions. *African Journal Biotechnology*. **7**(8): 1101-1106.

Burt, S. 2004. Essential oils: their antibacterial properties and potential applications in foods – a review. *Food Microbiology*. **94**: 223-253.

Busatta, C., Vidal, R. S., Popiolski, A. S., Mossi, A. J., Dariva, C., Rodrigues, M. R. A., Corazza, F. C., Corazza, M. L., Oliveira, J. V. & Cansian, R. L. 2008. Application of *Origanum majorana* L. essential oil as an antimicrobial agent in sausage. *Food Microbiology*. **25**: 207-211.

Calar, A. & Demirba, A. 2002. Hydrogen rich gas mixture from olive husk via pyrolysis. *Energy Conversion Management*. **43**(1): 109-117.

Candan, F., Unlu, M., Tepe, B., Daferera, D., Polissiou, M. & Sokmen, A. 2003. Antioxidant and antimicrobial activity of the essential oil and methanol extracts of *Achillea millefolium subsp. Millefolium Afan.* (Asterraceae). *Journal of Ethnopharmacology*. **87**: 215-220.

Canillac, N. & Mourey, A. 2004. Effects of several environmental factors on the anti-*Listeria monocytogenes* activity of an essential oil of *Picea excelsa*. *International Journal of Food Microbiology*. **92**: 95-103.

Carreno, S. & Aristizabal, L. 2003. Utilisation de bananas plantain pour produire du vin. *InfoMusa*. **12**(1): 2-4.

Casaurang, M., Herrera, P., Gonzalez, I. & Aguilar, V. M. 2001. Physical and mechanical properties of henequen fibers. *Journal Application Polymer Science*. **43**: 749-56.

Cava, R., Nowak, E., Taboada, A. & Marin-Iniesta, F. 2007. Antimicrobial activity of clove and cinnamon essential oils against *Listeria monocytogenes* in pasteurized milk. *Journal of Food Protection*. **70**(12): 2757-2763.

Cayuela, M. L., Sanchez-Monedero, M. A & Roig, A. 2006. Evaluation of two different aeration systems for composting two-phase olive mill wastes. *Process Biochemistry*. **41**(3): 616-623.

Centers of Disease Control and Prevention. 2006. Preliminary FoodNet data on the incidence of infection with pathogens transmitted commonly through food-10 states. United States. Morb. Mortal weekly. Rep **55**: 392-395.

Charu, G., Amar, P. G., Ramesh, C. U. & Archana, K. 2008. Comparative analysis of the antimicrobial activity of cinnamon oil and cinnamon extract on some foodborne microbes. *African Journal of Microbiology Research*. **2**(9): 247-251.

Chaudhary, N. & Sharma, C. B. 2005. Production of citric acid and single cell protein from agrowaste. *National Academic Science Letter*. **28**(5/6): 189-193.

Chandrasekaran, M. & Venkatesalu, V. 2004. Antibacterial and antifungal activity of *Syzgium jambolanum* seeds. *Journal Ethanopharmacol*. **91**: 105-108.

Chattopadhyay, D., Maiti, K., Kundu, A. P., Chakrabarty, M. S., Bahdra, R., Mandal, S. C. & Mandal, A. B. 2001. Antimicrobial activity of *Alsotonia macrophyllia*. Folklore of Bay Island. *Journal of Ethnopharmacology*. **77**: 49-55.

Chauhan, A. S., Negi, P. S. & Ramteke, R. S. 2007. Antioxidant and antibacterial activities of aqueous extract of Seabuckthorn (*Hippohae rhamnoides*) seeds. *Filoterapia*. **78**: 590-592.

Chea, A., Hout, S., Bun, S. S. Tabatadze, N., Gasquet, M., Azas, N., Elias, R. & Balansard, G. 2007. Antimalarial activity of alkaloids isolated from *Stephania rotunda*. *Journal of Ethnopharmacology*. Accepted Manuscripts.

Chen, Z. Y. & Chan, P. T. 1996. Antioxidative activity of green tea catechins in canola oil. *Chemistry and Physics of Lipids*. **82**: 163-172.

Chen, G. & Leung, D. Y. C. 2003. Experimental investigation of biomass waste, (rice straw, cotton stalk, and pine sawdust), pyrolysis characteristics. *Energy Sources Part A: Recovery. Utilization Environmental Effects.* **25**(4): 331-337.

Cheng, A. H. 2009. The probability of growth of *Listeria monocytogenes* in cooked salmon and tryptic soy broth as affected by salt, smoke compound and storage temperature. *Food Microbiology.* **26**: 253-258.

Cho, W. I., J. B. Choi, K. Lee, M. S. Chung & Y. R. Pyun. 2008. Antimicrobial activity of Torilin isolated from Torilis japonica fruit against *Bacillus subtilis. Journal of Food Science.* **73**: 37-46.

Clarke, W. P., Radnidge, P., Lai, E., Jensen, P. D. & Hardin, M. T. 2008. Digestion of waste bananas to generate energy in Australia. *Waste Management.* **28**(3): 527-533.

Cordeiro, N., Belgacem, M. N., Torres, I. C. & Moura, J. C. V. P. 2004. Chemical composition and pulping of banana pseudo-stems. *Industrial Crops and Products.* **19**: 147-154.

Cornu, M., Beaufort, A., Rudelle, S., Laloux, L., Bergis, H., Miconnet, N., Serot, T. & Delignette-Muller, M., 2006. Effect of temperature, water-phase salt and phenolic content on *Listeria monocytogenes* growth rates on cold-smoked salmon and evaluation of secondary models. *International Journal of Food Microbiology.* **106**: 159-168.

Cowan, M. M. 1999. Plant products as antimicrobial agents. *Clinical Microbiology Review.* **12**: 564-577.

Cushnie, T. P. T. & Lamb, A. J. 2005. Antimicrobial activity of flavonoids. *International Journal of Antimicrobial Agents.* **26**: 343-356.

Daniells, J., Jenny, C., Karamura, D. & Tomekpe, K. 2001. *Musalogue: A catalogue of Musa germplasm diversity in the genus Musa.* Montpellier, France: International Network for the Improvement of Banana and Plantain.

Daroit, D. J., Silveir, S. T., Hertz, P. F. & Brandelli, A. 2007. Production of extracellular glucosidase by *Monascus purpureus* on different growth substrates. *Process Biochemistry.* **42**(5): 904-908.

Das, H. & Singh, S. 2004. Useful by-products from cellulosic wastes of agriculture and food industry - A critical appraisal. *Critical Review Food Science Nutrition.* **44**(2): 77-89.

Das, N. & Mukherjee, M. 2007. Cultivation of *Pleurotus ostreatus* on weed plants. *Bioresource Technology.* **98**(14): 2723-2726.

Davidson, P. M. & Parish, M. E. 1989 Methods for testing the efficiency of food antimicrobials. *Food Technology.* **43**: 148-154.

Davidson, P. M. & Naidu, A. S. 2000. Phyto-phenols. *In* Naidu, A. S. (ed.). *Natural Food Antimicrobial Systems*. Florida: CRC Press.

Davidson, P. M., John, N. S. & Branen. A. L. 2005. *Antimicrobials In Food*. 3rd edition. Boca Raton: CRC Press.

Davies, G. 1993. Production domestique de la biere de banane dans la region de Mpigi, Ouganda. *InfoMusa*. **2**(1): 12-15.

Del Campo, L., Amoit, M. J. & Nguyen, T. C. 2000. Antimicrobial effect of rosemary extracts. *Journal of Food Protection*. **63**(10): 1359-1368.

Demirbas, A. 2008. Products from lignocellulosic materials via degradation processes. *Energy Sources Part A: Recovery, Utilization, and Environmental Effects*. **30**(1): 27- 37.

Devlieghere, F., Vermeulen, A. & Debevere, J. 2004. Chitosan: antimicrobial activity, interactions with food components and applicability as a coating on fruit and vegetables. *Food Microbiology*. **21**: 703-714.

Digabel, F. L., Boquillon, N., Dole, P., Monties, B. & Averous. 2004. Properties of thermoplastic composites based on wheat-straw lignocellulosic fillers. *Journal Applied Polymer Science*. **93**(1): 428 – 436.

DOA. 2003. *Fruit crops statistics: Malaysia 2003*. Department of Agriculture, Ministry of Agriculture, Putrajaya.

DOA. 2007. *Report on crops hectarage and production in Sabah 2007*. Department of Agriculture, Ministry of Agriculture, Ministry of Agriculture, Putrajaya.

Dorman, H. J. D. & Deans, S. G. 2000. Antimicrobial agents from plants: antibacterial activity of plant volatile oils. *Journal of Applied Microbiology*. **88**: 308-316.

Drell, W. 1970. Separation of catecholamines from catechol acids by alumina. *Analytical Biochemistry*. **34**: 142–151.

Duangporn, K., William, C. & Komontam, U. 2008. Antibacterial activities of fermented plant beverages collected in Southern Thailand. *Journal of Biological Sciences*. **8**(8): 1280-1288.

Dupont, L., Bouanda, J., Dumonceau, J. & Aplincourt, M. 2005. Biosorption of Cu(II) and Zn(II) onto a lignocellulosic substrate extracted from wheat bran. *Journal Environmental Chemistry Letter*. **2**(4): 165-168.

Elgayyar, M., Draughon, F. A., Golden, D. A. & Mount, J. R. 2001. Antimicrobial activity of essential oils from plants against selected pathogenic and saprophytic microorganisms. *Journal of Food Protection*. **64**(7): 1019-1024.

