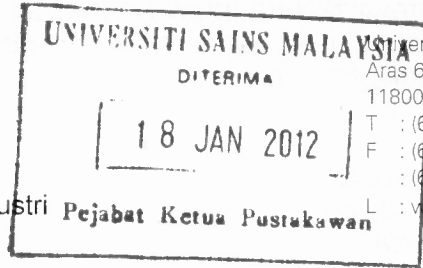




Canselori,

No. Fail : F0341
Tarikh : 2 Disember 2011

Dr. Cheng Lai Hoong
Pusat Pengajian Teknologi Industri
Universiti Sains Malaysia



Universiti Sains Malaysia
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11800 USM Pulau Pinang
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L : www.research.usm.my

Puan,

LAPORAN AKHIR SKIM GERAN PENYELIDIKAN FUNDAMENTAL (FRGS)

Tajuk Projek : Chemical Reactivity and Toxicity Potential of Insonated Liquid Food
No. Akaun : 203/PTEKIND/6711100

Dengan hormatnya perkara di atas dirujuk.

2. Terlebih dahulu saya ucapkan ribuan terima kasih di atas satu salinan laporan akhir untuk projek penyelidikan seperti tajuk di atas.
3. Adalah dimaklumkan walaupun projek ini telah selesai, kerjasama Jabatan Bendahari dipohon untuk menguruskan penutupan akaun projek pada selewat-lewatnya **31 Disember 2011**. Tempoh ini bertujuan untuk menyelesaikan semua urusan tuntutan dan bayaran yang telah dibelanjakan di dalam tempoh projek. Walau bagaimanapun, puan dinasihatkan supaya tidak mengeluarkan borang-borang pesanan baru di dalam tempoh ini.
4. Selanjutnya sila ambil perhatian terhadap perkara-perkara berikut sekiranya berkaitan:
 - (i) Semua penerbitan harus merakamkan penghargaan kepada **Skim Geran Penyelidikan Fundamental (FRGS)** dan puan dipohon mengemukakan satu salinan ke Pejabat ini.
 - (ii) Bahagian Penyelidikan & Inovasi boleh/akan mengagihkan semula peralatan yang telah dibeli menggunakan peruntukan geran ini seandainya terdapat penyelidik lain yang memerlukan peralatan tersebut.
5. Akhir sekali, tahniah di atas usaha dan kejayaan pihak puan dapat menyelesaikan projek ini dengan jayanya.

Sekian, terima kasih.

"BERKHIDMAT UNTUK NEGARA"
'Memastikan Kelestarian Hari Esok'

Yang menjalankan tugas,

(AMRA OTHMAN)
Penolong Pendaftar
Unit Pengurusan Geran & Kontrak

HAT, HAR, SM

LAPORAN AKHIR SKIM GERAN PENYELIDIKAN FUNDAMENTAL (FRGS)

Tajuk Projek : Chemical Reactivity and Toxicity Potential of Insonated Liquid Food

No. Akaun : 203/PTEKIND/6711100

s.k. Dekan Penyelidikan
Pelantar Sains Fundamental
Pejabat Pelantar Penyelidikan
Universiti Sains Malaysia

Dekan
Pusat Pengajian Teknologi Industri
Universiti Sains Malaysia

Timbalan Dekan
(Pengajian Siswazah & Penyelidikan)
Pusat Pengajian Teknologi Industri
Universiti Sains Malaysia



Ketua Pustakawan
Perpustakaan Hamzah Sendut
Universiti Sains Malaysia

Penolong Bendahari Kanan
Unit Kumpulan Wang Penyelidikan
Jabatan Bendahari
Universiti Sains Malaysia

Pegawai Sains
Pelantar Sains Fundamental
Pejabat Pelantar Penyelidikan
Universiti Sains Malaysia

Disampaikan satu salinan laporan akhir projek untuk simpanan Perpustakaan

Mohon kerjasama pihak puan untuk menguruskan penutupan akaun projek selewat-lewatnya pada **31 Disember 2011** dan mohon kemukakan satu salinan penyata kewangan terakhir ke Pejabat ini untuk tujuan rekod



