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Effect of acetic acid vapour on sensory quality of strawberries

During recent years it has been shown that postharvest treatment with gaseous acetic acid (AA) was effective in suppressing fungal decay on various fruits. Also an AA treatment of strawberries was successful in suppressing gray mould, caused by *Botrytis cinerea*. Guaranteeing the quality of the fruit is a prerequisite for the application of AA as a sanitizer. The aim of the study was to evaluate if the AA treatment affects the odour and taste of strawberries. Sensory tests showed a pronounced influence on odour. Without further improvement AA treatment is not reasonable for practical use.

Keywords

Strawberries, acetic acid, odour, taste

Abstract

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■ Strawberries are one of the most popular fruits. However, they are extremely perishable and very susceptible to fungal decay. The estimated losses at the wholesale, retail and consumers are in the range of 28 to 41% [1].

Gray mould, caused by *B. cinerea*, is the main reason for postharvest decay (**figure 1**). Noteworthy, the infection with *B. cinerea* occurs in the field during early growth stages, partially during bloom [2; 3].

To reduce the growth of *B. cinerea* fungicidal sprays during the flowering season were applied in the past, but several strains of *B. cinerea* have developed resistance to these fungicides [4; 5]. Therefore, the development of alternative methods for reduction of produce losses due to by *B. cinerea* is requested.

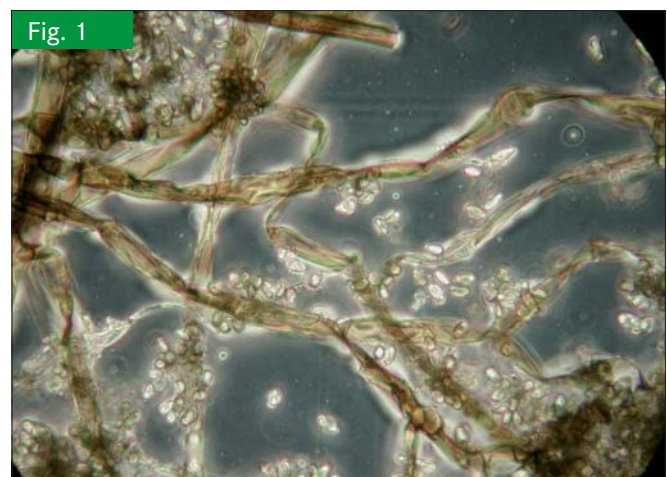
In recent years, a couple of investigations have shown that treatment of several fresh produce, such as peaches, apples, apricots, pears and plums with AA vapour effectively suppressed fungal decay [6-10]. Moreover, AA treatment has been successfully applied to reduce *B. cinerea* on strawberries [11]. The application of AA is harmless, AA is occurring in plants and animals and it is commonly used by food manufacturers as antimicrobial preservative or acidulant in a variety of food product [12].

An important requirement for the application as a sanitizer is the guarantee of the produce quality, including taste and odour. Therefore, the objective of this study was to determine if AA vapour treatment affects odour and taste of strawberries. For this panel tests were arranged to evaluate the sensory quality of fruit after AA vapour treatment.

Materials and methods

For all experiments, „Pegasus“ strawberries were purchased from local farmers directly after harvest. Immediately after purchase the strawberries were used for experiments.

Before panel tests the fruit were fumigated with AA (100%, Carl Roth GmbH & Co., Germany, $c = 2$ and $4 \text{ mg} \cdot \text{l}^{-1}$) in a closed



LM micrograph of *Botrytis cinerea*. Photos: ATB

perspex box ($V = 22.4$ l) at room temperature and high humidity for 30 min. The strawberries were placed in the chamber and AA was injected via a syringe onto a filter paper through a port in the lid. After the injection an axial blower (XD 8025 HS, XINDA Electric CO., LTD., China), installed under the filter paper, was turned on (**figure 2**). After treatment the strawberries were taken out of the chamber and packed in plastic punnets (500 g capacity), which were commonly used for strawberry sale (**figure 3**).

Five variants were examined:

- untreated control stored in an open box,
- two AA fumigated variants (2 or 4 mg • l⁻¹ AA) stored in an open box and
- two AA fumigated variants (2 or 4 mg • l⁻¹ AA) stored in a box wrapped with a perforated foil.

