# Chemical composition and Phospholipids Content of Indonesian Jack Bean (Canavalia ensiformis L.)

*by* Dwi Hudiyanti

**Submission date:** 12-Jun-2020 04:49PM (UTC+0700)
**Submission ID:** 1342486836
**File name:** C1_chemical.pdf (47.71K)
**Word count:** 2029
**Character count:** 10130

ORIENTAL JOURNAL OF CHEMISTRY
An International Open Free Access, Peer Reviewed Research Journal
www.orientjchem.org
Est. 1984
ISSN: 0970-020 X
CODEN: OJCHEG
2015, Vol. 31, No. (4):
Pg. 2043-2046

# Chemical composition and Phospholipids Content of Indonesian Jack Bean (*Canavalia ensiformis L.*)

**DWI HUDIYANTI[1]*, ADITYA PUTRI ARYA[1], PARSAORAN SIAHAAN[1] and LINDA SUYATI[1]**

[1]Departement of Chemistry, Faculty of Science and Mathematics,
Diponegoro University, Semarang, Indonesia.
*Corresponding author E-mail: dwi_hudiyanti@undip.ac.id

http://dx.doi.org/10.13005/ojc/310423

(Received: September 30, 2015; Accepted: November 07, 2015)

**ABSTRACT**

The chemical composition and phospholipids content of Indonesian Jack Bean (*Canavalia ensiformis L.*) were determined. This was conducted with a view to supply data to direct industrial utilization of these seeds. The proximate study revealed the following information: total protein 34.6%, total fat 2.4%, fibre 1.2%, ash 2.8%, moisture 12.5% and phospholipids 0.1%. FTIR analysis confirmed the specific peaks for phospholipids and GCMS analysis showed that the fatty acid residues of the phospholipids were palmitic and oleic acids. This study has established useful information for further utilization of this seeds.

**Key words:** Jack bean, *Canavalia ensiformis* L., proximate, phospholipid

## INTRODUCTION

Indonesia is a tropical country particularly blessed with a variety of rich vegetations having great, diverse and highly beneficial economic potentials for the populations. One field of such economic prospect is the availability of indigenous seeds that may themselves provide biochemical sources. Among the abundant variety of vegetation that cultivated in Indonesia are coconut, sesame and candlenut. They are usually only used as cooking ingredient. Recent study has highlight the possibility to utilize coconut, sesame and candlenut as phospholipids sources for biosurfactants and drug delivery systems [1–4].

Other vegetation that captures our attention is jack bean (*Canavalia ensiformis* L.). In India, the nutritional value of jack bean seeds collected from nine different locations has been reported to have slightly different in composition [5]. Indian researchers have extensively study this legume for different kind of applications [6–8]. In Indonesia, jack bean is grown in many regions including most part of Jawa island and Central Sulawesi. Jack bean has been cultivated and used to produce variety of homemade snacks but the use of these seeds in more advance applications has not been given serious attention. Such seeds may not only serve as nutritional purposes but also as biochemical sources for instance their phospholipids and other chemical components.

In this report we establish nutritional data i.e. the chemical compositions and phospholipids content of jack bean (*Canavalia ensiformis* L.), an under-utilized legume. The general aim was to explore their potential as food, feed and biochemical sources for our industries.

## MATERIAL AND METHODS

### Samples collection

Jack Bean (*Canavalia ensiformis L.*) seeds were purchased from a leading local grower in kecamatan Wonoboyo Temanggung, Central Java.

### Identification of the seeds

The seeds was identified and authenticated at the Department of Biology, Faculty of Sciences and Mathematics, Diponegoro University, Semarang.

### Samples preparation

Jack bean seeds were cleaned and peeled carefully from their epidermis. They were sun-dried for one week. The seeds were kept in clean and airtight glass jars, covered and labelled for later used. The seeds were ground to powder by food miller prior used.

### Chemical analysis

The moisture content was measured by taking 1 g of each sample and drying in an oven at 105 ºC for about 1 hour followed by cooling in a desiccator. The samples mass was measured before and after handling until a constant mass was attained. Total protein of dried samples was determined based on nitrogen content as indicated by Kjeldahl method. To convert total nitrogen to total protein a conversion factor of 6.25 was used for all samples. The total fat was determined by calculating mass difference of sample before and after extraction with n-hexane in Soxhlet apparatus for 8 hours. Cholesterol Content was determined by gas chromatography. Ash content was determined by burning the samples in a furnace at 600 ºC for 6 h. Crude fiber content was also determined. Phosphorus content was also determined colorimetrically [9].

### Phospholipids analysis

Ground jack bean seeds was macerated with a mixture of chloroform : isopropanol (1/1, v/v). The filtrate was evaporated and the residue obtained was homogenized in chloroform: methanol (2/1, v/v) [10], then washed by NaCl solution 0.9% and evaporated to acquire polar lipids. Phospholipids were isolated by solvent partition with 87% aqueous ethanol and n-hexane (1/1, v/v) as described by Galanos et al. [11]. The phospholipids functional groups were analyzed by FTIR and the fatty acid components were determined by GCMS [2].