Elizabeth, A. L., Yoke, B. Joaanne, F. J. & John, B. B. 2000. Antibacterial compounds form *Carissa Ianceolata*. *Phytochemistry*. **55**: 403-406.

Emaga, T. H., Ronkart, S. N., Robert, C., Wathelet, B. & Paquot, M. 2008. Characterisation of pectins extracted from banana peels (*Musa* AAA) under different conditions using an experimental design. *Food Chemistry*. **108**(2): 463-471.

Emtiazi, G., Naghavi, N. & Bordbar, A. 2001. Biodegradation of lignocellulosic waste by *Aspergillus terreus*. *Biodegradation*. **12**(4): 257-261.

Espiard, E. 2002. *Introduction à la transformation industrielle des fruits. Banane*. Londres/Paris/New York: Editions Tec & Doc. pp. 103-111.

Essien, J. P., Akpan, E. J. & Essien, E. P. 2005. Studies on mould growth and biomass production using waste banana peel. *Bioresource Technology*. **96**(13): 1451-1456.

Evandro, L. S., Jefferson, C. B., Maria, L. C., Nelson, J. S. N. & Anna, C. V. S. 2009. Combined application of *Origanum vulgare* L. essential oil and acetic acid for controlling the growth of *Staphylococcus aureus* in foods. *Bazilian Journal of Microbiology*. **40**: 387-393.

Fagbemi, J. S., Ugoji, E., Adenipekun, T. & Adelowaotan, O. 2009. Evaluation of the antimicrobial properties of unripe banana (Musa sapientum L.), lemon grass (*Cymbopogon citrates S.*) and turmeric (*Curcuma longa L.*) on pathogens. *African Journal of Biotechnology*. **8**(7): 1176-1182.

Faisant, N., Gallant, D. J., Bouchet, B. & Champ, M. 1995. Banana starch breakdown in the human small intestine studied by electron microscopy. European *Journal of Clinical Nutrition*. **49**: 98-104.

Fan, Y. T., Zhang, Y. H., Zhang, S. F., Hou, H. W. & Ren, B. Z. 2006. Efficient conversion of wheat straw wastes into biohydrogen gas by cow dung compost. *Bioresource Technology*. **97**(3): 500-505.

Fan, W., Chi, Y. & Zhang, S. 2008. The use of a tea polyphenol dip to extend the shelf life of silver carp (*Hypophthalmicthys molitrix*) during storage of ice. *Food Chemistry*. **108**: 148-153.

FAO. 2003. The World Banana Economy 1985-2002. Food and Agriculture Organization of the United Nations (FAO).

FAO. 2008. Food and Agriculture Organization of the United Nations. FAOSTAT statistic database. Available http://www.fao.org/.

Fereidoon, S. & Marrian, N. 2004. *Phenolics in Food and Nutraceuticals*. London, Boca Raton: CRC Press. pp. 179-180.

Fernandes, J. C., Tavaria, F. K., Soares, J. C., Ramos, O. S., Monteiro, M. J., Pintado, M. E. & Malcata, F. X. 2008. Antimicrobial effects of chitosans and chitooligosaccharides, upon *Staphylococcus aureus* and *Escherichia coli*, in food model systems. *Food Microbiology*. **25**: 922-928.

Feyza, O., Belma, A., Sahlan, O. & Senol, A. 2009. Essential oil composition, antimicrobial and antioxidant activities of *Satureja cuneifolia Ten. Food Chemistry*. **112**: 874-879.

Firouzi, R., Shekarforoush, S. S., Nazer, A. H., Borumand, Z. & Jooyandeh, A. R. 2007. Effects of essential oils of oregano and nutmeg on growth and survival of *Yersinia enterocolitica* and *Listeria monocytogenes* in barbecued chicken. *Journal of Food Protection*. **70**(11): 2626-2630.

Foyle, T., Jennings, L. & Mulcahy, P. 2007. Compositional analysis of lignocellulosic materials: Evaluation of methods used for sugar analysis of waste paper and straw. *Bioresource Technology*. **98**(16): 3026-3036.

Galbe, M. & Zacchi, G. 2007. Pretreatment of lignocellulosic materials for efficient bioethanol production. *Advanced Biochemistry England Biotechnology*. **108**: 41-65.

Gao, J., Weng, H., Zhu, D., Yuan, M., Guan, F. & Xi, Y. 2008. Production and characterization of cellulolytic enzymes from the thermoacidophilic fungal *Aspergillus terreus* M11 under solid-state cultivation of corn stover. *Bioresource Technology*. **99**(16): 7623-7629.

Garcia-Conzalez, L., Geeraed, A. H., Elst, K., Van Ginneken L., Van Impe, J. F. & Devilieghere. 2009. Influence of type of microorganism, food ingredients and food properties on high-pressure carbon dioxide inactivation of microorganism. *International Journal of Food Microbiology*. **129**: 253-263.

Garcia-Gomez, A., Bernal, M. P. & Roig, A. 2005. Organic matter fractions involved in degradation and humification processes during composting. *Compost Science Utilization*. **13**(2): 127-135.

Georgopoulos S. T., Tarantili, P. A., Avgerinos, E., Andreopoulos, A. G. & Koukios, E. G. 2005.Thermoplastic polymers reinforced with fibrous agricultural residues. *Polymer Degradation*. **90**(2): 303-312.

Ghalfi, H., Benkerroum, N., Doguiet, D. D., Bensaid, M. & Thonart, P. 2007. Effectiveness of cell-adsorbed bacteriocin produced by *Lactobacillus curvatus* CWBI-B28 and selected essential oils to control *Listeria monocytogenes* in pork meat during cold storage. *Letters in Applied Microbiology*. **44**(3): 268-273.

Gill, A. O., Delaquis, P., Russo, P. & Holley, R. A. 2002. Evaluation of antilisterial action of cilantro oil on vacuum packed ham. *International Journal of Food Microbiology*. **73**: 83-92.

Glass, K. A. & Johnson, E. A. 2004. Antagonistic effect of fat on the antibotulinal activity of food preservatives and fatty acids. *Food Microbiology*. **21**: 675-682.

Goli, A. H., Barzegar, M. & Sahari, M. A. 2004. Antioxidant activity and total phenolic compounds of pistachio (*Pistachia vera*) hull extracts. *Food Chemistry*, **92**: 521-525.

Gong, R., Ding, Y., Mei, L., Yang, C., Liu, H. & Sun, Y. 2005. Utilization of powdered peanut hull as biosorbent for removal of anionic dyes from aqueous solution. *Dye Pigments*. **64**: 187-192.

Gonzalez-Paramas, A. M., Esteban-Ruano, S., Santos-Buelga, C., Pascual-Teresa, S., & Rivas-Gonzalo, J. C. 2004. Flavanol content and antioxidant activity in winery by-products. *Journal of Agricultural and Food Chemistry*. **52**(2): 234-238.

Gonzalez-Soto, R. A., Mora-Escobedo, R., Hernandez-Sanchez, H., Sanchez- Rivera, M., & Bello Perez, L. A. 2007. The influence of time and storage temperature on resistant starch formation from autoclaved debranched banana starch. *Food Research International*. **40**(2): 304–310.

Gopalkrishna, K. B., Amruta, T., Rajasree, R. & Sreeja, R. 2009. A simple broth-disk method to determine the minimum inhibitory concentration of ceftriaxone on *Salmonella enteric* serovar typhi and paratyphi. *Indian Journal of Pathology and Microbiology*. **52**(2): 189-190.

Greig, J. D. & Ravel, A. 2009. Analysis of foodborne outbreak data reported internationally for source attribution. *International Journal of Food Microbiology*. **130**: 77-87.

Griffiths, L. A. 1959. *Detection and identification of the polyphenol substrate of the banana*. Nature. **184**: 58-59.

Guerrero, S., Alzamora, S. M. and Gerschenson, N. 1994. Development of shelf-stable banana puree by combined factors: microbial stability. *Journal of Food Protection*. **57**(10):902-907.

Guerrero, M., Femandez, L., Pablo, R., Antonia, N., Miguel, D. G. & Jorge, M. 2004. Prosthetic valve endocarditis due to *Listeria monocytogenes* report of two cases and reviews. *International Journal of Infectious Diseases*. **8**(2): 97-102.

Guillier, A. I. Nazer & F. Dubois-Brissonnet. 2007. Growth response of *Salmonella Typhimurium* in the presence of natural and synthetic antimicrobials: estimation of MICs from three different models. *Journal of Food Protection*. **70**: 2243-2250.

Gurumaa, A. 2008. *Banana: Banana Guide Benefit and Nutrition Facts.* http://www.gurumaa.com/health-go-bananas.php.

Gutierrez, J., Barry-Ryan, C. & Bourke, P. 2008. The antimicrobial efficacy of plant essential oil combinations and interactions with food ingredients. *International Journal of Food Microbiology*. **124**: 91-97.

Guzel-Seydim, Z., Bever, P. I. & Greene, A. K. 2004. Efficacy of ozone to reduce bacterial populations in the presence of food components. *Food Microbiology*. **21**: 475-479.

Hameed, B. H., Mahmoud, D. K. & Ahmad, A. L. 2008. Sorption equilibrium and kinetics of basic dye from aqueous solution using banana stalk waste. *Journal of Hazardous Materials*. **158**: 499-506.

Hammer, K. A., Carson, C. F. & Riley, T. V. 1999. Antimicrobial activity of essential oils and other plant extracts. *Journal of Applied Microbiology*. **86**: 985-990.

