

Optimization of citrus peels D-limonene extraction using solvent-free microwave green technology

Abstract

Attention is presently drawn to the development of a new and green alternative technique for the extraction of essential oil from citrus plant materials. This study was aimed at the extracting essential oil from orange and lemon peels using solvent-free microwave method. This process uses microwave-assisted hydro-diffusion technique to extract essential oil from citrus peels. Response surface methodology was used to investigate the effect of microwave power (200–1,000 W) and extraction time (10–40 min) on the essential oil yield. The oil extracted was characterized using Fourier transform infrared radiation (FTIR) and Gas chromatography–mass spectrometry analysis to determine the functional groups and chemical components present, respectively. The optimum yield of extract from orange and lemon peels were 3.7 and 2.0%, respectively at corresponding power of 1,000 W and time of 10 min. The analysis of variance results showed that the resulting models for both orange and lemon peels were significant and microwave power had greater influence on the extraction processes at both linear and quadratic levels. The FTIR analysis revealed prominent functional groups of alkenes that majorly constitute limonene compound at 1,642 and 1,643 cm^{-1} for orange and lemon peels, respectively. The present process permits fast and efficient extraction, avoids water and solvent consumption, and allows substantial energy savings.