Spinach: We like it healthy and tasty
A new approach

Christine Brugger[a], Daniel Baumgartner[a], David Drissner[a], Stefan Boguslawski[b], Dietrich Knorr[b]
[a]Agroscope Changins-Waedenswil ACW, Food microbiology, analytics and sensory science, Schloss, 8820 Waedenswil
[b] Technische Universität Berlin, Department of Food Biotechnology, Koenigin-Luise-Str. 22, D-14195 Berlin
Contact: christine.brugger@acw.admin.ch

Introduction

Aroma, taste and color are key quality factors of processed fruit and vegetables and of major influence to consumer acceptance. In vegetables, spinach is one of the sensitive products where conventional processing reduces not only product-specific, pleasant flavor compounds, but increases unpleasant off-flavor compounds like fishy and hay-like characteristics. The study focuses on sensory evaluation of spinach juice treated with high hydrostatic pressure.

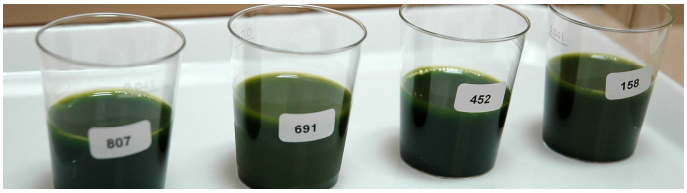

Figure 1: Spinach juice samples (from left to right: untreated, 600 MPa, untreated control, 360 MPa) for sensory evaluation at T3

Method

Spinach juice samples were treated with 360 MPa and 600 MPa (20℃/10min), respectively. The reference sample was untreated (0.1 MPa). A trained sensory panel (n=12) evaluated the samples using 11 aroma and taste attributes. All samples were presented at 20℃. Additionally, an electronic nose - SMartNose® - was used which is based on mass spectroscopy. Samples were incubated for 20min at 37℃. Principal Component Analysis was performed of the 15 highest significant masses after data normalization with m/z = 40 (Ar) and standardization with a spinach puree mixture. Measurements were spanned along 28 days (T0 – T4) and evaluated weekly, keeping the treated juice under standard conditions (4℃) and the untreated control sample at -18℃.

Results & Discussion

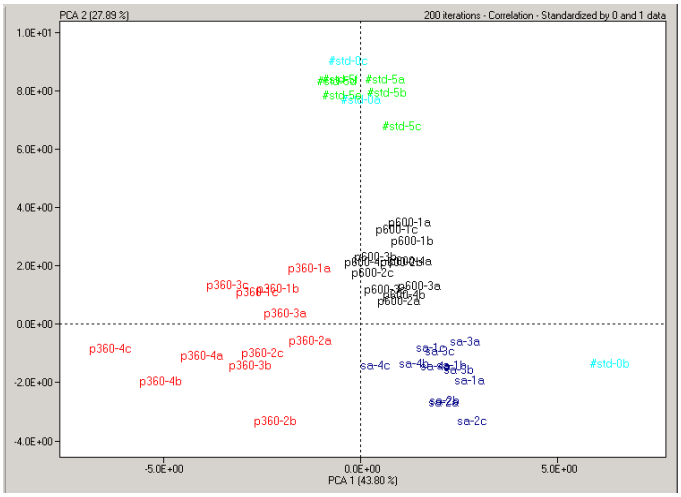

Figure 2: SMartNose® groupings of the 2 treated (p360, p600) and the untreated sample (sa) over 4 weeks measurement

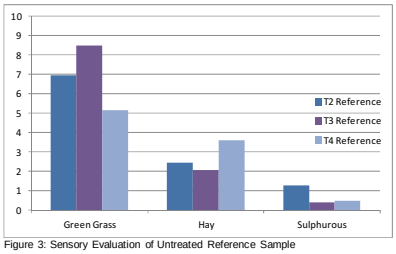

Figure 3: Sensory Evaluation of Untreated Reference Sample

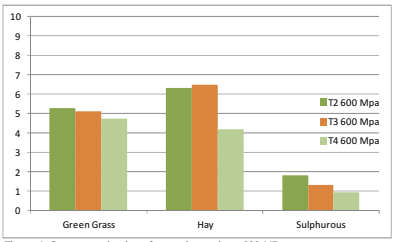

Figure 4: Sensory evaluation of treated sample at 600 MPa

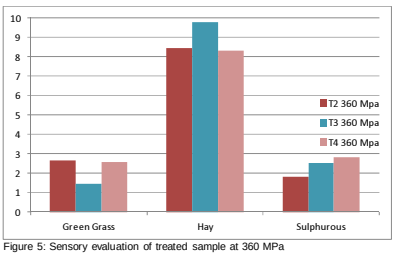

Figure 5: Sensory evaluation of treated sample at 360 MPa

The reference sample is significantly less hay-like ($p<0.05$) than samples with 360 and 600 MPa treatments across measurements. Sulphury compounds were perceived only over time and differentiated ($p<0.05$) the reference from the 360 MPa sample at T4 ($d=28$).

Green-grass flavour was significantly lower in 360 MPa compared to the other samples and over time. Bitterness, sweetness and astringency were not perceived different ($p<0.05$) across treatments and time.

Spinach samples differed also according to varying treatments based on significant masses (see Figure 2). However, the 600 MPa sample had much less variation over the 4 week measurements time span in comparison to the sample treated with 360 MPa. Analysing only the 360 MPa samples an increasing signal of mass 64 could be observed from T1 to T4. This signal can potentially be attributed to SO_2 as an indicator of sulphurous compounds present in the sample. This would be in agreement with the results from sensory analysis showing the increase in sensory perception of the sulphurous flavour at measurement T4. Green colour did change only slightly over the treatments and time span from T1 to T4.

Conclusion

High pressure treatment with 600 MPa seems to provoke less change during processing as compared to the 360 MPa treated sample. Positive sensory attributes like green-grass were higher, negative sensory attributes like hay and sulphurous notes were lower in intensity than in the 360 MPa sample.
The electronic nose shows also less variation in overall aroma over the measured time span of 4 weeks with 600 MPa treatment. This suggests further investigations also in combination with conventional processing methods.

In collaboration with

Technische Universität Berlin

Schweizerische Eidgenossenschaft
Confédération suisse
Confederazione Svizzera
Confederaziun svizra

Swiss Confederation

Federal Department of Economic Affairs FDEA
Agroscope Changins-Wädenswil
Research Station ACW

Agroscope