## RESULT AND DISCUSSION

The chemical profile of Indonesian jack bean seeds (total protein, total fat, fiber, ash, moisture and phosphorous contents) is presented in Table 1.

The data show that protein content of jack bean was not far from the value obtained by Indian researchers [12,13] and higher than the protein content of some other legumes such as soybean and edamame [14]. Proteins are vital part of living cell. They are nutrients needed for growth and conservation of body cells. This result indicated that Indonesian jack bean could provide good supply of protein. The high level of protein content in jack bean had nutritional significant, since medium intake of these seeds would greatly boost the total dietary protein intake.

The fat value of jack bean showed close agreement with the amount (2.0-6.0%) reported earlier in India [12]. This indicated that jack bean was a low source of fat. This data pointed out that jack bean was good for people who were in fat-controlled diet.

The amount of ash in jack bean was 2.8%. Jack bean ash content was consistence with the

**Table 1: Chemical Profile of Indonesian jack bean seeds**

| Components | Composition (% dry weight) |
|---|---|
| Total protein | 34.6 |
| Total fat | 2.4 |
| Fiber | 1.2 |
| Ash | 2.8 |
| Moisture | 12.5 |
| Phospholipids | 0,1 |

data from Doss [12]. Ash content corresponds to the presence of mineral in jack bean. High ash contents represent high concentration of various mineral elements. Mineral elements are important in metabolic process, growth and development of human body.

The fiber content, 1.2%, was lower than reported previously [12]. The benefits of high fiber intake prevent various degenerative diseases. Low fiber intake is associated with occurrence of various cancers such as colon and rectum and diabetes [15,16]. This data suggest that jack bean alone is not suitable as fiber source in foods it should be supplemented with other high fiber content sources.

The moisture content of the seeds was noticeably high, 12.5% dry weight. Vadivel and Janardhanan [5] reported that the moisture content of jack bean from different locations in south India was varied in the range of 3.8-9.2 %. Our data confirmed considerable variation for moisture content of jack bean from different origin. The moisture content is important in storage availability of the seeds. The high moisture content of jack bean indicating that jack bean is susceptible to spoilage. This would cause storage problems if it did not properly manage. Microorganisms would be easy grow and survive which may results in decomposition of the seeds.

Phospholipids are biosurfactant useful for many industrial applications. Investigation on phospholipids natural sources is a continuing effort to provide alternative for industrial necessitate for surfactants that are environmental friendly. The phospholipids isolated from jack bean was 0,1%. Analysis of functional groups by FTIR confirmed the existence of functional groups specific for phospholipids [2] in the jack bean phospholipids extract. The absorbance band at 1234.44 indicated the P=O stretch. The 1064.71 $cm^{-1}$ absorption band belonged to P-O-C stretch while absorption at 825.53 designated to the –P-O asymmetric stretch of the phospholipids. From GCMS analysis the fatty acid residues of jack bean phospholipids were found to be palmitic acid, C16:0 and oleic acid, C18:1.

## ACKNOWLEDGMENTS

We are grateful to the Government of Indonesia, Ministry of Research, Technology and Higher Education for financial assistance via Hibah Penelitian Unggulan Perguruan Tinggi, Dikti 2015.

## REFERENCES

1. Hudiyanti, D.; Supardi, A.; Nugroho, S. The Characteristics of Coconut Phospholipids as Biosurfactants. *J. SAINS DAN Mat.* **2012**, *20*, 93–97.
2. Hudiyanti, D.; Raharjo, T. J.; Narsito, N.; Noegrohati, S. Isolasi Dan Karakterisasi Lesitin Kelapa Dan Wijen. *J. Agritech Fak. Teknol. Pertan. UGM* **2012**, *32*.
3. Hudiyanti, D.; Raharjo, T. J.; Narsito, N.; Noegrohati, S. Investigation On The Morphology And Properties Of Aggregate Structures Of Natural Phospholipids In Aqueous System Using Cryo-Tem. *Indones. J. Chem.* **2012**, *12*, 57–61.
4. Hudiyanti, D.; Raharjo, T. J.; Narsito, N.; Noegrohati, S. Study on Leakage of Sesame (Sesamum Indicum L.) and Coconut (Cocos Nucifera L.) Liposomes. *Orient. J. Chem.* **2015**, *31*, 435–439.
5. Vadivel, V.; Janardhanan, K. Diversity in Nutritional Composition of Wild Jack Bean (Canavalia Ensiformis L. DC) Seeds Collected from South India. *Food Chem.* **2001**, *74*, 507–511.
6. Faheina-Martins, G. V.; da Silveira, A. L.; Cavalcanti, B. C.; Ramos, M. V.; Moraes, M. O.; Pessoa, C.; Araújo, D. A. M. Antiproliferative Effects of Lectins from Canavalia Ensiformis and Canavalia Brasiliensis in Human Leukemia Cell Lines. *Toxicol. In Vitro* **2012**, *26*, 1161–1169.
7. Mulinari, F.; Becker-Ritt, A. B.; Demartini, D. R.; Ligabue-Braun, R.; Stanisçuaski, F.; Verli, H.; Fragoso, R. R.; Schroeder, E. K.; Carlini,

C. R.; Grossi-de-Sá, M. F. Characterization of JBURE-IIb Isoform of Canavalia Ensiformis (L.) DC Urease. *Biochim. Biophys. Acta BBA - Proteins Proteomics* **2011**, *1814*, 1758–1768.

