

## ***PRODUCTION OF LECITHIN AS AN EMULSIFIER FROM VEGETABLE OIL USING WATER DEGUMMING PROCESS***

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### **INTISARI**

Lecithin adalah fosfolipid yang mempunyai sifat amphifilik yang mempunyai daerah polar dan nonpolar sehingga sangat efektif sebagai emulsifier makanan. Akan tetapi komersial lecithin berasal dari isolasi organ hewan seperti babi yang jelas haram. Lecithin yang berasal dari minyak nabati yang komersial hanya berasal dari minyak kedelai. Oleh karena itu, produksi lecithin dari minyak nabati lain dapat menjadi solusi akan ketersediaan lecithin nabati yang halal. Pada penelitian ini dikaji produksi lecithin dari minyak nabati (minyak kelapa, minyak kelapa sawit, minyak jagung dan minyak kedelai) menggunakan proses water degumming. Minyak nabati dipanaskan sampai 70 °C dan ditambahkan soft water sebanyak 3% kemudian diaduk selama satu jam. Untuk memisahkan gum yang ada digunakan proses centrifugasi pada 5.000 rpm selama 20 menit. Dari hasil penelitian menunjukkan bahwa hanya gum minyak jagung yang dapat menghasilkan crude lecithin yang berpotensi sebagai emulsifier. Rendemen gum yang dihasilkan sebanyak 0,11% dan Acetone insoluble (AI) gum minyak jagung sebesar 62,75% significant sama dengan gum minyak kedelai sebagai control. Akan tetapi gum yang dihasilkan mempunyai kadar air yang tinggi sebesar 6,14% sehingga perlu proses selanjutnya.

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### **ABSTRACT**

Lecithin is a phospholipid that has amphiphilic properties resulted polar and non-polar regions, thus it is very effective to be food emulsifier. However, commercial lecithin derived from animal organs such as pig brain, that it is clearly haram. Today, commercial vegetable lecithin derived from soybean oil only. Therefore, lecithin production from other vegetable oils can be made Halal food. In this study, it determined production of lecithin from vegetable oils (coconut oil, palm oil, corn oil and soybean oil) using water degumming process. Vegetable oil is heated up to 70 °C and added 3% of soft water and then stirred for an hour. To separate the gum, it is used centrifuge at 5000 rpm for 20 minutes. The results showed that only gum from corn oil that can be potentially produce crude lecithin as an emulsifier, resulted gum dry yield (0.11%) and acetone insoluble (AI) 62.75%. This result has significantly the same with soybean lecithin as a control. Unfortunately, it has water content of 6.14% that need further improvement

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## 1. INTRODUCTION

Vegetable lecithin refers to a complex, naturally occurring mixture of polar lipids obtained from water degumming crude vegetable oils and separating and drying a hydra-table gum. Water degumming is an oldest degumming treatment and also forms the basic production of commercial lecithin. The term lecithin is its trivial name for the compound phosphatidylcholine (PC), phosphatidylethanolamine (PE) and phosphatidylinositol (PI) (1)(2). Lecithins are among the most widely used emulsifiers in the food industry such as margarine making, controlling viscosity in chocolate making and instantization of food. Most use levels vary between 0.1 – 2 % (3). If it is compared with the other emulsifier agents, a little amount of lecithin to make oil water stable makes a useful emulsifier.

The commercial lecithin originated from animal sources such as egg yolk, milk, brain of pigs or cows, consisting of up to 90% phospholipids. Although the highest concentration of phospholipids occurs in animal products, the production of lecithin from vegetable lipids is also considered due to the need for halal food products. Soybean lecithin is a co-product of oil processing which contains 0.3 % to 0.6% phospholipids (3). Several modified degumming processes have already been conducted in order to minimize the residual phosphorus content in the oil (4). The conditions during the degumming process, such as quality and origin of the oil, have a considerable influence on the composition and quality of the crude lecithin (5). Vegetable oils such as corn oil, coconut oil and crude palm oil have phospholipids that also have a higher potential to produce vegetable lecithin. The objectives of this study were to determine the potential of vegetable oil; corn oil, coconut oil and crude palm oil instead of soybean oil to produce vegetable lecithin using the water degumming process.

## 2. METHODS

### 2.1 Materials

Commercially extracted crude vegetable oils were investigated. Corn oil, soybean oil and coconut oil were purchased from Soon Soon Oil Mills SDN BHD Penang Malaysia, while crude palm oil was purchased from PT Perkebunan Kelapa Sawit Riau.