Hammond, J. B., Egg, R., Diggins, D. and Coble, G. C. 1996. Alcohol from bananas. *Bioresources Technology*. **56**(1):125-130.

Hanchar, R. J., Farzaneh Teymouri, F., Nielson, C. D., McCalla, D. & Stowers, M. D. 2007. Separation of glucose and pentose sugars by selective enzyme hydrolysis of AFEX-treated corn fiber. *Journal Applied Biochemistry Biotechnology*. **137-140**(1-12): 313-325.

Hao, Y. Y., Brackett, R. E. & Doyle, M. P. 1998. Efficacy of plant extracts in inhibiting *Aeromonas hydrophila* and *Listeria monocytogenes* in refrigerated, cooked poultry. *Food Microbiology*. **15**: 367-378.

Harborne, J. B. 1991. *Phenolic compounds. In: Phytochemical Methods, A Guide to Modern Techniques of Plant Analysis*. Second ed. Chapman and Hall, London. pp. 37-54.

Harim, M., Maleque, M. A. & Sapuan, S. M. 2003. Mechanical properties of epoxy/coconut shell filler particle composites. *Arab Journal Science Eng*. **28**(2B): 171-81.

Harman, G., Patrick, R. & Spittler, T. 2007. Removal of heavy metals from polluted waters using lignocellulosic agricultural waste products. *Indian Biotechnology*. **3**(4): 366-374.

Hart, T. D., Lynch, J. M. & De Leij F. A. A. M. 2003. Production of *Trichurus spiralis* to enhance the composting of cellulose-containing waste. *Enzyme Microbialogy Technology*. **32**(6):745-750.

Haruhiro, O., Shoko, T., Soichi, T. & Michiko, W. 1998. 6-methylsulfinylhexyl isothiocyanate and its homologues as food-originated compounds with antibacterial activity against *Escherichia coli* and *Staphylococcus aureus*. *Bioscience Biotechnology Biochemistry*. **62**(2): 363-365.

Hembade, A. S. & Patel, P. M. 2004. Green banana leaves in the ration of kids. *Indian Journal Animal Nutrition*. **21**: 5-7.

Hill, G. B. 1991. Spiral gradient endpoint method compared to standard agar dilution for susceptibility testing of anaerobic Gram-negative bacilli. *Journal Clinical Microbiology*. **29**: 975.

Ho, Y. S., Chiang, T. H. & Hsueh, M. Y. 2005. Removal of basuc dye from aqueous solution using tree fern as a biosorbent. *Process Biochemistry*. **40**: 119-124.

Hong, S. I. & Pyun, Y. R. 1999. Inactivation kinetics of *Lactobacillus plantarum* by high pressure carbon dioxide. *Journal of Food Science*. **64**: 728-733.

Hong, S. I., Park, W. S. & Pyun, Y. R., 1999. Non-thermal inactivation of *Lactobacillus plantarum* as influenced by pressure and temperature of pressurized carbon dioxide. *International Journal of Food Science and Technology*. **34**: 125-130.

Horosova, K., Bujnakova, D. & Kme, V. 2006. Effect of oregano essential oils on chicken *Lactobacillus* and *E. coli*. *Folia Microbiology*. **51**: 278-280.

Howard, R. L., Abotsi, E., Jansen van Rensburg, E. L. & Howard, S. 2003. Lignocellulose biotechnology: Issues of bioconversion and enzyme production. *African Journal Biotechnology*. **2**(12): 602-619.

Hsieh, P. C., Mau, J. L. & Huang, S. H. 2001. Antimicrobial effect of various combinations of plant extracts. *Food Microbiology*. **18**: 35-43.

Hurst, A. & Hughes, A. 1983. The protective effect of some food ingredients on *Staphylococcus aureus* MF31. *Journal of Applied Bacteriology*. **55**: 81-88.

Huys, G., D'Haene, K. & Swings, J. 2002. Influence of the culture medium on antibiotic susceptibility testing of food-associated lactic acid bacteria with the agar overlay disc diffusion method. *Letter in Applied Microbiology*. **34**: 402-406.

Ibrahim, M. N. M., Nadiah, M. Y. N., Norliyana, M. S., Sipaut, C. S. & Shuib, S. 2008. Separation of vanillin from oil palm empty fruit bunch lignin. *Acta hydrochimica et hydrobiologica*. **36**(3): 287-291.

International Commission on Microbiological Specifications for Foods (ICMSF). 1996. *Staphylococcus aureus*. *In* Micro-organisms in Foods 5 Microbiological Specifications of Food Pathogens. London: Blackie Academic and Professional. pp 299-333.

Isenberg, H. D. & Jenkins, S. G. 2004. Clinical Microbiology. *In* Gorbach, S. L., Bartlett, J. G. and Blacklow, N. R. (ed.). Infectious diseases. 3rd edition. Philadelphia: Lippincott Williams and Wilkins. pp. 142-143.

Ismail, S. 2000. *Sayuran Tradisional Ulam dan Penyedap Rasa*. Selangor: Universiti Kebangsaan Malaysia.

Jacqui, M. M., Qi, Y. Russell, J. C. & Enzo, A. P. 2008. Antibacterial compounds from *planchonia careya* leaf extracts. *Journal of Ethnopharmacology*. **116**: 554-560.

Jay, M. J. 2000. *Modern Food Microbiology*. 6th edition. New York: Aspen Publisher.

Jayaprakasha, G. K., Singh, R. P. & Sakariah, K. K. 2001. Antioxidant activity of grape seed (*Vitis vinifera*) extracts on peroxidation models *in vitro*. *Food Chemistry*. **73**: 285-290.

Jecu, L. 2000. Solid state fermentation of agricultural wastes for endoglucanase production. *Indian Crops and Products*. **11**(1): 1-5.

Jelena, K., Visnja, P., Silvana, P., Pavel, M., Ana, C., Dejan, S. & Marina, S. 2008. Antioxidant and antimicrobial activity of *Cynara cardunculus* extracts. *Food Chemistry*. **107**: 861-868.

Jin, F., Zhou, Z., Kishita, A & Enomoto, H. 2006. Hydrothermal conversion of biomass into acetic acid. *Journal Material Science*. **41**(5): 1495-1500.

John, P. & Marchal, J. 1995. *Ripening and biochemistry of the fruit*. In Gowen, S. R. (ed). Bananas and Plantain. London: Chapman and Hall.

John, M. J., Francis, B., Varughese, K. T. & Thomas, S. 2008. Effect of chemical modification on properties of hybrid fiber biocomposites. *Composites Part A: Applied Science Manufacture*. **39**(2): 352-363.

Jongeson, J. H., Tumidge, J. D. & Washington, J. A. 1999. *Antibacterial susceptibility test: dilution and disc diffusion methods*. In Murry, P. R., Baron, E. J., Pfailler, M. A., Tenover, F.C. & Yoiken, R. H. (eds) Manual of Clinical Microbiology. 7th edition. Washington: ASM Press.

Joseph, S., Sreekala, M. S., Oommen, Z., Koshy, P. & Thomas, S. 2002. A comparison of the mechanical properties of phenol formaldehyde composites reinforced with banana fibres and glass fibres. *Composites Science and Technology*. **62**: 1857-1868.

Joshu, E. S., David, T., Kenneth, W. & Graham, L. J. 2007. Identification of antibacterial constituents from the indigenous Australian medicinal *Eremophila duttonni* F. Muell (Myoporaceae). *Journal of Ethnopharmacology*. **112**: 386-393.

Juarez-Garcia, E., Agama-Acevedo, E., Sayago-Ayerdi, S. G., Rodriguez-Ambriz, S. L. & Bello-Perez, L. A. 2006. Composition, digestibility and application in breadmaking of banana flour. *Plant Foods for Human Nutrition*. **61**: 131-137.

Julies, J. & Robert, E. P. 2008. *The encyclopedia of fruits and nuts*. CABI Publisher. pp. 514-519.

Juven, B. J., Kanner, J., Schved, F. & Weisslowicz, H. 1994. Factors that interact with the antibacterial action of thyme essential oil and its active constituents. *Journal of Applied Bacteriology*. **76**: 626-631.

Kaferstein, F. & Abdussalam, M. 1999. Food Safety in the 21st century. *Bull of the World Health Organization*. **77**: 347-351.

Kalm, E. & Sargin, S. 2004. Cultivation of two *Pleurotus* species on wheat straw substrates containing olive mill waste water. *International Biodeterioration Biodegradation*. **53**(1): 43-47.

Kamatou, G. P. P., Van Vuuren, S. F., Van Heerden, F. R., Seaman, T. & Viljoen, A. M. 2007. Antibacterial and antimycobacterial activities of South African Salvia species and isolated compounds from *S. chamelaeagnea*. *South Africa Journal of Botany*. **73**: 552-557.

Kanazawa, K. & Sakakibara, H. 2000. High content of dopamine, a strong antioxidant in *Cavendish* banana. *Journal Agricultural and Food Chemistry*. **48**: 844-848.

Kardivelu, K., Kavipriya, M., Karthika, C., Radhika, M., Vennilamani, N. & Pattabhi, S. 2003. Utilization of various agricultural wastes for activated carbon preparation and application for the removal of dyes and metal ions from aqueous solutions. *Bioresource Technology*. **87**: 129-132.

Khokhar, S. & Magnusdotti, S. G. M. 2002. Total phenol, catechin, and caffeine contents of teas commonly consumed in the United Kingdom. *Journal of Agricultural and Food Chemistry*. **50**: 565-570.

