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Evaluierung der flüchtigen Komponenten und der sensorischen Eigenschaften von verschiedenen Papaya (*Carica papaya* L.) Genotypen aus Costa Rica

Diplomarbeit

im Studiengang Lebensmitteltechnologie

vorgelegt von
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Evaluation of volatiles and sensory characteristics of different Costa Rican papaya (*Carica papaya* L.) genotypes.

Summary

Global use of papaya (Carica papaya L.) is mostly limited to fresh consumption of a few varieties, since off-flavor formation during processing results in low consumer acceptance of most papaya products. Therefore, a main objective of the thesis presented was the evaluation of sensory and aroma relevant traits of five different Costa Rican papaya genotypes regarding their suitability for fresh consumption and puree processing. Moreover, the influence of several processing parameters on flavor composition was studied in order to elucidate the causes of off-flavor formation. First, wide morphological variations were found among the four red-fleshed genotypes (Pococí, Industrial 10G, LM13 and Solo cv. Sunrise) and the yellow-fleshed genotype (Sinta). For instance, the small, round shaped fruits of the genotype Solo cv. Sunrise had a weight of 1675 ± 202 g, while the large, egg-shaped fruit of the genotype Industrial 10G reached a weight of 3650 ± 181 g.

In sensory trials, the fruits of the genotype Solo cv. Sunrise were significantly ($p > 0.05$) assessed as the sweetest genotype, whereas least sweetness was identified for the genotype Pococí. In accordance, highest amounts of D-glucose, D-fructose, sucrose (12.7 g/100 g fresh weight (FW)) and soluble solids (14.8 °Brix) were found in fruits of the genotype Solo cv. Sunrise. D-glucose concentrations dominated all five genotypes (3.7 ± 0.7 to 6.3 ± 0.5 g/100 g FW), whereas D-fructose contents varied from 2 1 ± 0.2 to 5.8 ± 0.6 g/100 g FW. Despite thermal inactivation of invertase, relatively low sucrose levels were found (0.6 to 1.1 g/100 g FW). While the studied fruits showed only marginal differences of titratable acids, significant variations of the mostly dominating citric acid were determined (66-176 mg/100g FW). Unexpectedly, malic acid was the main acid of fruits of the genotype Pococí (23 mg/100 g FW). Puree from fruits of the genotype Solo cv. Sunrise achieved best preference in sensory trials, possibly due to a favorable sugar-acid ratio (from 23.8 to 31.8).

Peel and flesh firmness of the fruits of the genotype Solo cv. Sunrise were comparatively low (5.26 N and 0.36 N), whereas the genotype Pococí displayed higher peel and flesh firmness (7.62 N and 1.33 N). Thus, fruits of the genotype

Pococí should reveal better suitability for exportation by enhanced mechanical stability, which finally might reduce post-harvest losses. However, the soft fruits of the genotype Solo cv. Sunrise favorably showed the most intensive red flesh coloring as determined by sensory trials and objective CIE-L*a*b*-color values.

Furthermore, characterization of the aroma profile of the different papaya genotypes was accomplished by using headspace solid phase micro extraction (HS-SPME) and simultaneous distillation and extraction (SDE) and subsequent GC/MS analysis. The preliminary optimization of the HS-SPME method led to the use of a PDMS/DVB fibre, an adsorption time of 60 minutes and to an optimum temperature of 22℃.

The characteristic flavor profile of the Solo cv. Sunrise was characterized by the smallest number of flavor components (18). The genotype LM13 reached by far the highest concentration of methyl butanoate (5.96 µg/g FW), a typical papaya flavor impact component with a very fruity smell. Moreover, the genotype LM13 showed an outstanding low content of linalool (0.04 µg/g FW). The flavor profile of the fruits of the genotype Pococí was characterized by the greatest diversity of 33 identified flavor components and highest concentrations of the spicy and pungent benzyl isothiocyanate were present (0.07 µg/g FW). The flavor profile of the yellow-fleshed hybrid Sinta was characterized by the presence of ethyl butanoate (8.19% total peak area), which did not occur in the other four genotypes investigated.

Using the HS-SPME method, highly volatile aroma components like e.g. methyl butanoate were found. In contrast, low-volatile aroma components such as Farnesol could only be identified by the SDE method, due to the used water steam distillation and the direct injection of the sample into the GC/MS system. Astonishingly, some highly volatile compounds such as methyl butanoate could not be detected by application of the SDE. However, the number of identified substances by SDE (42 compounds) is considerably larger in comparison to the HS-SPME method (26 compounds). The thermal load during the SDE sample preparation raises the question of whether certain compounds like e.g. 5-methylfurfural were originally present in the sample or were generated during the analytical procedure.

The processing of the fresh fruit into puree resulted in a significant decrease of the main components of methyl butanoate (from 67.5 to 98.0%), linalool (from 33.0 to 94.4%), benzyl isothiocyanate (of 100%), particularly when using fruits of the genotype Pococí, which therefore was not recommended for thermal processing.

Investigating the causes of the strong aroma changes during papaya processing, the factors temperature, heating time and dosage of citric acid was investigated by using a statistical experimental design. Unexpectedly, the dosage of citric acid had a massive influence on flavor impact components masking the effects of temperature and heating time. This finding leads to a fundamental dilemma of papaya processing. Since the native pH of papayas is relatively high (pH 5.5), an acidification is a prerequisite for puree pasteurization in order to achieve microbial product safety. At the same time, the dosage of citric acid and subsequent heating leads to an enormous loss of aroma compounds and off-flavor formation. Future research should aim at a possible solution of this problem, such as flavor separation before heating as to date applied e.g. in juice or puree concentrate production.

In summary, this thesis provides a sensory and analytical characterization of different papaya genotypes and derived purees, particularly using different aroma analysis methods (SDE, HS-SPME). Furthermore, this work contributes to the elucidation of the causes of flavor changes occurring during papaya processing.

URL: http://troz.uni-hohenheim.de/msc-diploma-iiii.html

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