SUPERABSORBENT POLYMER FROM CASSAVA (*Manihot esculenta*) PEELS FOR IMPROVING SOIL WATER RETENTION

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An Undergraduate Thesis Submitted to the Faculty of the Department of Agricultural and Biosystems Engineering, College of Engineering, Central Luzon State University, Science City of Muñoz, Nueva Ecija, Philippines
in Partial Fulfillment of the Requirements
for the Degree of

BACHELOR OF SCIENCE IN AGRICULTURAL AND BIOSYSTEMS ENGINEERING
(Major in AB Land and Water Resources Engineering)

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ACCEPTANCE SHEET

This undergraduate thesis entitled "**SUPERABSORBENT POLYMER FROM CASSAVA (*Manihot esculenta*) PEELS FOR IMPROVING SOIL WATER RETENTION,**" prepared and submitted by **PIA ANGELA T. ADVIENTO** and **ANGEL ZERAH M. MORENO**, in partial fulfillment of the requirements for the degree of **BACHELOR OF SCIENCE IN AGRICULTURAL AND BIOSYSTEMS ENGINEERING (AB LAND AND WATER RESOURCES ENGINEERING)**, is hereby accepted:

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BIOGRAPHICAL SKETCH

Pia Angela Tebrio Adviento was born on January 30, 2001, in Urdaneta City, Pangasinan and currently residing at Mangaldan, Pangasinan. She is the middle child among the seven children of Mr. Eduardo I. Adviento and Mrs. Virginia T. Adviento. She graduated as 7th honorable mention in her elementary education in year 2013 at Cayambanan Elementary School. She completed her Junior Highschool from Mangaldan National High School in year 2017. Continuing her educational journey at the same high school, she took up Science, Technology, Engineering, and Mathematics (STEM) academic strand for Senior High School level and graduated with honors in year 2019. She took up Bachelor of Science in Agricultural and Biosystems Engineering, Major in AB Land and Water Resources Engineering at Central Luzon State University.

Angel Zerah Mabitasan Moreno was born on December 21, 2000, in San Quintin, Pangasinan. She is the eldest among the three children of Mr. Albino L. Moreno and Mrs. Hilda M. Moreno. In 2007, she spent her elementary days at Teofilo C. Quintin Elementary School. She graduated in 2013 and had a fulfilling experience during her time at San Quintin National High School, where she acquired valuable knowledge and skills that led her to decide on STEM strand as her specialization in senior high school. She graduated with honors and received recognition as one of the best research awardees in 2019.

In 2019, she enrolled in higher education at Central Luzon State University. She pursued a Bachelor of Science in Agricultural and Biosystems Engineering to gain a deeper understanding of the agricultural business, and to effectively tackle challenges and concerns faced in the field of agriculture. Navigating the pandemic was a challenging

experience for her, but she persevered and is now approaching her last semester intending to graduate in February 2024. Residing in a region where agriculture serves as the primary means of livelihood, the researcher considers it an honor to pursue an agricultural-focused program at an institution renowned for its exceptional educational standards.

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The researchers, Ms. Adviento and Ms. Moreno, would like to extend their heartfelt appreciation to the individuals for their highly valued and duly recognized contribution in making their undergraduate thesis successful and possible:

First and foremost, they express heartfelt gratitude to the Almighty God, to whom He has provides the wisdom, strength, good health, firm commitment, and determination to perform and finish the thesis study.

To their research adviser, Dr. Carolyn Grace G. Somera, the researchers express heartfelt appreciation for the patience and guidance shown throughout the process of completing the thesis from the beginning to the end.

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Ms. Adviento would like to express her sincerest gratitude to her parents, Mrs. Virginia and Mr. Eduardo for providing unending support, guidance, and comfort since the beginning. The researcher also expresses her gratitude to her elder sister Joeverly for the additional financial and emotional support.

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Ms. Moreno would like to express her biggest appreciation to her parents, Mrs. Hilda and Mr. Albino, for unwavering support, providing finances and words of encouragement throughout the study.

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ABSTRACT

ADVIENTO, PIA ANGELA T., MORENO, ANGEL ZERAH M., Department of Agricultural and Biosystems Engineering, College of Engineering, Central Luzon State University, Science City of Munoz, Nueva Ecija, Philippines, JANUARY 2024, **SUPERABSORBENT POLYMER FROM CASSAVA *(Manihot esculenta)* PEELS FOR IMPROVING SOIL WATER RETENTION**

ADVISER: CAROLYN GRACE G. SOMERA, Ph.D.

In this study, Superabsorbent Polymers (SAPs) derived from cassava peels were explored as a potential solution to address water scarcity in agriculture. With SAPs capable of absorbing water up to fifteen times their dried weight, the study aimed to produce superabsorbent polymer and determine the optimum application rate through water absorbency and soil water retention test. The current investigation was undertaken to synthesize a starch-based SAP from agricultural and/or food residue, cassava peels. SAP was formulated by combining carboxymethyl cellulose sodium salt, aluminum sulfate with cassava peel starch that had been extracted. The water absorption capacity of SAP was evaluated using the tea bag test, and the optimal application rate was determined by conducting a soil water retention test with various proportions of SAP. Treatment 1 will have no SAP (0%), Treatment 2 contained 0.25% of SAP, Treatment 3 has 0.50% of SAP, and Treatment 4 has 0.75% of SAP. The result of water absorption capacity reveals that the highest percentage of swelling occurs after 24 hours, ranging from 2300% to 2550% demonstrating its effectiveness in soil water retention. In Treatment 4, the soil water retained involved the application of 0.75% of SAP, which exhibits superior soil water retention during both morning and afternoon observations. After 9 hours, the retained water in the soil decreases from 20–45% in the morning to 17–

41% in the afternoon, highlighting the impact of climatic factors on soil water depletion. Further, the cost of producing 1kg of superabsorbent polymer from cassava peels was estimated to be ₱1,903.86 which is less expensive, sustainable than the commercially available SAP. Overall, the study contributes valuable insights into the utilization of cassava-based SAPs as a feasible solution for improving water retention in soil, benefiting agricultural practices and environmental sustainability. The findings pave the way for practical applications of SAP in agriculture, particularly in regions prone to water scarcity, offering a cost-effective and environmentally friendly alternative to commercially available options.

Keywords: superabsorbent polymer; cassava peels; water absorbency; soil water retention

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