### 2.2 Water degumming method

Crude vegetable oil (250 ml) was taken in a 500 ml beaker glass that was fitted with a laboratory model stirrer, driven by a variable speed motor. The beaker along with the content was placed in a water bath maintained at temperature. Degumming was carried out at temperature of 70°C. With the required quantity of soft distilled water at 3 % added to the oil, having set the time at one hour for extraction of the gum, while the speed of agitation was varied from 30 – 400 rpm. All experiments were conducted in duplicates. After degumming, the mixture was cooled for 30 min after that heated to 60°C followed by centrifugation at 5000 rpm for 20 min. The degummed oil was removed by decantation and wet gums were then dried at 90°C until it dried as dry gum.

### 2.3 Moisture content determination

Moisture content of crude gum lecithin was determined using AOAC methods (6).

### 2.4 Acetone Insoluble in Dry Gum

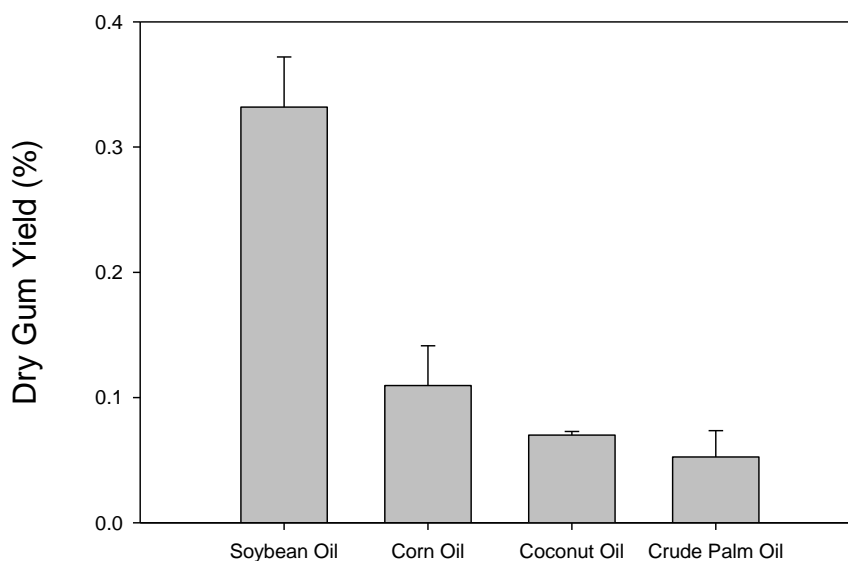
The acetone acetone – insoluble matter serves as a standard for the valuable constituents of lecithin. The amount of acetone – insoluble matter (AI) is a measure of the polar material found in lecithin. The amount of AI is determined by AOC Official Method Ja-4-46 (6). The soybean lecithin has AI content typically <60% (1).

## 3. RESULTS AND DISCUSSION

Water degumming is a process of removing gum through precipitation by pure water hydration of crude vegetable oil via centrifugal separation. This method is used when extracting gum for production of lecithin, soybean oil and for crude vegetable oil with 200 ppm phosphorus content. In this process, water is the main agent used to remove the hydra-table phosphatides from vegetable oils and it can be carried out in batch or continuous process depending on the type of the oil to be degummed and amount of oil to be processed (2).

The yield of dry gum for various vegetable oils is presented in **figure 1**. The higher yield was resulted in soybean oil (0.33%). Although the highest concentrations of phospholipids occur in animal products, i. e., meat, poultry, fish, eggs and milk/cheese, the major commercial source is the soybean, which contains 0.3 – 0.6% (1). And oils produced less dry gum were corn oil (0.11%), coconut oil (0.07%), and crude palm oil (0.05), respectively. The commercial exploitation of co-product corn lecithin has not taken place in large

quantities due to the phenomenal growth in demand corn sweetener and other corn product. Unlike corn have found 2.5% to 4.5% of phosphorus in form of phospholipids (1) (3). Phosphatidic acid and glycolipids in corn oil represent a higher proportion of polar lipids than in soybean oil. While composition of Phosphatidyl Choline (PC) and Phosphatidyl Inosine (PI) were the same in both of oils. Both the glycolipids and phospholipids of corn have lower percentages of linoleic acid (18:3) and more saturated than those in the soybean. It may have resulted less dry gum after degumming processes. The compositions of the phospholipids in corn and soybean oil also are equal in linoleic acid (18:2), but it is depending on the variety of corn (7). the coconut oil and crude palm oil have less produced dry gum due to contain small number of phospholipids. The higher amount of fat in coconut and palm oil is triglyceride (1)(8). It indicated that in this study only corn oil has potential as production of lecithin beside of soybean oil established.



