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Review

Valorization of Tropical Biomass Waste by Supercritical Fluid Extraction Technology

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Abstract: The inception of sustainable and cleaner extraction technology has paved the way for the innovative development of nonconventional extractions, such as supercritical fluid extraction, apart from conventional extraction counterparts. The concept of biomass waste-to-wealth for the conversion of biomass waste or by-products into value-added products for diversified applications had piqued the prominent interest of researchers and industry players, especially with the abundance of biomass resources readily available in tropical regions that have yet to be tapped into to reach their full potential. In this paper, a critical review of the developments of supercritical fluid technology from its initial inception up to commercialized scalability, including its limitations, extraction of potential tropical biomass wastes for various types of applications, such as biopesticides, bio-repellents, phenolics, and lipids for biofuel, and its role in circular bioeconomy and sustainable development approaches, are discussed in detail.

Keywords: biomass valorization; waste-to-wealth; supercritical fluid; supercritical fluid extraction; biomass; biopesticide; bio repellent; biofuel

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1. Introduction

The concept of biorefinery is homologous to the refining facilities derivable from fossil fuels as feedstocks. Instead, the biorefinery concept refers to a refinery facility that co-integrates itself with green and sustainable processes for biomass conversion to produce biofuels and value-added bioproducts from biomass sources [1]. An example of a scalable green technology that is becoming more practical by the day is supercritical fluid extraction (SFE) technology. In the increasing demand of the efficient separation and recovery of value-added biocompounds based on greener and cleaner extraction technologies, the concept of SFE technology was incepted in the early 1980s to substitute extractive solvents in conventional extraction processes such as maceration and Soxhlet extraction methods. Moving forward nearly 40 years later into the future, the maturity of SFE technology had grown tremendously with various applications ranging from hydrocarbon extraction from Marcellus shale [2] to selective recoveries of bioactive compounds from various plants, biomass wastes, and marine sources [3–5], as well as the selective removal of unwanted compounds such as the decaffeination of coffee and tea [6–8] found in food processing industries.