The first test was arranged 2 h after treatment. 10 strawberries of each variant were placed on a plate for aroma test and 6 to 9 strawberries were placed in a plastic punnet with a lid for odour test. The sensory panel test was performed with 8 panellists (4 female, 4 male, mean age 40.3 ± 13.8 , employees of the institute).

First the subjects randomly tested the taste of the fruit indicating the presence or absence of acetic acid flavour. Panellists were asked to rinse their mouth with water between samples. Second, panellists lifted the lids of the punnets and sniffed the samples in random order indicating the presence or absence of acetic acid odour.

After the test, the punnets with the fruit were kept in a cool chamber over night (2 °C, 95% RH) and a second test was arranged 26 h after treatment following the same procedure as the first test.

Results

The AA treated strawberries revealed no significant differences in taste independent of the AA concentration applied and the packing method used.

In fruit stored in open boxes the odour of strawberries was not affected by the treatment up to an AA concentration of 2 mg • l⁻¹. When the strawberries were treated with 4 mg • l⁻¹ AA a significant change of odour was observed. Half of the panellists identified an odour change after 2 h of storage while 37.5% of panellists noticed this only after 26 h.

When strawberries were stored (2 h) in boxes wrapped with perforated foil an AA concentration of 2 mg • l⁻¹ resulted in a significant change of odour as recognized by 75% of subjects. The increase in AA concentration to 4 mg • l⁻¹ increased the olfactory perception to 87.5% of panellists.

The following 24 h storage did not result in a significant decrease in AA odour (**table 1**).

Conclusions

The high losses of strawberries caused by microorganisms resulted in high financial penalties for producers and in a high dissatisfaction of consumer. The growth of *B. cinerea* can be clearly suppressed by storage at low temperatures between 0 and 2 °C but pathogens rapidly develop upon removal of the fruit to shelf-life conditions [13; 14].

Because several strains of *B. cinerea* developed resistance against fungicides during recent years, the development of alternative methods is of great interest.

AA vapour fumigation may successfully inhibit the growth of *B. cinerea* on strawberries but a complete suppression of gray mould is not possible.

For an industrial application the guarantee of fruit quality including odour and taste is a prerequisite. The presented study demonstrates that AA vapour treatment results in a changed odour, depending on AA concentration and packing applied. Therefore, the AA vapour treatment used in the described way is not qualified for strawberry sanitation.

If the off-odour development can be successfully eliminated, possibly by forced convection, the application of AA vapour can help to minimize produce losses during postharvest.

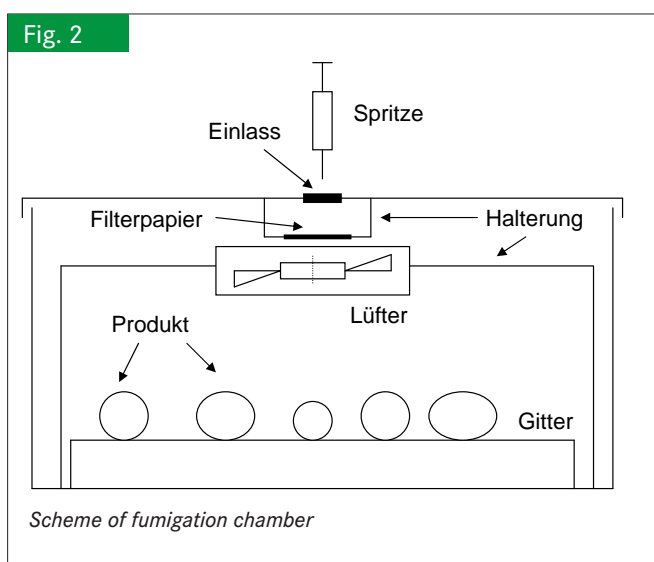


Table 1

Panel evaluation of strawberry taste and odour after AA vapour treatment

c(AA) [mg l ⁻¹]	packing method	aroma test				odour test			
		time after treatment [h]							
		2		26		2		26	
evaluation [%]									
		regular	modified	regular	modified	regular	modified	regular	modified
-	open box	87.5	12.5	75	25	87.5	12.5	87.5	12.5
-	open box	62.5	37.5	75	25	62.5	37.5	87.5	12.5
2	open box	87.5	12.5	87.5	12.5	100	-	75	25
4	open box	100	-	75	25	50	50	62.5	37.5
2	wrapped box	87.5	12.5	87.5	12.5	25	75	75	25
4	wrapped box	62.5	37.5	75	25	12.5	87.5	12.5	87.5

Literature Books are signed with ●

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