**Figure 1.** Dry gum yield from varied vegetable oils

Acetone-Insoluble (AI) of dry gum is indicated to show quality of lecithin. It was shown that AI of dry gum from soybean oil and corn oil were significant different with another oils (Table 1). The amount of AI matter (%AI) is the approximate indication for the number of phospholipids, glycolipids and carbohydrate, due to the polar content of the lipid was not dissolved in acetone. In crude lecithin, AI is also synonym referred as “Active ingredient”. Since it was insoluble in acetone, The AI serves as a standard for the valuable constituent of lecithin (5) (9). Lecithin as food additive was legally regulated in the European Union under directives 96/77/EG (quality requirements) under number E 322 is given that lecithin has not less than 60% acetone-insoluble content (1). In this study, dry gum from soybean oil and corn oil showed more than 60%. It indicated that dry gum from corn oil has quality requirement as food additive like soybean oil. It also has a brown color like soybean gum. The other oils such as coconut oil and crude palm oil has less AI content due to less phospholipids. The vegetable lecithins, containing primary phosphatidylcholine (PC), phosphatidylethanolamine (PE), phosphatidylinositol (PI) are derived commercially from oil bearing seed (9). Even though palm oil has surface active that could be applicable to be emulsifier, it come from higher amount of monoglycerides instead of phospholipids (8). Phospholipids content in coconut oil and palm oils were higher in saturated lipids when compare to seed oil such as soybean oil and corn oil (8)(10). The color of the dry gum from coconut oil also showed a light like water, while palm oil showed dark brown. The natural lecithin has a brown color. The color it indicated to the colored component, carotenoid, melanooids and porphyrins, in addition to the Maillard and Amadori reaction product (9)(11).

Table 1. Acetone Insoluble (AI) from varied vegetable oils

Vegetable oils	Acetone Insoluble(AI)
Soybean Oil	76.95 ± 29.76 <sup>a</sup>
Corn Oil	62.75 ± 10.33 <sup>ab</sup>
Coconut Oil	22.08 ± 2.56 <sup>b</sup>
Crude Palm Oil	28.28 ± 1.42 <sup>b</sup>

Assays were performed in triplicate. Mean ± SD values in the same column with different superscripts are significantly different ( $p \leq 0.05$ )

Most lecithin products are preserved well during storages. Higher moisture contents indicate a greater potential for spoilage or chemical degradation. The moisture content of the dry gum from all oils still was high (**Figure 2**). The water content of lecithin products is usually less than 1%. It determined to the microbiological profile of most food system in order to have long shelf life and fluidity (5). In this study, drying process was difficult to control. Often a long batch with higher temperature results in severe darkening due to Maillard reaction of the adherent sugar and Amadori reaction between sugar and phospholipids (2). The higher amount of moisture content due to dry lecithin is highly viscous, and the viscosity increase dramatically and then fall off as the moisture content increases (11).

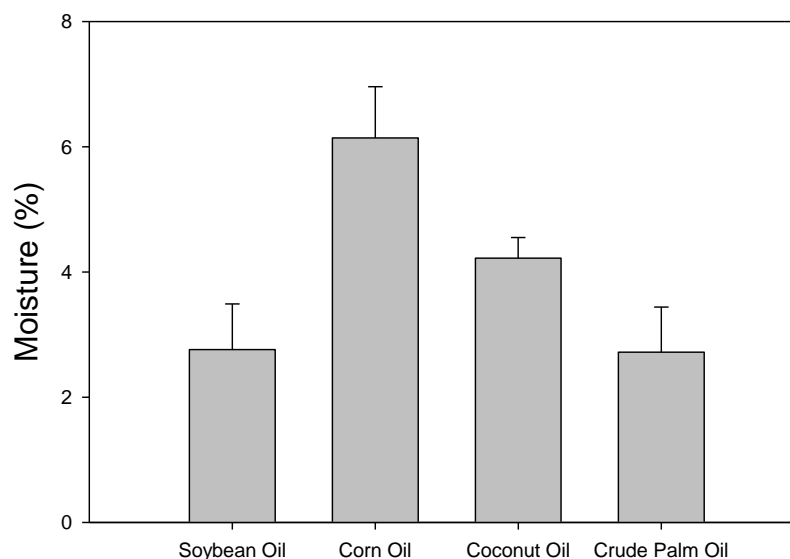


Figure 2. Moisture content of crude lecithin from varied vegetable oils

#### 4. CONCLUSION

In this study, beside of established lecithin from soybean oil, corn oil has also potential to be improved produce. Both of them have significantly the same in acetone insoluble (AI), therefore the reducing moisture content of corn dry gum is still necessary further improvement. Water degumming process rendered isolation of corn lecithin depending on the process parameter.

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