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Authenticity of essential oils

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HIGHLIGHTS

- A comprehensive overview of known adulterations in essential oils
- Analytical methodology for detecting adulterations in essential oils
- Overview on fundamental principles and applications of analytical techniques
- Discussion and comparison of advantages and limitations of analytical techniques

ABSTRACT

Essential oils are natural materials widely used in many fields all over the world and have become an integral part of everyday life. There is increasing demand for essential oils, which has resulted in cases of adulteration. Authentication is thus a matter of critical importance for both consumers and chemical companies. This comprehensive overview covers known adulterations in essential oils, and some analytical methodologies adopted for their detection. We first list recommended tests, and then we explain and discuss common analytical techniques, such as chiral gas chromatography, isotope-ratio mass spectrometry, and nuclear magnetic resonance spectroscopy. We also present (high-performance) thin-layer chromatography, vibrational spectroscopy, coupled and multidimensional chromatography, high-performance liquid chromatography, and combination with chemometrics-metabolomics. This review provides a critical overview of existing techniques.

Keywords:

Analytical methodology
Adulteration
Authentication
Chiral gas chromatography
Detection
Essential oil
Isotope-ratio mass spectrometry
Natural extract
Nuclear magnetic resonance spectroscopy
Quality control

Abbreviations: AFNOR, Association Française de Normalisation; AED, Atomic emission detector; ANRT, Association Nationale de la Recherche et de la Technologie; BS, British Standard; DSC, Differential scanning calorimetry; EFSA, European Food Safety Authority; EO, Essential oil; FID, Flame-ionization detector; FTIR, Fourier-transform infrared spectroscopy; GC, Gas chromatography; HPTLC, High-performance thin-layer chromatography; IFRA, International Fragrance Association; IR, Infrared; IRMS, Isotope-ratio mass spectrometry; ISO, International Standard Organization; LC, Liquid chromatography; MDGC, Multidimensional gas chromatography; MS, Mass spectrometry; NIR, Near-infrared reflectance; NMR, Nuclear magnetic resonance; Ph. Eur., European Pharmacopoeia; PS, Photoacoustic spectroscopy; SFE, Supercritical fluid extraction; SNIF, Site-specific natural isotopic fractionation; TLC, Thin-layer chromatography; TOF, Time of flight; USP, United States Pharmacopoeia

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