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# PURIFICATION OF PALM KERNEL CAKE BASED PROTEIN

**EDGAR AZZANO ALJUDAVI**



**DEPARTMENT OF AGROINDUSTRIAL TECHNOLOGY  
FACULTY OF AGRICULTURAL ENGINEERING AND TECHNOLOGY  
IPB UNIVERSITY  
BOGOR  
2025**



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I declare that the undergraduate final project entitled “Purification of Palm Kernel Cake Based Protein” is my work, completed under the direction of my supervisors, Prof. Dr. Farah Fahma, S.T.P., M.T., and Prof. Dr. Ir. Erliza Hambali, M.Si. This undergraduate final project has not been submitted in any form to any university. All sources of information, whether originating or quoted from published or unpublished works by other authors, have been mentioned in the text and listed in the Bibliography at the end of this undergraduate final project.

Furthermore, I now assign the copyright of my written work to IPB University.

Bogor, July 2025

Edgar Azzano Aljudavi  
F3401211074



## ABSTRACT

EDGAR AZZANO ALJUDAVI. Purification of Palm Kernel Cake Based Protein. Supervised by FARAH FAHMA and ERLIZA HAMBALI.

Palm Kernel Cake (PKC), an abundant by-product of Indonesia's palm oil industry, possesses significant protein content but is currently underutilized, primarily serving as animal feed. Its direct application in food is limited by impurities, a dark color, and high fiber content. This study aims to develop a high-purity protein from PKC, effectively utilizing this co-product to reduce waste and explore its potential for human consumption. The methodology involved alkali extraction (1N NaOH at 55°C for 4 hours) with varying material-to-solvent ratios (1:50 and 1:20 w/v), followed by isoelectric precipitation (pH 3-4.5), and ethanol purification at different ratios (1:3, 1:5, 1:10 w/v). The best purified sample protein (IPBP), and the unpurified protein (IPB) were characterized for proximate composition, physical properties, pH, solubility, TPC, and functional properties. Results showed that ethanol purification significantly increased protein content (from 47.79% to 59.74% at 1:5 ratio) and significantly reduced fat content (from 25.81% to 6.52%), with the 1:5 ethanol ratio being the best ethanol ratio for purity. The purified product exhibited significantly lower bacterial contamination (TPC) compared to unpurified samples due to ethanol's bactericidal action, demonstrating good microbial safety. IPBP had a pH of 6, aligning with protein isolate standards. Its high oil holding capacity (2.70 mL fat/g) suggests potential for meat products and sausages, while its low water holding capacity (0.29 mL water/g) indicates suitability for crispy products. The protein obtained is not soluble in water, but soluble in alkali. The final product, with protein content over 50%, is classified as protein flour. A smaller extraction solvent ratio (1:20) significantly increased yield (7.47%) but slightly lowered purity compared to the 1:50 ratio (54.46% vs 59.74%). This study provides a foundational process for valorizing PKC into a valuable food ingredient, contributing to sustainable palm oil downstream processing.

**Keywords:** Palm Kernel Cake, Protein Isolation, Purification



## ABSTRAK

EDGAR AZZANO ALJUDAVI. Pemurnian Protein dari Bungkil Inti Sawit.  
Dibimbing oleh FARAH FAHMA dan ERLIZA HAMBALI.