Kim, K. Y., Davidson, P. M. & Chung, H. J. 2001. Antibacterial activity in extracts of *Camellie japonica L.* petals and its application to a model food system. *Journal of Food Protection*. **64**(8): 1225-1260.

Kim, J. B., Lee, G. S., Kim, Y. B., Kim, S. K. & Kim, Y. H. 2004. *In vitro* antibacterial activity of echinomycinand a novel analogue, YK 2000, against vancomycin-resistant *enterococci*. *International Journal Antimicrobial Agents*. **24**: 613-615.

Kim, Y., Hendrickson, R., Mosier, N. S., Ladisch, M. R, Bals, B., Balan, V. & Dale, B. E. 2008. Enzyme hydrolysis and ethanol fermentation of liquid hot water and AFEX pretreated distillers' grains at high-solids loadings. *Bioresource Technology*. **99**(12): 5206-5215.

Kim, S. R., Park, H. J., Yim, D. S., Kim, H. T., Choi, I. G. & Kim, K. H. 2008. Analysis of survival rates and cellular fatty acid profiles of *Listeria monocytogenes* treated with supercritical carbon dioxide under the influence of cosolvents. *Journal of Microbiological Methods*. **75**: 47-54.

Kim, M. K., Bang, W., Drake, M. A., Hanson, D. J. & Jaykus, L. A. 2009. Impact of storage temperature and product pH on the survival of *Listeria monocytogenes* in vacuum-packaged souse. *Journal of Food Protection*. **72**(30): 637-643.

Kotzekidou, P., Giannakidis, P. & Boulamatsis, A. 2008. Antimicrobial activity of some plant extracts and essential oils against foodborne pathogens in vitro and on the fate of inoculated pathogens in chocolate. *Food Science and Technology*. **41**: 119-127.

Krishna, C. & Chandrasekharan, M. 1996. Banana waste as substrate for alpha-amylase production by *Bacillus subtilis* (CBTK 106) under solid state fermentation. *Applied Microbiology and Biotechnology*. **46**: 106-111.

Krishna, C. 1999. Production of bacterial cellulases by solid state bioprocessing of banana wastes. *Bioresource Technology*. **69**: 231-239.

Krishnani, K. K. & Ayyappan, S. 2006. Heavy metals remediation of water using plants and lignocellulosic agrowastes. *Review Environental Contamination Toxicology*. **188**: 59-84.

Kuete, V., Tangmouo, J. G., Penlap, B. V., Ngounou, F. N. & Lontasi, D. 2006. Antimicrobial activity of the methanolic extract from the stem bark of *tridesmostemon omphalocarpoides* (*Sapotaceae*). *Journal of Ethnopharmacology*. **104**: 5-11.

Lafka, T. I., Sinanoglou, V. & Lazos, E. S. 2007. On the extraction and antioxidant activity of phenolic compounds from winery wastes. *Journal of Food Chemistry*. **104**(3): 1206-1214.

Lambert, R. J. W. & Pearson, J. 2000. Susceptibility testing: accurate and reproducible minimum inhibitory concentration (MIC) and non-inhibitory concentration (NIC) values. *Journal Applied Microbiology*. **88**: 784.

Lambert, R. J. W., Skandamis, P. N. Coote, P. J. & Nycs, G. J. E. 2001. A study of minimum inhibitory concentration and mode of action of oregano essential oil, thymol and carvacrol. *Journal Applied Microbiology*. **91**: 453-462.

Lassoudiere, A. 2007. *Le bananier et sa culture*. France: Editions QUAE.

Lebois, M., Conni, N., Onno, B., Prevost, H. & Dousset, X. 2004. Efect of diversin V41 combined to NaCl content, phenol (liquid smoke) concentration and pH on *Listeria monocytogenes* Scott A growth in BHI broth by an experimental design approach. *Journal Applied Microbiology*. **96**: 931-937.

Lehmann, U., Jacobasch, G. & Schmiedl, D. 2002. Characterization of resistant starch type III from banana (*Musa acuminata*). *Journal of Agricultural and Food Chemistry*. **50**: 5236-5240.

Leistner, L. 2000. Basic aspects of food preservation by hurdle technology. *International Journal Food Microbiology*. **55**: 181-186.

Leroi, F. & Joffraud. J. J. 2000. Salt and smoke simultaneously affect chemical and sensory quality of cold-smoked salmon during 5°C storage predicted using factorial design. *Journal of Food Protection*. **63**: 1222-1227.

Lertsutthiwong, P., Khunthon, S., Siralertmukul, K., Noomun, K. & Chandrkrachang, S. 2008. New insulating particleboards prepared from mixture of solid wastes from tissue paper manufacturing and corn peel. *Bioresource Technology*. **99**(11): 4841-4845.

Li, W., Xu, J., Wang, J., Yan, Y. J., Zhu, X. F., Chen, M. Q. & Tan, Z. C. 2008. Studies of monosaccharide production through lignocellulosic waste hydrolysis using double acids. *Energy Fuels*. **22**(3): 2015–2021.

Lin, H. M., Cao, N. & Chen, L. F. 1994. Antimicrobial effect of pressurized carbon dioxide on *Listeria monocytogenes*. *Journal of Food Science*. **59**: 657-659.

Lin, Y., Labbe, R. & Shetty, K., 2004. Inhibition of *Listeria monocytogenes* in fish and meat systems by use of oregano and cranberry phytochemical synergies. *Applied and Environmental Microbiology*. **70**: 5672-5678.

Lopez-Malo, A., Palou, E., Parish, M. E. & Davidson, P. M. 2005. Methods for activity assay and evaluation of results. *In* Davidson, P. M., Sofos, J. N. and Branen, A. L. (ed.). *Antimicrobials in Food*. 3rd ed. Florida: CRC Press.

Lopez, M. J., Carmen, M., Vargas-Garcia, C., Suarez-Estrella, F. & Moreno, J. 2006. Biodelignification and humification of horticultural plant residues by fungi. *International Biodeterioration Biodegradation*. **57**(1): 24-30.

Lopez, D. G. J., Balart, R., Ruseckaite, R, A. & Stefani, P. M. 2007. Composites based on sintering rice husk–waste tire rubber mixtures. *Materials Design*. **28**(7): 2234-2238.

Luo, S. & Netravali, A. N. 2003. Mechanical and thermal properties of environmentally friendly green composites made from pineapple leaf fibres and poly(hydroxybutyrate-co-valerate) resin. *Polymer Composition*. **20**(3): 367-78.

Mabrouk, M. E. M. & El-Ahwany, A. M. D. 2008. Production of mannanase by *Bacillus amylolequifaciens* cultured on potato peels. *African Journal Biotechnology*. **7**(8): 1123-1128.

MacNaughton, W. K. & Wallace, J. L. 1989. A role of dopamine as endogenous protective factor in the rat stomach. *Gastroenterology*. **96**: 972-980.

Mahfuzul, H., Bari, M. L., Vijay, K. J. & Kawamoto, S. 2008. Antimicrobial activity of cloves and cinnamon extracts against food borne pathogens and spoilage bacteria, and inactivation of *Listeria monocytogenes* in ground chicken meat with their essential oils. *National Food Research Institute*. **72**: 9-21.

Mahmoud, B. S., Yamazaki, K., Miyashita, K., Kawai, Y., Shin, I. S. & Suzuki, T. 2006. Preservative effect of combined treatment with electrolyzed NaCl solutions and essential oil compounds on carp fillets during convectional air-drying. *International Journal of Food Microbiology*. **106**(3): 331-337.

MariaRota, C., Antonio, H., Rosa, M. M., Jose, A. S. & MariaJordan, J. 2008. Antimicrobial activity and chemical composition of *Thymus vulgaris*, *Thymus zygis* and *Thymus hyemalis* essential oils. *Food Control*. **19**: 681-687.

Marwan, A. G. & Nagel, C. W. 1986. Quantitative information of infinite inhibition concentration of antimicrobial agents. *Applied Environmental Microbiology*. **51**: 559.

Marzouk, B., Zohra, M., Rachel, D., Hayet, E., Ehsen, H., Nadia, F. & Mahjoub, A. 2009. Antibacterial and anticandidal screening of Tunisian *Citrullus colocynthis* Schrad. from Medenine. *Journal of Ethnopharmacology*. **23**:21-27.

Mattila, K., Saris, P. & Tyopponen, S. 2003. Survival of *Listeria monocytogenes* on sliced cooked sausage after treatment with pediocin AcH. *International Journal Food Microbiology*. **89**(2): 281-286.

McKay, G., Porter, J. F. & Prasad, G. R. 1999. The removal of dye colours from aqueous solutions by absorption on low-cost materials. Water, Air and Soil Pollution. *Dye Pigments*. **114**: 423-438.

McMeekin, T. A., Olley, J. N., Ross, T. & Ratkowsky, D. A. 1993. *Predictive Microbiology — Theory and Application*. Taunton: Research Studies Press.

Mead, P. S., Slutsker, L., Dietz, V., Mccaig, L. F., Breese, J. S., Shapiro, C., Griffin, P. M. & Tauxe, R. V. 1999. Food related illness and dead in the United States. *Emerg. Infect. Dis.* **5**: 607-625.

Melendez, P. A. & Capriles, V. A. 2006. Antibacterial properties of tropical plants from Puerto Rico. *Phytomedicine*. **13**: 272-276.

Meng, J. & Doyle, M. P. 2002. Introduction: Microbiology Food Safety. *Microbes and Infection*. **4**(4): 395-397.