**FINAL REPORT
FUNDAMENTAL RESEARCH GRANT SCHEME (FRGS)**

*Laporan Akhir Skim Geran Penyelidikan Asas (FRGS) IPT
Pindaan 1/2010*

A RESEARCH TITLE : Chemical reactivity and toxicity potential of insonated liquid food
Tajuk Penyelidikan

PROJECT LEADER : Dr. Cheng Lai Hoong
Ketua Projek

PROJECT MEMBERS : 1. Assoc. Prof. Dr. Rosma Ahmad
(including GRA) 2. Assoc. Prof. Dr. Noryati Ismail
Ahli Projek 3. Cik Nur Halawiah Hamid

PROJECT ACHIEVEMENT (*Prestasi Projek*)

B

ACHIEVEMENT PERCENTAGE

| Project progress according to milestones achieved up to this period | 0 - 50% | 51 - 75% | 76 - 100% |
|---|---------|----------|-----------|
| Percentage | | | 95% |

RESEARCH OUTPUT

| Number of articles/ manuscripts/ books (Please attach the First Page of Publication) | Indexed Journal | Non-Indexed Journal |
|---|-----------------|---------------------|
| | 1 | |
| Conference Proceeding (Please attach the First Page of Publication) | International | National |
| | | |
| Intellectual Property (Please specify) | | |

HUMAN CAPITAL DEVELOPMENT

| Human Capital | Number | | | | Others (please specify) |
|-----------------------|-----------|---------------|-----------|---------------|----------------------------|
| | On-going | | Graduated | | |
| Citizen | Malaysian | Non Malaysian | Malaysian | Non Malaysian | |
| PhD Student | | | | | |
| Master Student | 2 | | | | |
| Undergraduate Student | | | 6 | | |
| Total | 2 | | 6 | | |

EXPENDITURE (Perbelanjaan)

C Budget Approved (Peruntukan diluluskan) : RM 71,000.00
 Amount Spent (Jumlah Perbelanjaan) : RM 69,970.40
 Balance (Baki) : RM 1,029.60
 Percentage of Amount Spent : 98.55%
 (Peratusan Belanja)

ADDITIONAL RESEARCH ACTIVITIES THAT CONTRIBUTE TOWARDS DEVELOPING SOFT AND HARD SKILLS
 (Aktiviti Penyelidikan Sampingan yang menyumbang kepada pembangunan kemahiran insaniah)
D

| International | | |
|--|--------------------|-----------|
| Activity | Date (Month, Year) | Organizer |
| (e.g : Course/ Seminar/ Symposium/ Conference/ Workshop/ Site Visit) | - | - |
| National | | |
| Activity | Date (Month, Year) | Organizer |
| (e.g : Course/ Seminar/ Symposium/ Conference/ Workshop/ Site Visit) | - | - |

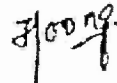
PROBLEMS / CONSTRAINTS IF ANY (Masalah/ Kekangan sekiranya ada)**E** No problem.**RECOMMENDATION (Cadangan Penambahbaikan)****F** No recommendation.

RESEARCH ABSTRACT – Not More Than 200 Words (*Abstrak Penyelidikan – Tidak Melebihi 200 patah perkataan*)

G This project was carried out to study the effects of ultrasound on food materials. In the beginning, the influences of sonication on guava juice were studied. It was found that sonication gave rise to a higher cloudiness and polyphenoloxidase activity. This was attributed to the production of a stabilized colloid system due to smaller particle size formation and higher phenolic compounds availability, respectively. Following which, konjac glucomannan (KGM) was used as a model to follow the degradation effects caused by sonication. Results showed that sonication was effective in yielding a smaller molecular weight fraction of KGM and a solution with higher fluidity. This was resulted from the localized high temperature and high shear forces generated during cavitation that facilitated the endothermic hydrolysis degradation. In the subsequent phase, inactivation of E.coli at sub-lethal temperature was studied. It was evident that high-intensity ultrasound was efficient in inactivating E.coli progressively with increase in medium temperature. Besides, the effect was found to be synergistic under low pH condition. Lastly, our hypothesis on the formation of antagonist and antinutritional substances were not supportive with the current research status. Overall, ultrasound technology is seen to be very useful for minimal processing.

