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Review

Medicinal plants in the treatment of women's disorders: Analytical strategies to assure quality, safety and efficacy

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ABSTRACT

During last decades an increasing number of herbal products specifically targeting women's disorders has appeared in the worldwide marketplace. This growth highlights the need for a critical evaluation of quality, safety and efficacy of these products.

Analytical techniques applied to the quality control of the main medicinal plants used for women health (relief of menopause and menstrual related symptoms) have been reviewed. Thanks to the innovation in analytical technology, identification and detection of secondary metabolites dramatically improved. In particular, hyphenated techniques have proved to be the most suitable for the rapid identification of compounds in plant matrix. Moreover, taking into account that differences in sample quality are not only found in the main compounds or in the chemical markers but also in the low-concentration compounds, fingerprint analysis might be a simple way for identification and quality control of herbal products containing a large number of low amounts of unknown compounds. Furthermore in several papers the informations obtained from the analysis of a plant have been processed by statistical elaborations.

Medicinal plants here discussed are classified on the basis of the chemical markers used for their quality control.

Contents

Abbreviations: CE, capillary electrophoresis; DAD, diode array detector; ELSD, evaporative light scattering; ESI, electrospray ionization; FLD, fluorescence detector; GC–MS, gas chromatography–mass spectrometry; HPLC, high performance liquid chromatography; HPTLC, high performance thin layer chromatography; HR-MS, high resolution mass spectrometry; HSCC, high-speed countercurrent chromatography; HS-SPME, headspace-solid phase microextraction; IR, infrared spectroscopy; IT, ion trap; LC–MS, liquid chromatography mass spectrometry; MALDI, matrix assisted laser desorbition ionization; MS, mass spectrometry; NIR, near-infrared diffuse reflectance spectroscopy; PAD, photodiode array detection; PCA, principal component analysis; PLS-DA, partial least squares discriminant analysis; TLC, thin layer chromatography; ToF, time of flight; UPLC, ultra-performance liquid chromatography.

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1. Introduction

During last decades an increasing number of herbal products specifically targeting women in menopause and with menstrual affections has appeared in the worldwide marketplace. This growth highlights the need for a critical evaluation of quality, safety and efficacy of these products.

Ensuring that plant-based products are of suitable quality is important for several reasons. Herbs are natural products and, for this reason, they do not have a consistent, standardized composition [1].

Plants contain numerous chemical constituents and if we analyze different parts of the plant (e.g. roots, leaves), we certainly find a different qualitative and quantitative profile of constituents. The reason of this variability is that the content and concentration of constituents can be influenced by several factors including climate, growing conditions, time of harvesting, and post-harvesting factors, such as storage conditions (e.g. light, temperature, humidity) and processing (e.g. extraction and drying). The quality of plant raw materials can also be influenced by human adulterations due to dishonesty or unscrupulous operators. Errors could be accidental botanical substitution (misidentification of plant species) or intentional botanical substitution (deliberate exchange with other, sometimes more toxic, plant species). The variability in the content and concentrations of constituents of plant material, together with the range of extraction techniques and processing steps used by different manufacturers, results in marked variability in the quality of commercially available herbal products [1]. Thus quality control of herbal products is needed to ensure their consistency, safety, and efficacy.

The current approaches to the quality control of herbal products are either compound-oriented or pattern-oriented [2], the former targeting specific components with known chemical structures, the latter targeting all detectable components. Regarding this latter approach, fingerprint analysis is often accepted by regulatory authorities as a tool to identify herbal formulations and to assess their quality. A fingerprint is a characteristic profile or pattern which chemically represents the sample [3].