8. Postal, M.; Martinelli, A. H. S.; Becker-Ritt, A. B.; Ligabue-Braun, R.; Demartini, D. R.; Ribeiro, S. F. F.; Pasquali, G.; Gomes, V. M.; Carlini, C. R. Antifungal Properties of Canavalia Ensiformis Urease and Derived Peptides. *Peptides* **2012**, *38*, 22–32.
9. Kitson, R. E.; Mellon, M. G. Colorimetric Determination of Phosphorus as Molybdivanadophosphoric Acid. *Ind. Eng. Chem. Anal. Ed*. **1944**, *16*, 379–383.
10. Folch, J.; Lees, M.; Sloane Stanley, G. H. A Simple Method for the Isolation and Purification of Total Lipides from Animal Tissues. *J. Biol. Chem*. **1957**, *226*, 497–509.
11. Galanos, D. S.; Kapoulas, V. M. Isolation of Polar Lipids from Triglyceride Mixtures. *J. Lipid Res*. **1962**, *3*, 134–136.
12. Doss, A.; Pugalenthi, M.; Vadivel, V. Nutritional Evaluation of Wild Jack Bean (Canavalia Ensiformis DC) Seeds in Different Locations of South India. *World Appl. Sci. J.* **2011**, *13*, 1606–1612.
13. Akpapunam, M. A.; Sefa-Dedeh, S. Jack Bean (Canavalia Ensiformis): Nutrition Related Aspects and Needed Nutrition Research. *Plant Foods Hum. Nutr.* **1997**, *50*, 93–99.
14. Nutrient Data Laboratory http://ndb.nal.usda.gov/ndb/nutrients/report/nutrientsfrm? max=25&offset=0&totCount=0&nutrient1=203&nutrient 2=&nutrient3=&subset=0&fg=11 &sort=c&measureby=g (accessed Oct 28, 2015).
15. Modan, B.; Barell, V.; Lubin, F.; Modan, M.; Greenberg, R. A.; Graham, S. Low-Fiber Intake as an Etiologic Factor in Cancer of the Colon. *J. Natl. Cancer Inst.* **1975**, *55*, 15–18.
16. Salmerón, J.; Ascherio, A.; Rimm, E. B.; Colditz, G. A.; Spiegelman, D.; Jenkins, D. J.; Stampfer, M. J.; Wing, A. L.; Willett, W. C. Dietary Fiber, Glycemic Load, and Risk of NIDDM in Men. *Diabetes Care* **1997**, *20*, 545–550..

# Chemical composition and Phospholipids Content of Indonesian Jack Bean (Canavalia ensiformis L.)

ORIGINALITY REPORT

| 8% | 5% | 5% | 2% |
|---|---|---|---|
| SIMILARITY INDEX | INTERNET SOURCES | PUBLICATIONS | STUDENT PAPERS |

PRIMARY SOURCES

| | | |
|---|---|---|
| 1 | Abdelrahman Mohamed Yassin, Nehal Mohamed El-Deeb, Fahmy Gad Elsaid, Ali Abdullah Shati et al. "Lectin from Pisum fulvum Seeds as in vitro Anticancer and Apoptotic Gene Regulator", Revista de Chimie, 2019<br>Publication | 1% |
| 2 | repositorio.ual.es<br>Internet Source | 1% |
| 3 | Zheng Shi, Jie Chen, Chun-yang Li, Na An, Zi-jie Wang, Shu-lin Yang, Kai-feng Huang, Jin-ku Bao. "Antitumor effects of concanavalin A and Sophora flavescens lectin in vitro and in vivo", Acta Pharmacologica Sinica, 2013<br>Publication | 1% |
| 4 | Jacob Popoola, Omena Ojuederie, Conrad Omonhinmin, Adegoke Adegbite. "Chapter 8 Neglected and Underutilized Legume Crops: Improvement and Future Prospects", IntechOpen, 2020<br>Publication | 1% |

| | | |
|---|---|---|
| 5 | mdpi.com<br>Internet Source | 1% |
| 6 | aip.scitation.org<br>Internet Source | 1% |
| 7 | ipi.portalgaruda.org<br>Internet Source | 1% |
| 8 | www.tandfonline.com<br>Internet Source | <1% |
| 9 | scholar.valpo.edu<br>Internet Source | <1% |
| 10 | www.mdpi.com<br>Internet Source | <1% |
| 11 | Submitted to iGroup<br>Student Paper | <1% |

| | | | |
|---|---|---|---|
| Exclude quotes | Off | Exclude matches | Off |
| Exclude bibliography | Off | | |