Date : 10 / 03/ 2011
Tarikh

Project Leader's Signature:
Tandatangan Ketua Projek



COMMENTS, IF ANY/ ENDORSEMENT BY RESEARCH MANAGEMENT CENTER (RMC)

(Komen, sekiranya ada/ Pengesahan oleh Pusat Pengurusan Penyelidikan)

F

Name:
Nama:

Signature:
Tandatangan:

Date:
Tarikh:

Ultrasound mediated acid hydrolysis of konjac glucomannan

*Cheng, L.-H., Nur Halawiah, H, Lai, B. N., Yong, H. M. and Ang, S. L.

*Food Technology Division, School of Industrial Technology, Universiti Sains Malaysia,
11800 Minden, Penang, Malaysia*

Abstract: Konjac glucomannan (KGM) was treated with or without sonication and/or hydrochloric acid (HCl). Hydrolysis effects on KGM were studied for properties such as degree of hydrolysis, fluidity, molecular mass, and creep properties. The degree of hydrolysis for sonicated KGM and acid treated KGM were not significantly different. However, the combination treatment of acid hydrolysis and sonication was found effective in yielding a smaller molecular weight fraction of KGM and solution with higher fluidity. From the creep analysis, KGM treated with combination treatment exhibited the highest compliance among samples tested. In general, ultrasound mediated acid hydrolysis was found to be a promising technique in degrading high molecular weight biopolymer. This could be attributed to a localized high temperature and high shear forces generated during cavitation that facilitated the endothermic acid hydrolysis.

Keywords: Acid hydrolysis, sonication, konjac glucomannan, molecular mass

Introduction

High molecular weight biopolymers, such as konjac glucomannan (KGM), are found not suitable for certain applications due to the fact that such biopolymer tends to incur high viscosity at low solid content. Depolymerization is one of the strategies to produce smaller molecular weight fractions to acquire desired properties (Szu *et al.*, 1986; Lii *et al.*, 1999; Liu, 2006; Desai *et al.*, 2008; Iida *et al.*, 2008). The common treatments for biopolymer degradation are enzymatic hydrolysis and acid hydrolysis. Both methods have received extensive attention from researchers and substantial amount of work has been focusing on starch (Gorinstein *et al.*, 1993; VanSoest *et al.*, 1995; Wang *et al.*, 1995; Mélo *et al.*, 1996; Cote and Willet, 1999).

Sonication is another mean of depolymerisation of macromolecules. According to Desai *et al.* (2008), ultrasonication has been proven to be an effective means to depolymerise macromolecules, because it reduces the molecular weight of a polymer by simply splitting the most susceptible chemical bond without causing any changes in the chemical nature of the polymer during cavitation. It was reported that prolonged exposure of macromolecules solutions to high energy ultrasonic waves produced a permanent reduction in viscosity resulted from degradation of molecules (Desai *et al.*, 2008; Grönross *et al.*, 2003). On

the other hand, Iada *et al.* (2008) studied the changes in the viscosity of starches and polysaccharides by sonication and found that glucomannan with 1% concentration showed a drastic depression in viscosity by the sonication. Cote and Willet (1999) revealed that sonication was much more effective in producing lower molecular weight fragments of macromolecules than extrusion or jet cooking.

To the best of our knowledge, the research work on KGM hydrolysis is relatively scarce. Enzymatic degradation on KGM was first attempted by Mayeda (1922), using the growing culture of a sporulating bacterium isolated from konjac flour, as reported in Kato *et al.* (1970). Using crude and purified cellulases, Kato *et al.* (1970) managed to isolate oligosaccharides from the KGM hydrolysates. In 2005, Chen *et al.* studied the effect of unhydrolyzed KGM and acid hydrolyzed glucomannan on cecal and fecal microflora and found that the hydrolyzed glucomannan exerts a greater prebiotic effect than the non-hydrolyzed KGM in Balb/c mice. This is inline with work reported by Al-Ghazzewi *et al.* (2007), Alonso-Sande *et al.* (2009) and Al-Ghazzewi and Tester (2010).

This research was conducted with the aim of producing KGM with modified physical properties by degradation.

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