Mihriban, K., ozan, G., Yasemin, S., Aycan, Y., Oya, K. & Russel, R. 2008. Chemical characterization and antifungal activity of *Origanum onites L.* essential oils and extracts. *Journal of Food Safety*. **29**: 144-161.

Millan-Testa, C. E., Mendez-Montealvo, M. G., Ottenhof, M.-A., Farhat, I. A. & Bello-Perez, L. A. 2005. Determination of the molecular and structural characteristics of okenia, mango, and banana starches. *Journal of Agriculture and Food Chemistry*. **53**(3): 495-501.

Misra, L. & Wagner, H. 2004. Alkaloidal constituents of Mucuna pruiens seed. *Phytochemistry*. **65**: 2565-2567.

Miyazawa, M., Yoshihiharu, O., Nakamura, S. & Kosaka, H. 2000. Antimutagenic activity of flavonoids from *Pogostemon cablin*. *Journal of Agricultural and Food Chemistry*. **48**: 642-647.

Mokbel, M. S. & Hashinaga, F. 2005. Antibacterial and Antioxidant Activities of Banana (*Musa, AAA cv. Cavendish*) Fruits Peel. *American Journal of Biochemistry and Biotechnology*. **1**(3): 125-131.

Moody, J. & Knapp, C. 2004. Tests to assess bacteriacidal activity. In: *Clinical Microbiology Procedures Handbook*. 5.10. Isenberg, D. (Ed). ASM Press, Washington, D. pp: 31-36.

Moore, G., Griffith, C. & Peters, A. 2000. Bactericidal properties of ozone and its potential applications as a terminal disinfectant. *Journal of Food Protection*. **63**: 1100-1106.

Morais, M. H., Ramos, A. C. & Matos, N. 2000. Production of shiitake mushroom (*Lentinus edodes*) on lignocellulosic residues. *International of Food Science Technology*. **6**(2): 123-128.

Mortan, C., Scolbert, A., Morand, C. & Jimenez, L. 2004. Polyphenols: Food Sources and bioavailability. *American Journal of Clinical Nutritional*. **79**: 727-747.

Mota, R. V., Lajolo, F. M., Ciacco, C., & Cordenunsi, B. R. 2000. Composition and functional properties of banana flour from different varieties. *Journal of Food Chemistry*. **52**(2-3): 63-68.

Mounia, O., Stephane, C., Stephane, S., Linda, S. & Monique, L. 2007. Antimicrobial effects of alginate-based films containing essential oils on *Listeria monocytogenes* and *Salmonella typhimurium* present in bologna and ham. *Journal of Food Protection*. **70**(4): 901-908.

Mtui, G. 2007. Trends in industrial and environmental biotechnology research in Tanzania. *African Journal Biotechnology*. **6**(25): 2860-2567.

Mtui, G. & Nakamura, Y. 2007. Characterization of lignocellulosic enzymes from white-rot fungus *Phlebia crysocreas* isolated from a marine habitat. *Journal England Applied Science*. **2**: 1501-1508.

Mustafa, A. M., Tik, Hj. M. & Zahurin, I. 1993. *Asas Microbiologi dengan Penggunaannya*. Kuala Lumpur: Dewan Bahasa dan Pustaka.

Muthuswamy, S., Rupasinghe, H. P. V. & Stratton, G. W. 2008. Antimicrobial effect of cinnamon bark extract on *Escherichia coli* 0157:H7, *Listeria innocua* and fresh cut apple slices. *Journal of Food Safety*. **28**: 534-549.

Muthuvelayudham, R. & Viruthagiri, T. 2006. Fermentative production and kinetics of cellulase protein on *Trichoderma reesei* using sugarcane bagasse and rice straw. *African Journal Biotechnology*. **5**(20): 1873-1881.

Mytle, N., Anderson, G. L., Doyle, M. P. & Smith, M. A. 2006. Antimicrobial activity of clove (*Syzgium aromaticum*) oil in inhibiting *Listeria monocytogenes* on chicken frankfurters. *Food Control*. **17**: 102-107.

Nakasone, H. Y. & Paull, R. E. 1999. *Tropical fruits. Banana*. Wallingford, New York, USA: CABI Publishing. pp. 103-131.

Namasivayam, C., Muniasamy, N., Gayatri, K., Rani, M. & Ranganathan, K. 2006. Removal of dytes from aqueous solutions by cellulosic waste orange peel. *Bioresource Technology*. **57**: 37-43.

Naz, S., Siddiqi, R., Ahmad, S., Rasool, S. & Sayeed, S. 2007. Antibacterial activity directed isolation of compounds from *Punica granatum*. *Journal of Food Sciences*. **72**: 341-345.

NCCLS. 2002. *Methods for Dilution Antimicrobial Susceptibility Tests for Bacteria that Grow Aerobically; Approved Standards*. 6th edition. Wayne: National Committee for Clinical Laboratory Standards.

Negi, P. S. & Jayaprakasha, G. K. 2003. Antioxidant and Antibacterial Activities of *Punica granatum* Peel Extracts. *Journal of Food Science*. **68**(4): 1473-1477.

Ngah, W. S. W. & Hanafiah, M. A. K. M. 2008. Removal of heavy metal ions from wastewater by chemically modified plant wastes as adsorbents: A review. *Bioresource Technology*. **99**(10): 3935-3948.

Nguefack, J., Leth, V., Amvam Zollo, P. H. & Mathur, S. B. 2004. Evaluation of five essential oils from aromatic plants of Cameroon for controlling food spoilage and mycotoxin producing fungi. *International Journal Food Microbialogy*. **94**: 329-334.

Niamsa, N., Puangpronpitag, D. & Sittiwet, C. 2009. Anti-microbial properties of clove (*Eugenia caryophyllum* Bullock and Harrison) aqueous extract against foodborne pathogen bacteria. International Journal of Pharmacology. **5**(4): 281-284.

Norgrove, L. & Hauser, S. 2002. Yield of plantation grown under different tree densities and "slash and mulch" versus "slash and burn" management in an agricultural system in Southern Comeroon. *Field Crops Research*. **78**: 185-195.

Nychas, G. J. E. 1995. Natural antimicrobials from plants, In Gould, G. W., Ed., *New Methods of Food Preservation*. Glasgow: Blackie Academic and professional. pp.58-59.

Ofman, M. H., Camposa, C. A. & Gerschenson, L. N., 2004. Effect of preservatives on the functional properties of tapioca starch: analysis of interactions. LWT *Food Science and Technology*. **37**: 355-361.

Ogel, Z. B., Yarangumeli, K., Dundar, H. & Ifrij, I. 2001. Submerged cultivation of *Scytalidium thermophilum* on complex lignocellulosic biomass for endoglucanase production. *Enzyme Microbial Technology*. **28**(7-8): 689-695.

Ojumu, T. V., Solomon, B. O., Betiku, E., Layokun, S. K. & Amigun, B. 2003. Cellulase Production by *Aspergillus flavus* Linn Isolate NSPR 101 fermented in sawdust, bagasse and corncob. *African Journal Biotechnology*. **2**(6):150-152.

Okeke, M. I., Iroegbu, C. U., Eze, E. N., Okoli, A. S. & Esimore, C. O. 2001. Evaluation of extracts of the root of *Landolphia owerrience* for antibacterial activity. *Journal Ethnopharmacology*. **78**: 119-127.

Olasupo, N. A., Fitzgerald, D. J., Narbad, A. & Gasson, M. J. (2004). Inhibition of *Bacillus subtilis* and *Listeria innocua* by nisin in combination with some naturally occurring organic compounds. *Journal of Food Protection*. **67**: 596-600.

Olson, E. S. 2001. Conversion of lignocellulosic material to chemicals and fuels. National Energy Technology Lab., Pittsburgh, PA (US); National Energy Technology Lab., Morgantown, WV(US).

Onwuka, C. F. I., Adetiloye, P. O. & Afolami, C. A. 1997. Use of household wastes and crop residues in small ruminant feeding in Nigeria. *Small Ruminant Research*. **24**(3): 233-237.

Osma, J. F., Herrera, J. L. T. & Couto, S. R. 2006. Banana skin: A novel waste for laccase production by *Trametes pubescens* under solid-state conditions. Application to synthetic dye decolouration. *Dyes and Pigments*. **75**(1): 32-37.

Otalvaro, F., Nanclares, J., Vasquez, L. E., Quinones, W., Echeverri, F., Arango, R. & Schneider, B. 2007. Phenalenone-type compounds from *Musa acuminata* var. "Yangbami km 5" (AAA) and their activity against *Mycosphaerella fijinsis*. *Journal of Natural Products*. **70**(5): 887-890.

Oussalah, M., Caillet, S., Saucier, L. & Lacroix, M. 2006. Inhibitory effects of selected plant essential oils on the growth of four pathogenic bacteria: *E. coli* O157:H7, *Salmonella Typhimurium, Staphylococcus aureus* and *Listeria monocytogenes*. *Food Control*. **18**(5): 414-420.

Ovando-Martinez, M., Sayago-Ayerdi, S., Agama-Acevedo, E., Goni, I. & Bello-Perez, L. A. 2009. Unripe banana flour as an ingredient to increase the undigestible carbohydrates of pasta. *Food Chemistry*. **113**: 121-126.

Over, K. F., Hettiarachchy, N., Johnson, M. G. & Davis, B. 2009. Effect of organic acids and plant extracts on *Escherichia coli* 0157:H7, *Listeria monocytogenes*, and *Samonella Typhimurium* in broth culture model and chicken meat systems. *Journal of Food Science*. **74**(9): 515-521.

