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The Environmental Impact of the Pine Resin Essential Oil Extraction Methods and Its Qualitative and Quantitative Characteristics

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ABSTRACT

According to traditional Algerian medicine, pin resin is well known for its potent antiseptic properties and boosting effects. On the other hand, in traditional Chinese medicine, pin resin is used to treat skin conditions, burns and scratches, tracheitis, pulmonary tuberculosis, and as an effective antiseptic. The aims of this study is the extraction of volatile oil from pine resin using two extraction methods: microwave-assisted hydrodistillation (HDMO) and conventional hydrodistillation (HD) to study the effect of extraction technique on the chemical composition of the essential oil obtained, as well as the energy and environmental aspects of extraction. The best extraction yield is obtained by HD compared to HDMO. Chromatography coupled with mass spectrometry (GC-MS) showed a significant fluctuation in the qualitative and quantitative aromatic profile according to the extraction method used, in particular α-pinene (HDMO: 33.95% HD: 33.43%), ϱ-Cymene (7.01% HD: 6.317%), and Sabinene (8.55% HD: 8.207%).The environmental impact study showed that the energy consumed and the amount of carbon dioxide released into the atmosphere were significantly reduced (by 52.86%) with microwave-assisted hydrodistillation, attesting to the effectiveness of HDMO as accelerated green techniques.

Keywords :. essential oil, pine resin, hydrodistillation ,HDMO, environmental impact.

1. Introduction

Pine resin is a complex mixture of terpenes, consisting of a volatile part called turpentine and a non-volatile part called colophane [1]. It is mainly used as a solvent in pharmaceutical preparations, the perfume industry, the manufacture of synthetic pine oil, disinfectants, insecticides and denaturants[2]. This work is about a comparative analysis of the chemical composition of the essential oil of pin résine using two extraction methods: conventional hydrodistillation and hydrodistillation assisted by micro-onde and study their environmental impact.

2. Experimental

Pine resin volatile oil is extracted by conventional hydrodistillation (HD) and microwave-assisted hydrodistillation (HDMO), which is as a green technique. The extracted volatile oils are analyzed by gas chromatography coupled with mass spectroscopy (GC-MS) for both qualitative and quantitative identification of the two oils.

3. Results and Discussion

By using HDMO and HD, respectively, volatile oils were separated with 2.6% and 2.8% yields. The identification of 45 compounds was achieved using GC-MS analysis. The most abundant ones were: α-pinene (HDMO: 33.95% HD: 33.43%), ϱ-Cymene (7.01% HD: 6.317%), Sabinene (8.55% HD: 8.207%), and linalool (HDMO: 1.23% HD: 1.818%). The environmental impact research shown that the microwave-assisted hydrodistillation technique (HDMO) greatly reduced energy consumption and the amount of carbon dioxide released into the atmosphere (by 52.86%), indicating the efficacy of HDMO as accelerated green techniques.

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4. Conclusions

Based on the findings, it can be concluded that HDMO is a viable substitute for reducing carbon dioxide emissions into the atmosphere, saving energy and time during the extraction process, and producing high-quality essential oils.

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