THESIS

EFFECT OF CALCINATION AND SINTERING TEMPERATURES ON THE STRUCTURAL AND MECHANICAL PROPERTIES OF PVA-HYDROXYAPATITE BIOCERAMICS DERIVED FROM DUCK AND CHICKEN EGGSHELLS

By:

AYUNDA WULAN PERMATASARI
NPM: 22037010001

PHYSICS STUDY PROGRAM
FACULTY OF ENGINEERING AND SCIENCE
UNIVERSITAS PEMBANGUNAN NASIONAL "VETERAN"
JAWA TIMUR
SURABAYA

2026

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THESIS

Submitted to Partially Fulfill the Requirements
In Obtaining a Bachelor of Science (S.Si) Degree
Physics Study Program

By:

AYUNDA WULAN PERMATASARI
NPM: 22037010001

BACHELOR OF PHYSICS STUDY PROGRAM
FACULTY OF ENGINEERING AND SCIENCE
UNIVERSITAS PEMBANGUNAN NASIONAL "VETERAN"
JAWA TIMUR

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APPROVAL PAGE

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Compiled By: 22 April 2026

AYUNDA WULAN PERMATASARI
NPM: 22037010001

Defended Before and Accepted by the Thesis Examination Team
Faculty of Engineering and Science, Physics Study Program
Universitas Pembangunan Nasional "Veteran" Jawa Timur
On the Date:

Approved
Supervisor 1

Dr. Nur Aini Fauziyah, S.Pd., M.Si.
NIP. 21219901126308

Examiner I

Nenni Mona Aruan, S.Pd., M.Si.
NIP. 199010282024062002

Supervisor II,

Dr. Nailul Hasan.,S.Si, M.Sc.
NIP. 21119880102313

Examiner II

Akbar Sujiwa, S.Si., M.Si.
NIP. 199102202024061001

Acknowledged,
Coordinator of The Physics Study Program

Dr. Dira Ernawati, S.T.,M.T.
NIP. 19780602 202121 2003

Knowing,
DEAN OF THE FACULTY OF ENGINEERING AND SCIENCE
UNIVERSITAS PEMBANGUNAN NASIONAL "VETERAN"
JAWA TIMUR

Prof. Dr. Dra. Jariyah, M.P
NIP. 196504031991032001

STATEMENT OF PLAGIARISME-FREE

I, the undersigned:

Name	: Ayunda Wulan Permatasari
NPM	: 22037010001
Program	: Bachelor's degree (S1)
Study Program	: Physics
Faculty	: Engineering and Science

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Surabaya, 12 Mei 2026

Who made the statement,

Ayunda Wulan Permatasari
NPM. 22037010001

ABSTRACT

This study aims to investigate the effect of calcination and sintering temperatures on the structural and mechanical properties of PVA-Hydroxyapatite (HAp) bioceramics derived from chicken and duck eggshells. To improve its physical performance and broaden its applications, HAp can be combined with PolyVinyl Alcohol (PVA) as a polymer matrix. The HAp was synthesized using the wet chemical precipitation method followed by calcination and sintering processes at temperatures of 800°C, 900°C, and 1000°C. Characterization was carried out using XRD, FTIR, SEM and hardness testing using Shore A durometer. The results showed that hydroxyapatite was successfully synthesized from both chicken and duck eggshells, as confirmed by the characteristic XRD peaks and the presence of phosphate (PO_4^{3-}) and hydroxyl (OH-) functional groups identified through FTIR analysis. Increasing calcination and sintering temperatures significantly improved crystallinity, phase purity, and particle homogeneity. At 800°C, a secondary whitelockite phase was still observed, wehereas at 900°C and 1000°C, single phase hydroxyapatite 100% purity was successfully formed. SEM analysis revealed a denser particle distribution at higher temperatures, with particke sizes ranging from 0-500 nm and a average particle size of approximately 254.619 nm. Mechanical testing showed that the chicken eggshell sample treated at 1000-800°C exhibited the highest hardness value of 4.715 MPa, while the duck eggshell sample treated at 900-1000°C exhibited the lowest hardness value of 3.095 MPa. The porosity observed in the bioceramic structure also influenced the resulting mechanical strength. Overall, this study demonstrates that hydroxyapatite derived from chicken and duck eggshell waste combined with PVA has promising potential for biomaterial applications.

