
FACULTY OF ENGINEERING

DEPARTMENT OF POLYMER, TEXTILE, AND INDUSTRIAL

ENGINEERING

**VALORISATION OF BANANA PSEUDO-STEM SAP INTO NUTRIENT-
ENRICHED FERTILIZER PELLETS.**

BY

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Abstract

The increasing reliance on synthetic fertilizers in agriculture has led to environmental degradation and soil fertility decline, necessitating sustainable alternatives. In this study, we developed a pelletized bio-fertilizer from banana pseudo-stem sap (*Musa* spp.) as an eco-friendly, nutrient-enriched alternative for agricultural applications. Banana pseudo-stem sap was extracted using a mechanical pressing method, characterized through Fourier Transform Infrared spectroscopy (FTIR) and Gas Chromatography-Mass Spectrometry (GC-MS) analysis, and enriched with nutrients through nutrient isolation and enhancement techniques. The sap was pelletized using extrusion-spheronisation with calcium bentonite clay as a binding agent at a 2:1 ratio (treated sap solution: calcium bentonite clay), and under X-ray fluorescence, the pelletized biofertilizer demonstrated favorable nutrient composition with 21.56% potassium, 17.56% nitrogen, and 14.76% phosphorus. The biofertilizer achieved a balance of 18-15-22 (N-P-K) through the use of a CNS elemental analyser and X-ray fluorescence. Physical characterization revealed optimal properties, including 10.5% moisture content, 22.17% water solubility, and 84.94% granules within the ideal size range (2.0-4.0 mm) and bulky density of 0.88 g/cm³. Early maize growth response trials on maize seedlings showed significant improvements compared to untreated controls: the pelletized fertilizer increased shoot length, dry weight, and chlorophyll content by 28%. The Tukey's HSD Post Hoc Test obtaining significant differences for diluted liquid sap treatment(T₂) and pellet fertiliser(T₃) compared with the control setup(T₁). This study demonstrates that banana pseudo-stem sap can be converted into an effective, user-friendly pellet bio-fertilizer that improves general plant growth and performance while providing sustainable waste management solutions. The pelletized formulation offers practical advantages in storage, transport, and application, making it a viable resource for sustainable crop production systems.