AARHUS UNIVERSITY

VOLATILE **PROFILING** OF HOT WATER DIPPED **APPLES**

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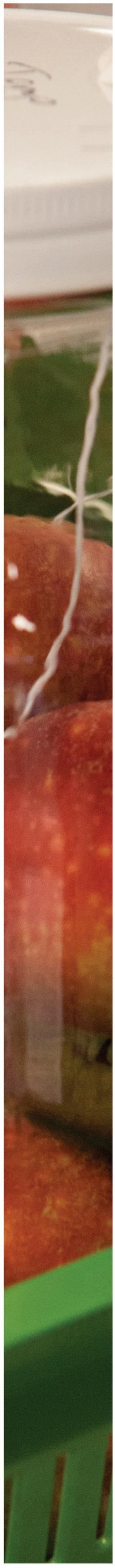


Introduction

Hot water dipping (HWD) has been proven successful to reduce storage rot in apples. However, excessive heat during dipping easily induces heat stress and physiological disorders which first show up after several weeks in cold storage (Fig. 1). A method for early detection of physiological disorders is desirable to further develop the technology for HWD of apples. Apples emit volatile organic compounds (VOCs) during ripening which may be used as indicators for heat stress in HWD apples.
The aim was to develop an analytical method for VOC profiling of apples dipped in hot water for future use in early detection of physiological disorders in apples.

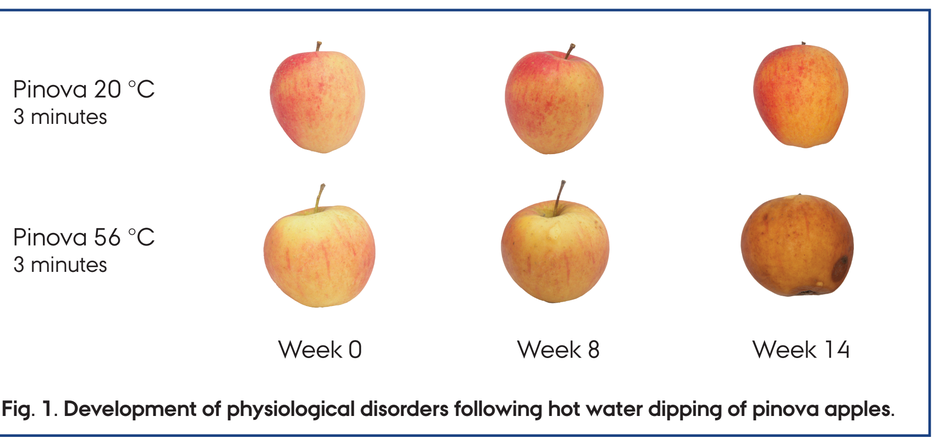


Fig. 1. Development of physiological disorders following hot water dipping of pinova apples.