Ozcelika, E. & Peken, A. 2007. Hazelnut husk as a substrate for the cultivation of shiitake mushroom (*Lentinula edodes*). *Bioresource Technology*. **98**(14): 2652-2658.

Paddock, L. J. 1990. Techniques used for determination of antimicrobial resistance and sensitivity in bacteria. *Journal Applied Bacteriology*. **68**: 307.

Palmer, A. S., Steward, J. & Fyfe, L. 2001. The potential application of plant essential oils as natural preservatives in soft cheese. *Food Microbiology*. **18**:463-470.

Pandey, A., Soccol, C. R., PoonamNigam, P. & Soccol, V. T. 2000. Biotechnological potential of agro-industrial residues. I: sugarcane bagasse. *Bioresource Technology*. **7**(1): 69-80.

Pandit, V. A. & Shelef, L. A. 1994. Sensitivity of *Listeria monocytogenes* to rosemary (*Rosmarinus officinalis* L.). *Food Microbiology*. **11**:57-63.

Pepe, O., Blaiotta, G., Bucci, F., Anastasio, M., Aponte, M. & Villani, F. 2006. *Staphylococcus aureus* and *staphylococcal enterotoxin* A in breaded chicken products: detection and behavior during the cooking process. *Applied and Environmental Microbiology*. **72**: 7057-7062.

Peschel, W., Sanchez, R. F. Dielmann, W., Plescher, A., Gartzia, I., Jimenez, D., Lamuela, R. R. Buxaderas, S. & Codina, C. 2006. An industrial approach in the search of natural antioxidants from vegetable and fruit wastes. *Food Chemistry*. **97**: 137-150.

Philippoussis, A., Zervakis, G. & Diamantopoulou, P. 2001. Bioconversion of agricultural lignocellulosic wastes through the cultivation of the edible mushrooms *Agrocybe aegerita, Volvariella volvacea* and *Pleu rotus* spp. *World Journal Microbiology Biotechnology.* **17**(2): 191-200.

Pinelo, M., Rubilar, M., Jerez, M., Sineiro, J. & Nunez, M. J. 2005. Effect of solvent, temperature, and solvent-to solid ratio on the total phenolic content and antiradical activity of extracts from different components of grape pomace. *Journal of Agricultural and Food Chemistry.* **53**(6): 2111-2117.

Pithayanukul, P., Tubprasert, J. & Wuthi-Udomlert, M. 2007. *In Vitro* Antimicrobial Activity of *Zingiber cassumunar* (Plai) Oil and a 5% Plai Oil Gel. *Phototherapy Research.* **21**: 164-169.

Pol, I. E., Mastwijk, H. C., Slump, R. A., Popa, M. E. & Smid, E. J. 2001. Influence of food matrix on inactivation on *Bacillus cereus* by combinations of nisin, pulsed electric field treatment and carvacrol. *Journal of Food Protection.* **64**(7): 1012-1018.

Pothan, L. A. & Thomas, S. 2003. Polarity parameters and dynamic mechanical behaviour of chemically modified banana fiber reinforced polyester composites. *Composites Science and Technology.* **63**: 1231-1240.

Pothan, L. A., Thomas, S. & Groeninckx, G., 2006. The role of fibre/matrix interactions on the dynamic mechanical properties of chemically modified banana fibre/polyester composites. *Composites Part A.* **37**:1260-1269.

Pothan, L. A., George, C. N., Jacob, M. & Thomas, S. 2007. Effect of chemical modification on the mechanical and electrical properties of banana fiber polyester composites. *Journal Composite Materials.* **41**(19): 2371-2386.

Pothiraj, C., Balaji, P. & Eyini, M. 2006. Enhanced production of cellulases by various fungal cultures in solid state fermentation of cassava waste. *African Journal Biotechnology.* **5**(20): 1882-1885.

Poyyamozhi, V. S. & Kadirvel, R. 1986. The value of banana stalk as a feed for goats. *Animal Feed Science and Technology.* **15**: 95-100.

Qian, H., Huang, W. L., Wu, X. M., Zhang, H. B., Zhou, J. P. & Ye, W.C. 2007. A new isochroman-4-one derivative from the peel of *Musa sapientum* L. and its total synthesis. *Chinese Chemical Letters.* **18**: 1227-1230.

Quintana, G., Jorge, V., Betancourt, S. & Ganan, P. 2009. Binderless fiberboard from steam exploded banana bunch. *Industrial Crops and Products.* **29**: 60-66.

Rafaela, G. M., Gloria, L. & Monica, G. 2009. Antioxidant activity in banana peel extracts: Testing extraction conditions and related bioactive compounds. *Journal of Food Chemistry.* **117**: 112-119

Rahman, A. & Kang, S. C. 2008. Inhibition of foodborne pathogens and spoiling bacteria by essential oil and extracts of *Erigeron Ramosus* (Walt.) B.S.P. *Journal of Food Safety*. **29**: 176-189.

Raj, K. & Singh, R. 2001. Semi-solid-state fermentation of *Eicchornia crassipes* biomass as lignocellulosic biopolymer for cellulase and glucosidase production by co-cultivation of *Aspergillus niger* RK3 and *Trichoderma reesei* MTCC164. *Journal Applied Biochemistry Biotechnology*. **96**(1-3):71-82.

Rani, P., Kalyani, N. & Prathiba, K. 2008. Evaluation of Lignocellulosic Wastes for Production of Edible Mushrooms. *Journal Applied Biochemistry Biotechnology*. **98**(3):173-185.

Ratkowsky, D. A. & Ross, T. 1995. Modelling the bacterial growth/no growth interface. *Letters in Applied Microbiology*. **20**: 29-33.

Rauha, J. P., Remes, S., Heinonen, M., Hopia, A., Kahkonen, M., Kujala, T., Pihlaja, K., Vuorela, H. & Vuorela, P. 2000. Antimicrobial effects of Finnish plant extracts containing flavonoids and other phenolic compounds. *International Journal of Food Microbiology*. **56**: 3-12.

Ray, B. 2003. *Fundamental Food Microbiology*. 3rd edition. Boca Raton: CRC Press.

Raybaudi-Massilia, R. M., Mosqueda-Melgar, J., Martin-Belloso, O. 2006. Antimicrobial activity of essential oils on *Salmonella enteritidis*, *Escherichia coli*, and *Listeria innocua* in fruit juices. *Journal of Food Protection*. **69**(7): 1579-1586.

Reddy, G. V., Ravindra Babu, P., Komaraiah, P., Roy, K. R. R. M. & Kothari, I. L. 2003. Utilization of banana waste for the production of lignolytic and cellulolytic enzymes by solid substrate fermentation using two *Pleurotus* species (*P. ostreatus* and *P. sajor-caju*). *Process Biochemistry*. **38**: 1457-1462.

Reddy, M., Gupta, S., Jacob, M., Khan, S. & Ferreira, D. 2007. Antioxidant, antimalarial and antimicrobial activities of tannin-rich fractions, ellagitannins and phenolic acids from *Punica granatum* L. Planta Medica. *International Journal of Food Microbiology*. **73**: 461-467.

Restaino, I., Frampton, E. W., Hempfill, J. B. & Palniker, P. 1995. Efficacy of ozonated water against various food-related microorganisms. *Applied and Environmental Microbiology*. **61**: 3471-3475.

Rieger, M. 2006. *Banana and plantain*. In: Introduction to fruit crops. New York/London/Oxford: Haworth Food & Agricultural. The Haworth Press, Inc. pp. 75-88.

Robinson, J. C. 1996. *Banana and Plantains*. Cambridge: CAB International.

Robinson, T., Chandran, B. & Nigam, P. 2002. Removal of dyes from an artificial textile dye effluent by two agricultural waste residues, corncob and barley husk. *Environment International*. **28**: 29-33.

Rodriguez-Ambriz, S. L., Islas-Hernandez, J. J., Agama- Acevedo, E., Tovar, J. & Bello-Perez, L. A. 2008. Characterization of a fibre-rich powder prepared by liquefaction of unripe banana flour. *Journal of Food Chemistry*. **107**: 1515-1521.

Rodriguez-Chonga, A., Ramirez, J. A., Garrote, G. & Vazquez, M. 2004. Hydrolysis of sugar cane bagasse using nitric acid: a kinetic assessment. *Journal Food England*. **61**(2): 143-152.

Rolain, J. M. & Raoult, D. 2005. Antimicrobial susceptibility testing for some atypical microorganisms (*Chlamydia, Mycoplasma, Rickettsia, Ehrlichia, Coxiella and Spirochetes*). *In* Lorian, V. (ed.). *Antibiotics in Laboratory Medicine*. 5th edition. Philadelphia: Lippincott Williams and Wilkins. pp. 269-271.

Rukayah, A. 2000. *Buah-buahan Malaysia*. Kuala Lumpur: Dewan Bahasa dan Pustaka.

Ryan, K. J. & Ray, C. G. 2004. *Sherris Medical Microbiology*. 4th Edition. New York: McGrow Hill.

Saha, B. C. 2003. Hemicellulose bioconversion. Journal Indian Microbiology Biotechnology. **30**: 279-29.

Sakanaka, S., Kim, M., Taniguchi, M. & Yamamoto, T. 1989. Antibacterial substances in Japanese green tea extract against *Streptococcus mutans*, a cariogenic bacterium. *Agricultural Biology and Chemistry*. **53**: 2307-2311.