*Inti sawit (PKC), hasil samping yang melimpah dari industri kelapa sawit Indonesia, memiliki kandungan protein yang signifikan namun saat ini masih kurang dimanfaatkan, terutama sebagai pakan ternak. Penerapan langsungnya dalam makanan terbatas karena adanya pengotor, warna gelap, dan kandungan serat yang tinggi. Penelitian ini bertujuan untuk mengembangkan protein dengan kemurnian tinggi dari PKC, memanfaatkan produk samping ini secara efektif untuk mengurangi limbah dan mengeksplorasi potensinya untuk konsumsi manusia. Metodologi yang digunakan meliputi ekstraksi alkali (NaOH 1N pada 55°C selama 4 jam) dengan variasi rasio bahan-pelarut (1:50 dan 1:20 b/v), diikuti oleh presipitasi isoelektrik (pH 3-4,5), dan pemurnian etanol pada rasio yang berbeda (1:3, 1:5, 1:10 b/v). Sampel terbaik protein yang dimurnikan (IPBP), dan protein yang tidak dimurnikan (IPB), dikarakterisasi untuk komposisi proksimat, sifat fisik, pH, kelarutan, TPC, dan sifat fungsional. Hasil penelitian menunjukkan bahwa pemurnian etanol secara signifikan meningkatkan kadar protein (dari 47,79% menjadi 59,74% pada rasio 1:5) dan secara signifikan mengurangi kandungan lemak (dari 25,81% menjadi 6,52%), dengan rasio etanol 1:5 menjadi rasio terbaik penggunaan etanol untuk kemurnian. Produk yang dimurnikan menunjukkan kontaminasi bakteri (TPC) yang jauh lebih rendah dibandingkan sampel yang tidak dimurnikan karena aksi bakterisida etanol, menunjukkan keamanan mikroba yang baik. IPBP memiliki pH 6, selaras dengan standar isolat protein. Daya serap minyak yang tinggi (2,70 ml lemak/g) menunjukkan potensi untuk produk daging dan sosis, sedangkan daya serap air yang rendah (0,29 ml air/g) menunjukkan kesesuaian untuk produk renyah. Protein yang didapat tidak larut dalam air dan hanya larut dalam basa. Produk akhir, dengan kandungan protein di atas 50%, diklasifikasikan sebagai tepung protein. Rasio pelarut ekstraksi yang lebih kecil (1:20) secara signifikan meningkatkan rendemen (7.47%) tetapi sedikit menurunkan kemurnian dibandingkan dengan rasio 1:50 (54,46% vs 59,74%). Penelitian ini menyediakan proses dasar untuk memanifestasikan PKC menjadi bahan pangan yang bernilai, berkontribusi pada hilirisasi kelapa sawit yang berkelanjutan.*

**Kata kunci:** Bungkil inti sawit, Isolasi protein, pemurnian



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# **PURIFICATION OF PALM KERNEL CAKE BASED PROTEIN**

**EDGAR AZZANO ALJUDAVI**

Undergraduate Final Project  
One of the requirements for obtaining a Bachelor of  
Engineering Degree with Honours  
at  
Study Program of Agro-Industrial Engineering

**DEPARTMENT OF AGROINDUSTRIAL TECHNOLOGY  
FACULTY OF AGRICULTURAL ENGINEERING AND TECHNOLOGY  
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Bogor, July 2025

*Edgar Azzano Aljudavi*



## TABLE OF CONTENT

|                                               |     |
|-----------------------------------------------|-----|
| ABSTRACT                                      | ii  |
| ABSTRAK                                       | iii |
| TABLE OF CONTENT                              | x   |
| LIST OF TABLES                                | xi  |
| LIST OF FIGURES                               | xi  |
| LIST OF ATTACHMENTS                           | xi  |
| INTRODUCTION                                  | 1   |
| 1.1 Background                                | 1   |
| 1.2 Problem Statement                         | 2   |
| 1.3 Project Objective                         | 2   |
| 1.4 Project Benefit                           | 3   |
| 1.5 Scope of Project                          | 3   |
| II LITERATURE REVIEW                          | 4   |
| 2.1 State of the Art                          | 4   |
| 2.2 Palm Kernel Cake                          | 5   |
| 2.3 Protein Isolation                         | 6   |
| 2.4 Protein Purification                      | 7   |
| III METHOD                                    | 8   |
| 3.1 Theoretical Framework                     | 8   |
| 3.2 Exploration and Problem Definition Phase  | 9   |
| 3.3 Ideation and Engineering Concept Solution | 9   |
| 3.4 Validation                                | 10  |
| 3.5 Time and Place                            | 11  |
| 3.6 Tools and Materials                       | 11  |
| 3.7 Research Procedures and Stages            | 11  |
| IV RESULT AND DISCUSSION                      | 14  |
| 4.1 Exploration and Problem Definition        | 14  |
| 4.2 Engineering Concept Solution and Ideation | 14  |
| 4.3 First Iteration Results                   | 15  |
| 4.4 Second Iteration Results                  | 16  |
| 4.5 Prototype Validation                      | 18  |
| V CONCLUSION AND SUGGESTION                   | 23  |
| 5.1 Conclusion                                | 23  |
| 5.2 Suggestion                                | 23  |
| REFERENCES                                    | 24  |
| ATTACHMENT                                    | 30  |
| BIOGRAPHY                                     | 33  |