Coffee Flavour Modulation – Favouring the Formation of Key Odorants Upon Roasting

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INTRODUCTION

The formation of important coffee aroma compounds has been extensively studied in model systems under dry heating conditions [1-3]. This has recently been extended to undesirable compounds such as furan [4]. However, the conclusions from results of model systems have to be taken with care and cannot simply be extrapolated to complex food products. Milo et al. [5] developed the so-called biomimetic in-bean experiment in order to study the importance of precursors for the formation of key aroma compounds during coffee roasting under real conditions. Said methodology is a potential tool when it comes to studying the modulation of coffee flavour.

Objective and Approach

Our study aimed at modulating coffee flavour based on the chemical understanding of formation pathways of characteristic impact aroma compounds such as 2-furfurylthiol (FFT) and diketones. In parallel, furan was monitored in order to identify strategies for its mitigation.

A combination of biomimetic in-bean experiments and spiking of green coffee with precursors was implemented. Biomimetic recombination of exhausted beans was based on analytical evaluation of the water extractable composition (Biomimetic recombined extract, BRE).

RESULTS & CONCLUSIONS

Model System

2-Furfurylthiol (FFT)

- FFT has been shown to be formed in arabino/cysteine model systems via 3-deoxyxystrose (3-Done) and furfural while maintaining the intact carbon chain [1].
- Grosh [2] provided evidence for arabinoxylans being the precursor of FFT by isolating the polysaccharide from green coffee and roasting it in the presence of cysteine.
- Milo et al. [5] stated that FFT derives from water non-extractable precursors as increased FFT amounts were found in water-extracted exhausted beans.

Diketones

- Precursors and key intermediates of 2,3-butanedione and 2,3-pentanedione (according to Schieberle et al. 2003 and Yaylayan et al. 1999).
- Diketones are formed from mono-, di- and oligosaccharides by Maillard-type reactions [8] under involvement of amino acids like glycine and alanine.
- Schieberle et al. [7] found in CAMOLA experiments that the recombination of C3 and C2 intermediates is the predominant pathway in 2,3-butanedione formation.
- Milo et al. [5] showed decreased amounts of α-diketones in water-extracted exhausted beans.

Furan

- Major pathway of furan from arabinoce is proceeds via 3-deoxyxystrose and furfural as key intermediates [4].
- CAMOLA experiments revealed that furan from hexoses is mainly derived from the intact C3-C4-C5-D6 moiety of the sugar (i.e. glucose) [4].

Conclusions

☑️ The results of the biomimetic in-bean experiments emphasize the potential of this methodology for the verification of proposed formation pathways in complex food systems like coffee and the evaluation of opportunities for aroma modulation.
☑️ A potential avenue for aroma modulation could be to increase both cysteine and alanine as well as decrease furan while mitigating the amount of furan.
☑️ However, mitigation of furan seems to be limited as both key aroma compounds and furan are formed from common precursors.

REFERENCES