Saletes, S., Siregar, F. A., Caliman, J. P. & Liwang, T. 2004. Lignocellulose composting: Case study on monitoring oil palm residuals. *Composite Science Utilization*. **12**(4): 372-382.

Salim Dulatti, M., Jinap, S. & Nasir Shamsudin, M. 2003. Pacific Food System Outlook. Malaysia: World Health Organization (WHO). pp 30-34.

Samelis, J., Sofos, J. N.Kain, M. L., Scanga, J. A., Belk, K. E. & Smith, G. C. 2001. Organic acids and their salts as dipping solutions to control *Listeria monocytogenes* inoculated following processing of sliced pork bologna stored at 4°C in vacuum packages. *Journal of Food Protection*. **64**: 1722-1729.

Samelis, J. & Sofos, J. N. 2003. Organic acids. In Roller, S. (ed.). *Natural antimicrobials for the minimal processing of foods*. Boca Raton: CRC Press. pp. 98-112.

Sapuan, S. M., Leenie, A., Harimi, M. & Beng, Y. K. 2006. Mechanical properties of woven banana fibre reinforced epoxy composites. *Materials & Design.* **27**(8): 689-693.

Savastano, H., Warden, P. G. & Coutts, R. S. P. 2000. Brazilian waste fibres as reinforcement for cement-based composites. *Cement and Concrete Composites.* **22**: 379-384.

Savastano, H., Warden, P. G. & Coutts, R. S. P., 2003. Potential of alternative fibre cements as building materials for developing areas. *Cement and Concrete Composites.* **25**: 585-592.

Savastano, H., Warden, P .G. & Coutts, R. S. P. 2005. Microstructure and mechanical properties of waste fibre–cement composites. *Cement and Concrete Composites.* **27**: 583-592.

Schalkowsky, S. 1986. Plating systems. *In Food Borne Microorganisms and Their Toxins: Developing Methodology.* New York: McGraw Hill.

Schelz, A., Molnar, J. & Hohmann, J. 2006. Antimicrobial and antiplasmid activities of essential oils. *Fitoterapia.* **77**(4):279-285.

SeongWei, L. & Musa Najiah. 2009. Antimicrobial Property of 2-Hydroxypropane 1,2,3-Tricarboxylic Acid Isolated from *Citrus microcarpa* Extract. *Agricultural Sciences in China.* **8**(7): 880-886.

Sepulveda-Huerta, E., Tellez-Luis, S. J., Bocanegra-Garcia, V., Ramirez, J. A. & Vazquez, M. 2006. Production of detoxified sorghum straw hydrolysates for fermentative purposes. *Journal Science Food Agriculture.* **86**(15): 2579-2586.

Seung-Youb, B., Hyun-Ho, J. & Sun-Young, L. 2009. Inhibitory effect of organic acids against *Enterobacter sakazakii* in laboratory media and liquid foods. *Food Control.* **20**: 867-872.

Shafique, S. Asgher, M., Sheikh, M. A. & Asad, M. J. 2004. Solis state fermentation of banana stalk for exoglucanase production. *International Journal of Agriculture & Biology.* **6**(3): 488-491.

Shaji, J., Kuruvilla, J. & Sabu, T. 2006. Green composites from natural rubber and oil palm fiber: physical and mechanical properties. *International Journal Polymer Material.* **55**(11): 925-945.

Shan, B., Cai, Y.-Z., Brooks, J., Corke, H., 2007. The *in vitro* antibacterial activity of dietary species and medicinal herb extracts. *International Journal of Food Microbiology.* **117**: 112-119.

Sheen, S., Cheng, A. H. & Vijay, K. J. 2009. Effect of salt, smoked compound, and temperature on the survival of *Listeria monocytogenes* in salmon during simulated smoking processes. *Journal of Food Science*. **74**: 523-529.

Shelef, L. A., Jyothi, E. K. & Bulgarelli, M. A. 1984. Growth of enteropathogenic and spoilage bacteria in sage-containing broth and foods. *Journal of Food Science*. **49**: 737-740.

Sherwin, E. R. 1998. Oxidation and antioxidants in fat and oil processing. *Journal of the American Oil Chemists Society*. **55**: 809-814.

Shibi, I. G. & Anirudhan, T. S. 2005. Adsorption of Co(II) by a carboxylatefunctionalized polyacrylamide grafted lignocellulosics. *Chemosphere*. **58**: 1117-1126.

Shin, L. S., Masuda, H. & Naohide, K. 2004. Bactericidal activity of wasabi (*Wasabiajaponoca*) against *Helicobacter pylori*. *International Journal of Food Microbiology*. **94**: 255-261.

Shui, G. & Leong, L. P. 2006. Residue from star fruit as valuable source for functional food ingredients and antioxidant nutraceuticals. *Journal of Food Chemistry*. **97**(2): 277-284.

Sibel, K. & Pelin, Y. 2005. Antibacterial effect of untreated and treated (decolozied) dyes by agricultural wastes. *American Journal of Biochemistry and Biotechnology*. **1**(1): 50-53.

Silva, E. M., Machuca, A. & Milagres, A. M. F. 2005. Effect of cereal brans on *Lentinula edodes* growth and enzyme activities during cultivation on forestry waste. *Letters in Applied Microbiology*. **40**(4): 283-288.

Singh, A., Singh, R. K., Bhunia, A. K. & Singh, N. 2003. Efficacy of plant essential oils as antimicrobial agents against *Listeria monocytogenes* in hotdogs. *LWT Food Science and Technology*. **36**: 787-794.

Singh, P., Suman, A., Tiwari, P., Arya, N., Gaur, A. & Shrivastava, A. K. 2008. Biological pretreatment of sugarcane trash for its conversion to fermentable sugars. *World Journal Microbiology Biotechnology*. **24**(5): 667-673.

Smith-Palmer, A., Stewart, J., Fyfe., L., 1998. Antimicrobial properties of plant essential oils and essences against five important food-borne pathogens. *Letters in Applied Microbiology*. **26**: 118-122.

Smith-Palmer, A., Stewart, J. & Fyfe., L. 2001. The potential application of plant essential oils as natural food preservatives in soft cheese. *Food Microbiology*. **18**: 463-470.

Smyth, T. J. P., Ramachandran, V. N. & Smyth, W. F. 2009. A study of the antimicrobial activity of selected naturally occurring and synthetic coumarins. *International Journal Antimicrobial Agents*. **33**: 421-6.

Solomakos, N., Govaris, A., Koidis, P. & Botsoglou, N. 2008. The antimicrobial effect of thyme essential oil, nisin, and their combination against *Listeria monocytogenes* in minced beef during refrigerated storage. *Food Microbiology*. **25**(1): 120-127.

Sousa, A., Ferreira, I. C. F. R., Calhelha, R., Andrade, P. B., Valentao, P. & Seabra, R. 2006. Phenolics and antimicrobial activity of traditional stoned table olives "alcaparra". *Bioorganic and Medicinal Chemistry*. **14**: 8533-8538.

Spiral Biotech, Inc. 2001. *SGE, Spiral Gradient Endpoint, User Guide*. Spiral Biotech, Norwood, MA.

Stover, R. H. & Simmonds, N. W. 1987. *Bananas* (3rd ed.). London: Longman.

Sun, T. & Ho, C. 2005. Antioxidant activities of buckwheat extracts. *Journal of Food Chemistry*. **90**: 743-749.

Tabka, M. G., Herpoel-Gimbert, I., Monod, F., Asther, M. & Sigoillot, J. C. 2006. Enzymatic saccharification of wheat straw for bioethanol production by a combined cellulase xylanase and feruloyl esterase treatment. *Enzyme Microbial Technology*. **39**(4,2): 897-902.

Tam, G. C., Rodrigues, L. C. & OBrien, S. 2003. The study of infectious intestinal disease in England: what risk factors for presentation to general practice tell us about potential for selection bias in case-control studies of reported cases of diarrhoea. *International Journal of Epidemiology*. **32**: 99-105.

Tassou, C., Drosinos, E. H. & Nychas, G. J. E. 1995. Effects of essential oil from mint (*Mentha piperita*) on *Salmonella enteritidis* and *Listeria monocytogenes* in model food systems at 4 °C and 10 °C. *Journal of Applied Bacteriology*. **78**: 593-600.

Tassou, C., Koutsoumanis, K., & Nychas, G. J. E. 2000. Inhibition of *Salmmonella entritidis* and *Staphylococcus aureus* in nutrient broth by mint essential oil. *Food Research International*. **33**:273-280.

Tauxe, R. V. 1997a. Emerging foodborne diseases: an evolving public health challenge. *Emerging Infectious Diseases*. **3**(4): 425-434.

Tauxe, R. V. 1997b. Emerging foodborne diseases: an evolving public health challenge. *Dairy, Food Environmental Sanitation*. **17**: 788-795.

Tengerdy, R. P. & Szakacs, G. 2003. Bioconversion of lignocellulose in solid substrate fermentation. *Biochemistry Engand*. **13**(2-3): 169-179.

Tenover, F. C. 1986. Studies of antimicrobial resistance genes using DNA probes. *Antimicrobial Agents Chemother.* **29**: 721.

Tomasz, M., Karine, N-I., Kazimierz, G., Agnieszka, M-C. & Kurt, H. 2006. Investigation of *Symphytum cordatum* alkaloids by liquid–liquid partitioning, thin-layer chromatography and liquid chromatography–ion-trap mass spectrometry. *Analytica Chimica Acta.* **566**: 157-166.

