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Short communication

Analysis of volatile compounds responsible for kiwifruit aroma by desiccated headspace gas chromatography–mass spectrometry

Chun-Yun Zhang[a,b], Qiong Zhang[a], Cai-Hong Zhong[a], Ming-Quan Guo[a,b,*]

[a] Key Laboratory of Plant Germplasm Enhancement and Specialty Agriculture, Wuhan Botanical Garden, Chinese Academy of Sciences, Wuhan 430074, China
[b] Sino-African Joint Research Center, Chinese Academy of Sciences, Wuhan 430074, China

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ABSTRACT

A new method for desiccated headspace (DHS) sampling of aqueous sample to GC–MS for the analysis of volatile compounds responsible for kiwifruit aroma in different kiwifruit cultivars has been developed based on the complete hydrate formation between the sample solvent (water) with anhydrous salt (calcium chloride) at an elevated temperature (above the boiling point of the aqueous sample) in a non-contact format, which overcame the water-effect challenge to directly introduce aqueous sample into GC–MS analysis. By means of DHS, the volatile compounds in three different kiwifruit cultivars were analyzed and compared under the optimized operating conditions, mainly time and temperature for headspace equilibration, column temperature program for GC–MS measurement. As a result, 20 peaks of volatile compounds responsible for kiwifruit aroma were detected and remarkable differences were found in the relative contents of three major volatile compounds among the three different kiwifruit cultivars, i.e., acetaldehyde, ethanol and furfural. The DHS sampling technique used in the present method can make the GC–MS analysis of volatile compounds in the aqueous sample within complex matrix possible without contaminating the GC–MS instrument. In terms of the analysis of volatile compounds in kiwifruit, the present method enabled a direct measurement on the filtrate of the aqueous kiwifruit pulp, without intermediate trap phase for the extraction of analytes, which will be more reliable and simpler as compared with any other headspace method in use. Thus, DHS coupled with GC–MS will be a new valuable tool available for the kiwifruit related research and organoleptic quality control.

1. Introduction

Kiwifruit (*Actinidia chinensis*) is one of the most valuable fruit crops that is native to China and now gaining international commercial importance [1]. It is widely appreciated by consumers for its flavor and nutritional qualities, e.g., high levels of vitamin C and health-promoting effects [2,3]. Together with sweetness and acidity, kiwifruit aroma is one of the crucial factors that contribute to the kiwifruit flavor, which is the result of a subtle mixture of volatile compounds [4]. Therefore, techniques that can efficiently and effectively analyze these volatile compounds of kiwifruit will be of great importance for the explanation of the fruit aroma and the breeding of new kiwifruit cultivars with better organoleptic quality.

Recently, more and more consumers have paid more attention to organoleptic quality of kiwifruit, even a growing percentage of consumers are willing to pay a premium for kiwifruit cultivars with higher organoleptic quality. Nowadays, with an increasing demand for kiwifruit around the world, the determination of the organoleptic quality of kiwifruit is becoming highly important. Since the organoleptic quality of kiwifruit is often ascribed to its volatile aroma components, many methods have been developed for the analysis of the aroma compounds in kiwifruit to date. Because of the ability of simultaneously separating and identifying multiple volatile components, GC–MS was commonly used for the analysis of aroma compounds in kiwifruit [5]. However, prior to GC–MS measurement, it is mandatory to isolate the volatile species from the complex sample matrix. Those techniques commonly used for the isolation of volatile compounds, including solvent extraction [6], distillation [7,8], static or dynamic headspace (SH or DH) [9,10] and solid phase micro-extraction (SPME) [11], were typically based on the volatility or solubility of the volatile compounds. In more details, solvent extraction and distillation were aiming at

* Corresponding author at: Key Laboratory of Plant Germplasm Enhancement and Specialty Agriculture, Wuhan Botanical Garden, Chinese Academy of Sciences, Wuhan 430074, China. Fax: +86 27 87518018.
E-mail address: guomq@wbgcas.cn (M.-Q. Guo).

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