



## Characterization of bioactive compounds in patchouli oil using microwave-assisted and traditional hydrodistillation methods

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### ABSTRACT

This study addressed the need for improved methods for the extraction of bioactive compounds from patchouli oil, focusing on the characterization and comparison of microwave-assisted hydrodistillation (MAHD) and traditional hydrodistillation techniques. Traditional hydrodistillation methods for the extraction of essential oils are less efficient in terms of time and yield. This research aims to bridge the knowledge gap regarding extraction efficiency, duration, and chemical composition. This study aimed to directly compare microwave-assisted hydrodistillation and traditional hydrodistillation for the extraction of bioactive compounds from patchouli oil and to evaluate the efficacy, efficiency, and chemical composition of these methods. The study reviews Advanced analytical tools such as Gas Chromatography and Mass Spectrometry (GC-MS), Scanning Electron Microscopy (SEM), Fourier Transform Infrared Spectroscopy (FTIR), Liquid Chromatography Quadrupole Time-of-Flight Mass Spectrometry (LC-Q-TOF-MS), and Gas Chromatography-Mass Spectrometry (GCMS) have been used to analyze the chemical makeup of patchouli oil. The results indicate that microwave-assisted hydrodistillation may offer benefits over traditional hydrodistillation, including reduced extraction times and increased yields. Differences were noted in the chemical composition of patchouli oil obtained through MAHD, particularly in the prevalence of bioactive compounds, such as patchoulol,  $\alpha$ -bulnesene, and caryophyllene. This study explored the potential biological activities, stability, safety, and cost-effectiveness of MAHD compared to traditional methods. It also examines the implications of these findings for industries reliant on the quality of essential oils, such as pharmaceuticals, cosmetics, and perfumes. This study provides significant insights into the extraction of essential oils, supporting industrial innovation, and contributing to Sustainable Development Goals (SDGs) related to health, wellbeing, responsible production, and life on land. The differences in the chemical composition between MAHD and traditional methods could have substantial implications for the essential oils industry.

### 1. Introduction

Patchouli oil (PO) is widely used in aromatherapy and traditional medicine owing to its numerous therapeutic properties. However, its natural compounds have not been fully analyzed. Research has

suggested that pogostone is a crucial constituent of PO, which not only has a distinct aroma, but also contributes to its pharmaceutical benefits (Swamy and Sinniah, 2015). Studies have demonstrated that PO possesses therapeutic properties such as antidepressant, anti-inflammatory, antiseptic, aphrodisiac, and sedative effects. PO contains various

**Abbreviations:** EO, Essential oils; FTIR, Fourier transform infrared; HD, Hydrodistillation; IR, Infrared; LC, Liquid Chromatography; MAE, Microwave-aided extraction; MAHD, Microwave-Assisted Hydrodistillation; MHD, Microwave hydrodistillation; NMR, Nuclear Magnetic Resonance; PA, Patchouli alcohol; PO, Patchouli oil; PP, Patchouli plant; QTOF, Quadrupole Time-of-Flight; SDG, Sustainable Development Goals; SEM, Scanning electron microscopy; TOF, Time-of-flight.

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