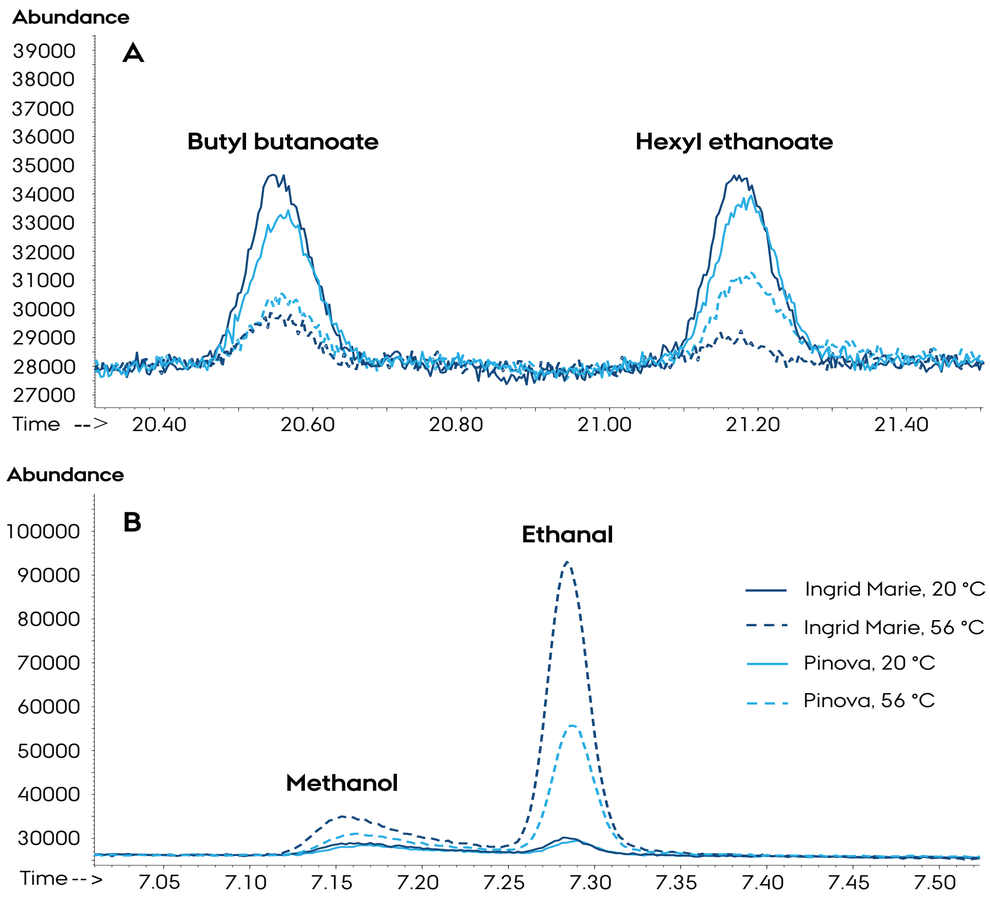


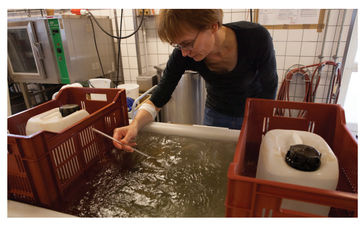
Fig. 2. Volatile organic compounds found in the static headspace samples. A. Butyl butanoate and hexyl ethanoate. B. Methanol and ethanal.

Material and Methods

Apples of cultivars Ingrid Marie and Pinova were dipped in water at 20 °C and 56 °C for 3 minutes and subsequently dried 20 min in ventilated air. For VOC analysis, apples were taken directly after drying. Physiological disorders were evaluated on apples stored at 2 °C for 8 and 14 weeks .

VOC analysis. Apples were placed in airtight jars and left for 2 hours at 20 °C before VOCs were sampled by solid-phase micro-extraction and static headspace sampling.

VOCs from solid-phase micro-extraction were analyzed on a gas chromatograph coupled to a mass spectrometer operating in total ion current mode and to a flame ionization detector. From the results, a selected ion monitoring (SIM) program was made. Using this program, VOCs from the static headspace samples were analyzed.



Results/Discussion

Treatment with 56 °C water for 3 minutes resulted in physiological disorders in all apples (Fig. 1) while no disorders were seen in apples treated with 20 °C water (Fig. 1).

A total of 54 compounds were found using solid-phase micro-extraction of which all were incorporated into the SIM program. Using the SIM program 27 VOCs representing 9 chemical groups could be detected in the static headspace samples including ethylene which was detected by the flame ionization detector. There were marked differences in the VOC profiles of the cultivars and between treatments. Butyl butanoate and hexyl ethanoate were produced in larger quantities at 20 °C than at 56 °C (Fig. 2A). The opposite was seen for methanol and ethanal which were produced in larger quantities after HWD at 56 °C (Fig. 2B).

Conclusions

The developed method allowed for volatile profiling of apples treated with hot water. Several compounds seem to be associated with hot water dipping at a damaging temperature thus indicating that volatile profiling could be used for early detection of physiological disorders of hot water dipped apples.

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