

两种椴树属植物香气化合物比较分析及加工过程中香气化合物的变化*

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摘 要:【目的】阐明欧洲小叶椴和南京椴花中香气化合物的种类及特征,揭示两种椴树属植物香气化合物的差异及分子基础,同时分析在 3 种干燥工艺后欧洲小叶椴和南京椴香气化合物的含量变化。【方法】以南京椴和欧洲小叶椴盛花期及不同干燥处理条件下的花做为研究对象,采用 HS-SPME-GC-MS 的方法对化合物进行定性及定量分析,基于正交偏最小二乘法判别模型(OPLS-DA)筛选样品间的差异代谢物,对差异代谢物进行 KEGG 注释并进行感官风味特征的注释。【结果】两种椴树属植物调查共鉴定 442 种化合物,种类最多的化合物为萜类化合物,最主要的香气的贡献化合物为杂化化合物;其中 76 种化合物被为椴树属最主要的特征香气化合物,其中 α/β 己酮, 2-异丁基-3-甲氧基吡嗪, (Z)-6-壬烯醛, 苯甲酸甲酯, (E)-2-己烯醛, 1-己醇, 2-噻吩甲硫醇, 对伞花烃, 呋喃酮和 (Z)-4-庚烯醛的香气贡献值最高;与南京椴相比,欧洲小叶椴花中的挥发性化合物的种类更多,且浓度更高,具有更明显香气;同时与新鲜样品相比,冻干处理对欧洲小叶椴和南京椴花中香气化合物具有更好的保存效果。【结论】本研究揭示椴树花产生香味的分子机制,为探索昆虫授粉奠定了理论基础,同时为椴树花茶和其他相关产品的开发和应用奠定了基础。

关键词: 欧洲小叶椴; 南京椴; 花香; 香气化合物; 加工方法

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Comparative analysis of floral aroma components of two *Tilia* species and dynamic changes of aroma substances under different processes

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Abstract:【Objective】This study aims to examine the various types and attributes of aroma compounds present in the flowers of *Tilia miqueliana* and *Tilia cordata*. It seeks to identify disparities and underlying molecular mechanisms of aroma compounds between the two *Tilia* species, as well as to assess alterations in aroma compound content following three distinct drying procedures applied to *T. miqueliana* and *T. cordata*. 【Method】It focused on examining the flowers of *T. miqueliana* and *T. cordata* under varying drying conditions at their peak flowering stages. Qualitative and quantitative analysis of compounds was conducted using the HS-SPME-GC-MS method. The orthogonal partial least squares discriminant model (OPLS-DA) was employed to identify differential metabolites between the samples. Differential metabolites were further annotated using KEGG annotation, and sensory flavor characteristics were also documented. 【Result】A total of 442 compounds were identified, with terpenoids being the most diverse and heterocyclic compounds being the primary contributors to aroma. Among

these, 76 compounds were identified as key contributors to the distinctive aroma of *Tilia*, including α/β -hexon, 2-isobutyl-3-methoxypyrazine, (Z)-6-nonenal, methyl benzoate, (E)-2-hexenal, 1-hexanol, 2-thiophenemethanethiol, p-cymene, furaneol, and (Z)-4-heptenal. The Tc samples displayed a higher concentration of volatile compounds compared to Tm, indicating a more pronounced aroma profile. **【Conclusion】** The current investigation lays a theoretical foundation for further revealing the molecular mechanisms underlying the production of fragrance in *Tilia* flowers and the exploration of insect pollination. Furthermore, it serves as the basis for the creation and use of *Tilia* flower tea and other related products.

Key words: *Tilia cordata*; *Tilia miqueliana*; floral aroma; aroma substances; process methods