Green technologies applied to the analysis of plant volatiles

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Plant volatiles play a well-defined role in the plant's life cycle as important biosensor diagnostic of plant metabolism and changes, and also, quite often, an effective marker of other metabolites, including the non-volatile metabolites. Recently, Maffei and co-workers defined the *plant volatilome* "… as the complex blend of essential oils (EOs) and volatile organic compounds (VOCs) fed by different biosynthetic pathways and produced by plants, constitutively and/or after induction, as a defense strategy against biotic and abiotic stress" (1,2). Moreover, plant volatiles can be also responsible for plant's biological properties. The extended role played by the plant volatiles have greatly contributed to increase the interest in their study in particular by adopting methods and technologies able to monitor their variations through their detection, identification and a correct quantification. At the same time, the recent technological approaches are in agreement with the present guidelines aimed at reducing organic solvent consumption (3). In this way, one of the best known methods to isolate volatiles from a plant quantitatively is their distillation from fresh or dried plant material as its essential oil. (EO). However, EO is not always fully representative of what the plants produce, because a part of the plant volatiles can be dissolved in the residual distillation water together with their glucosidically-bound form, in particular when a hydrodistillation procedure has been adopted. This preliminary study aims to investigate exhaustively the volatile composition of two model plants peppermint aerial parts (*Mentha x piperita* L., Lamiaceae) and dried cloves (*Syzygium aromaticum* (L.) Merr. & L.M.Perry, Myrtaceae) considering the distribution of their main volatile components L-menthol and eugenol in the essential oils and in the residual distillation water together with their glucosidically-bound form and comparing their distributions in the original matrices. The adoption of high-concentration-capacity sample preparation techniques (SBSE, and HS-SPME and in-solution SPME) to run quali-quantitative analysis without sample manipulation and as an example of green technologies, in combination with GC-MS, allow to define that about 20 % of L-menthol and of eugenol remained in the residual distillation water. These results confirm that the combination of different methods to isolate the plant volatiles is a promising approach to investigate the volatile fraction of aromatic plants and, at the same time, the residual distillation water can be considered an interesting by-product in cosmetic, pharmaceutical and food fields. Future investigations will deal with to a better knowledge of the volatiles' composition in the residual and distilled waters deriving from industrial processes.

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