Torre-Gutierrez, de la L., Chel-Guerrero, L. A. & Betancur-Ancona, D. 2008 Functional properties of square banana (*Musa balbisiana*) starch. *Food Chemistry.* **106**: 1138-1144.

Tribess, T. B., Hernandez-Uribe, J.P., Mendez-Montealvo, M. G. C., Menezes, E. W., Bello-Perez, L. A. & Tadini, C. C. 2009. Thermal properties and resistant starch content of green banana flour (*Musa cavendishii*) produced at different drying conditions. *Food Science and Technology.* **42**:1022-1025.

Tripoli, E., Guardia, M. L., Giammanco, S., Maju, D. D. & Giammanco, M. 2007. Citrus flavonoids: Molecular structure, biological activity and nutritional properties: A review. *Journal of Food Chemistry.* **104**: 466-479.

Tsunashi, K., Nobuhiro, H., Kumiko, I., Daie, F. & Hajime, O. 2001. New phenylphenalenones from banana fruit. *Tetrahedron.* **57**: 7649-7656.

Ubalua, A. U. 2007. Cassava wastes: Treatment options and value addition alternatives. African Journal Biotechnology. **6**(18): 2065-2073.

Uhart, M., Maks, N. & Ravishankar, S. 2006. Effect of spices on growth and survival of *Salmonella typhimurium* DT 104 in ground beef stored at 4 and 8°C. *Journal of Food Safety.* **26**(2): 115-125.

Valero, A., Perez-Rodriguez, F., Carrasco, E., Fuentes-Alventosa, J. M., Garcia-Gimeno, R. M. & Zurera, G. 2009. Modeling the growth boundaries of *Staphylococcus aureus*: Effect of temperature, pH and water activity. *International Journal of Food Microbiology.* **133**: 186-194.

Vandekinderen, I., Devlieghere, F., Van Camp, J., Kerkaert,, B., Cucu, T. & Ragaert, P. 2009. Effects of food composition on the inactivation of foodborne microorganisms by chlorine dioxide. *International of Food Microbiology.* **131**: 138-144.

Vatterm, D. A., Lin, Y. T., Labbe, R. G. & Shetty, K. 2004. Antimicrobial activity against select foodborne pathogens by phenolic antioxidant enriched in cranberry pomace by solid state bioprocessing using fungus *Rhizopus oligosporus. Process Biochemistry.* **39**: 1939-1946.

Venkat, S. R., Pullela, V., Srinivas, B., Praveen, K., HaraKishore, K., Raju, C. B. U., Suryanarayana, M. & Madhusudana, R. 2004. Antibacterial constituents from the berries of *Piper nigrum. Phytomedixcine.* **11**: 697-700.

Viswanathan, K., Kadirvel, R. & Chandrasekaran, D. 1989. Nutritive value of banana stalk (*Musa Cavendishi*) as a feed for sheep. *Animal Feed Science and Technology*. **22**: 327-332.

Voravuthikunchai, S., Lortheeranuwat, A., Jeeju, W., Sririrak, T., Phongpaichit, S. & Supawita, T. 2004. Effective medicinal plants against enterohaemorrhagic *Escherichia coli* O157:H7. *Journal of Ethnopharmacology*. **94**: 49-54.

Voravuthikunchai, S., Sririrak, T., Limsuwan, S., Supawita, T., Iida, T. & Honda, T., 2005. Inhibitory effects of active compounds from *Punica granatum pericarp* on verocytotoxin production by enterohemorrhagic Escherichia coli O157: H7. *Journal of Health Sciences*. **51**: 590-596.

Voravuthikunchai, S. P., Limsewan, S., Supapol, O. & Subhadirasakul, S. 2006. Antibacterial activity of extracts from family *Zingiberaceae* against foodborne pathogens. *Journal of Food Safety*. **26**: 325-334.

Wang, B. G., Zhang, W. W., Duan, X. J. & Li, X. M. 2009. *In vitro* antioxidative activities of extract and semi-purified fractions of the marine red alga, *Rhodomela confervoides* (Rhodomelaceae). *Food Chemistry*. **113**(4): 1101-1105.

Wanger, A. 2007. Disk diffusion test and gradient methodologies. *In* Schwalbe, R., Steele-Moore, L. and Goodwin, A. C. (ed.). *Antimicrobial Susceptibility Testing Protocols*. Florida: CRC Press. pp. 65-71.

Wen, Z., Liao, W. & Chen, S. 2005. Production of cellulase by *Trichoderma reesei* from dairy manure. *Bioresource Technology*. **96**(4): 491-499.

Wen-Jing, L., Hong-Tao, W., Yong-Feng, N., Zhi-Chao, W., De-Yang, H., Xiang-Yang, Q. & Jin-Chun, C. 2004. Effect of inoculating flower stalks and vegetable waste with ligno-cellulolytic microorganisms on the composting process. *Journal Environmental Science Health Part B: Pesticides, Food Contaminants, Agricultural Wastes*. **39**: 871-887.

WHO. 2002. *Global surveillance of foodborne disease:Developing a strategy and its interaction with risk analysis*. Geneva: World Health Organization (WHO). pp3-8.

WHO. 2003. *The present state of foodborne disease in OECD countries*. Genava: World Health Organization (WHO). pp. 20-22.

WHO. 2008. *World Health Report 2008*: Reducing risks, promoting healthy life. Geneva: World Health Organization (WHO). pp. 248.

Wilkins, K. M. & Board, R. G. 1989. Natural antimicrobial systems, In Gould, G. W., Ed., *Mechanisms of Action of Food Preservation Procedures*. New York: Elsevier Science Publishers Ltd. pp 285-362.

Wong, Y. Y. & Kitts, D. D. 2006. Studies on the dual antioxidant and antibacterial properties of parsley (*Petroselinum crispnum*) and cilantro (*Coriandrum sativum*) extracts. *Food Chemistry*. **97**: 505-515.

Yamazaki, K., Yamamoto, T., Kawai, Y. & Inoue, N. 2004. Enhancement of antilisterial activity of essential oils constituents by nisin and diglycerol fatty acid ester. *Journal of Food Microbiology*. **21**: 283-289.

Yanez, R., Alonso, J. L. & Parajo, J. C. 2004. Production of hemicellulosic sugars and glucose from residual corrugated cardboard. *Proc Biochemistry*. **39**(11): 1543-1551.

Yang, H. S., Kim, D. J., Lee, Y. K., Kim, H. J., Jeon, J. Y. & Kang, W. C. 2004a. Possibility of using waste tire composites reinforced with rice straw as construction materials. *Bioresource Technology*. **95**(1): 61-65.

Yang, H. S., Kim, H. J., Son, J., Park, H. J., Lee, B. J. & Hwang, T. S. 2004b. Rice husk flour filled polypropylene composites; mechanical and morphological study. *Composite Structures*. **63**(3-4): 305-312.

Yang, H. S., Kim, H. J., Park, H. J., Lee, B. J. & Hwang, T. S. 2007. Effect of compatibilizing agents on rice-husk flour reinforced polypropylene composites. *Composite Structures*. **77**(1): 45-55.

Yano, Y., Satomi, M. & Oikawa, H. 2006. Antimicrobial effect of spices and herbs on *Vibrio parahaemolyticus*. *Journal Food Microbiology*. **111**: 6-11.

Yayli, N., Nasar, A., Gulec, C., Usta, A., Kolayli, C. K. & Karaoglu, S. 2005. Composition and antimicrobial activity of essential oils from *Centaurea sesseilis* and *Centaurea armena*. *Phytochemistry*. **66**: 1741-1745.

Yee, Y. K. & Koo, M. W. 2000. Anti-*Helicobacter pylori* activity of Chinese tea: *in vitro* study. *Alimentary Pharmacology and Therapeutics*. **14**: 635-638.

Yildiz, S., Yildiz, U. C., Gezer, E. D. & Temiz, A. 2002. Some lignocellulosic wastes used as raw material in cultivation of the *Pleurotus ostreatus* culture mushroom. *Proc Biochemistry*. **38**(3): 301-306(6).

Yokozawa, T. & Nakagawa, T. 2004. Inhibitory effects of Luobuma tea and its components against glucose-mediated protein damage. *Food and Chemical Toxicology*. **42**: 975-981.

Zainun, X., Zhang, H. & Lo, R. 2004. Phenolic compounds from the leaf extract of artichoke (*Cynara scolymus L.*) and their antimicrobial activities. *Journal of Agricultural and Food Chemistry*. **52**: 7272-7278.

Zubair, A., Bhatti, H. N., Hanif, M. A. & Shafqat, F. 2008. Kinetic and equilibrium modeling for Cr (iii) and Cr (vi) removal from aqueous solutions by *Citrus reticulata* waste Biomass. *Journal Water Air Soil Pollution*. **191**(1-4): 305-318.

Zuluaga, R., Rios, A., Mauricio, A., Casas, A., Ramirez, M., Kerguelen, H. & Ganan, P. 2003. Aprovechamiento de los residuos fibrosos de la Agroindustria bananera. In: VII *Jornadas de Investigación. Proceedings VII Jornadas de Investigación*. Colombia: Universidad Pontificia Bolivariana. pp. 267-276.

Zuo, Y., Chen, H. & Deng, Y. 2002. Simultaneous determination of catechins, caffeine and gallic acids in green, oolong, black and pu-erh teas using HPLC with photodiode array detector. *Talant*. **57**: 307-316.

Zwietering, M. H., Jongenburger, I., Rombouts, F. M. & Van, T. K. 1990. Modeling of the bacterial growth curve. *Applied and Environmental Microbiology*. **56**(6): 1875-1881.