Keywords: Hydroxyapatite, eggshell waste, PVA, bioceramics, calcination temperature, sintering temperature, biomaterials.

FOREWORD

All praise and gratitude are due to God Almighty for His abundant blessings and grace, which have enabled the author to complete this undergraduate thesis proposal entitled **"Effect of Calcination and Sintering Temperatures on the Structural and Mechanical Properties of PVA–Hydroxyapatite Bioceramics Derived from Chicken and Duck Eggshells."** The preparation and writing of this thesis proposal could not have been accomplished properly without the assistance, support, and prayers of various parties.

The author wishes to express gratitude by thanking the people who helped in completing the preparation of this thesis:

1. To Mr. Prof. Dr. Ir. Akhmad Fauzi, M.MT., IPU as Rector of the Universitas Pembangunan Nasional "Veteran" Jawa Timur
2. To Prof. Dr. Dra. Jariyah, M.P., Dean of the Faculty of Engineering and Science, Universitas Pembangunan Nasional "Veteran" Jawa Timur.
3. To. Dr. Dira Ernawati, S.T., M.T., as coordinator of the Physics Study Program, Universitas Pembangunan Nasional "Veteran" Jawa Timur.
4. To. Dr. Nur Aini Fauziyah, S.Pd., M.Si., as Thesis Supervisor 1, as the author's intership supervisor and first thesis supervisor, the author would like to express sincere gratitude for the time, patience, attention, and valuable experience that she consistently provided despite her busy schedule. Every piece of advice, guidance, and motivation given by her has always been a source of encouragement for the author, not only during the process of writing this thesis but also as valuable preparation for entering the professional world and pursuing further studies.
5. To. Dr. Nailul Hasan, S.Si., M.Sc., as Thesis Supervisor 2, as the author's second thesis supervisor, the author would like to express sincere appreciation for the suggestions, time, and patience that he generously provided. Every piece of advice, direction, and knowledge shared by him has been highly beneficial to the author throughout the completion of this thesis.
6. To. Dr. Allif Rosyidy Hilmi, S.Si., M.Si, the author would like to express sincere gratitude for the guidance, assistance, and willingness to help during

the preparation of this thesis, especially when the author encountered difficulties in data processing and analysis.

7. To the author's beloved parents, the author would like to express heartfelt gratitude for their prayers nd unwavering support in completing this thesis. In particular, the author would like to extend the deepest appreciation to the author's mother for her endless prayers, care, affection, emotional and material support, as well as continuous motivation that enabled the author to complete this study with enthusiasm and determination. She has been the greatest source of strength and encouragement, inspiring the author to complete this academic journey successfully. Evert sacrifice, attention, and motivation given has become a source of strength for the author to complete this study ti the best of their ability.
8. To my siblings, the author would like to express sincere gratitude for the prayers, support, motivation, and advice that have encouraged the author throughout the completion of this study. Their support and encoyragement have become a great source of motivation during the thesis-writing process, enabling the author to complete this study with pride and gratitude.
9. To all my friends, the author would like to express sincere appreciation for the encouragement, support, enthusiasm, motivation, assistance, and friendship that they have provided throughout the author's academic journey and during the completion of this thesis.

The author realizes that there are still shortcomings in the preparation of this thesis proposal. Therefore, constructive suggestions and criticisms are highly appreciated. Finally, the author hopes that this thesis proposal will be beneficial for the author and all relevant parties, especially Physics students in general.

Surabaya, 8 April 2026

Ayunda Wulan Permatasari

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