Junior Science Communications
Faculty of Applied Sciences, UiTM Shah Alam
https://journal.uitm.edu.my/ojs/index.php/JSC

E-ISSN 2637-0689
Vol 49 2025

Colloquium on Applied Sciences 1 2025
20-24 January 2025, Faculty of Applied Sciences, UiTM Shah Alam, Malaysia

Solid-state fermentation of *Elaeis Guineensis* Leaves Using *Rhizopus Oryzae* and *Aspergillus Niger*

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Structured Abstract

Background: This study investigates the potential of solid-state fermentation (SSF) to improve the nutritional quality of *Elaeis guineensis* (oil palm) leaves using *Rhizopus oryzae* and *Aspergillus niger*. The primary objective is to evaluate the impact of SSF on crude fiber (CF) reduction and crude protein (CP) enhancement, addressing the limitations that restrict oil palm leaves as a livestock feed despite their abundance as agricultural waste. Specifically, the study aims to ferment oil palm leaves using *A. niger* and *R. oryzae* at different moisture levels (10 mL, 20 mL, and 30 mL), Secondly, to determine the CF and CP content after fermentation, and lastly to compare the CF and CP levels before and after SSF. The research addresses the challenges of high crude fiber (CF) and low crude protein (CP) content in oil palm leaves, which limit their use as livestock feed despite being an abundant agricultural waste.

Methods: In this study, oil palm leaves were collected, cleaned, dried, and ground into powder form. The substrate was inoculated with *A. niger* and *R. oryzae* at varying moisture levels (10 mL, 20 mL, and 30 mL) and incubated at 30°C for five days. SSF products were then dried and analyzed for CF and CP content. The Dumas method was used for CP analysis, while CF was measured using the Wendee method.

Results: Each experiment was conducted in triplicate to ensure the reliability of the results. Results indicated that *A. niger* was more effective, reducing CF from 30.00% to 3.95% (86.83%) at 10 mL inoculum, while *R. oryzae* achieved a lower reduction to 5.95% (80.17%). CF reduction varied with inoculum volume, confirming *A. niger* as the superior fiber degrader. Minimal increases in CP were observed, with *A. niger* achieving a detectable rise (3.21%) only at a 10 mL inoculum volume, while *R. oryzae* showed no significant improvement in CP content.

Conclusion: SSF successfully improved the digestibility of oil palm leaves by reducing CF, demonstrating its potential as a sustainable method for agricultural waste valorization. However, protein enhancement was limited, indicating the need for further optimization, such as the use of mixed microbial cultures or nitrogen-rich additives.

Keywords: *Elaeis guineensis* leaves, *Rhizopus oryzae*, *Aspergillus niger*, Crude fiber, Crude protein

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