EFFECT OF SMOKE GENERATION ON PROFILE OF AROMA-ACTIVE COMPOUNDS IN BEECHWOOD SMOKE

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I. INTRODUCTION

Smoking food is a process with a long tradition [1]. The smoke generation, in particular the traditional smouldering smoke itself, is still not fully controllable. Even in modern industrial smoking facilities, some parameters that affect smoke composition, such as smoke generation temperature, cannot be measured or precisely adjusted [2]. In this study, the status quo is presented without the possibility to control and adjust these parameters, which would, however, enable smoking under optimal conditions. Thus, the aroma-active fraction could be tailored to the product. The study deals with the effects of different smoke generation types (smoulder and friction smokes) and generation temperatures on the composition of beechwood smoke. The aim was to test the hypothesis, of whether the smoke generation method and temperature have a decisive influence on the profile of the aroma-active compounds in beechwood smoke.

II. MATERIALS AND METHODS

Smoulder and friction smoke generators were used to generate beechwood smoke. Smoke samples were taken from the smoke generation zone and the smoking chamber. The temperature in the smoulder zone of the smoulder smoke generator was measured. The smoke samples were analysed for 10 known aroma-active compounds (eugenol, syringol, *trans*-isoeugenol, *p*-cresol, *o*-cresol, 4-ethylguaiacol, phenol, 4-methylguaiacol, guaiacol and cyclotene) by HS-SPME-GC/MS (Table 1) [2].

Table 1. Specification of GC/MS conditions

Material	Specification
GC / Autosampler	7809B GC, Agilent Technologies (Waldbronn, Germany), MPS robotic (Gerstel, Germany)
Column	DB-WAXms, 30 m x 0.25 mm x 0.25 µm, Agilent Technologies
Extraction	CAR/PDMS/DVB fiber $T_{incubation}$: 60 °C, $t_{incubation}$ 30 min, $T_{extraction}$ 10 min
Desorption	1:10 (Friction and smoulder smoke), 250 °C, 1 min
Detection	5977B MS-Detector, scan (*m/z*) = 33 - 330, $T_{ionsource}$ 230 °C, T_{MS} 150 °C
Carrier gas / Flow rate	Helium / 1.62 mL/min
Temperature program	40 °C (3 min), 5 °C/min to 240 °C (3 min)

III. RESULTS AND DISCUSSION

The temperatures in the smoulder smoke generator differed in a wide range. It was not possible to set constant and narrow smoke generation temperature ranges in the smoulder generator (380 - 860 °C). However, differences in smoke composition and trends regarding changes in aroma profiles at different smoulder smoke generation temperatures could be observed (Fig. 1). Higher smoke generation temperatures increase the formation of the compounds shown in Fig. 1 A and reduce the formation of some compounds in Fig.1 B. It is also notable that 560 °C is a temperature which highly favours the formation of cyclotene, guaiacol *o*- and *p*-cresol. High percentages of syringol were found at all temperatures. Fig. 2 shows the changes in smoke composition between smoke generation zone and smoking chamber, and the differences between smoulder (approximately 550 °C) and friction smoke (approximately 400 °C). For both smoke generator types syringol is the most abundant aroma compound and its proportion decreases from generator to chamber. The other aroma-active

compounds vary dependent on the smoke generator. There is no pattern recognizable which indicates a tendency proportional changes of the compounds from generator to chamber. The formation of the aroma compounds and the resulting changes from generator to chamber are dependent on the smoke generator type. The aroma profile of smoke is influenced by the smoke generation temperature [2]. Friction smoke generation leads to a different and more stable temperature development [1]. The comparison of the two smoke generators shows, that the stability and range of the smoke generation temperature also plays an important role for the aroma composition of smoke.

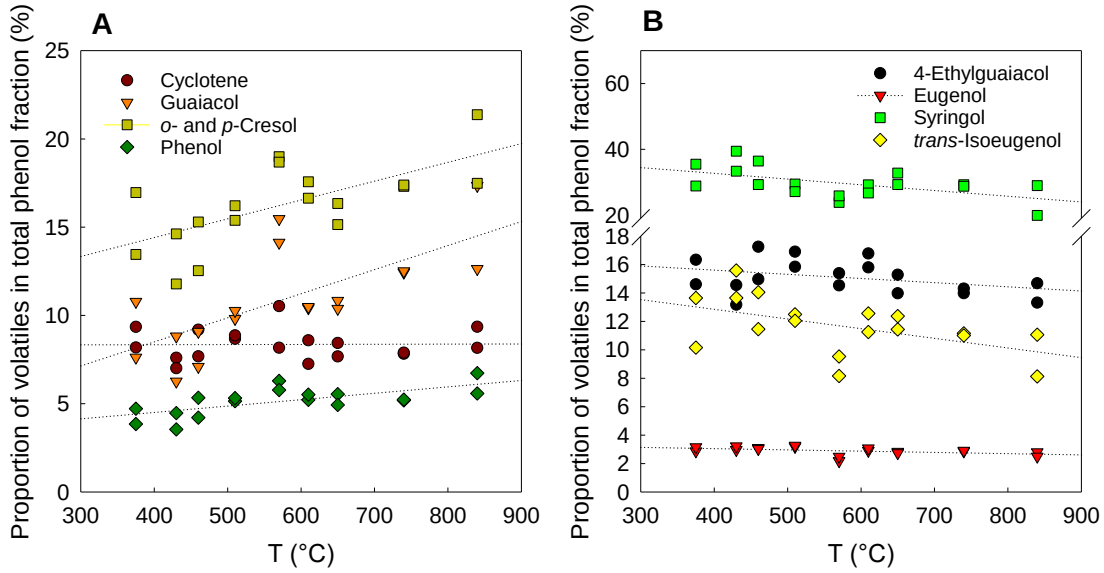

Figure 1. Percentages of marker aroma components in smoke at different temperatures in the smoulder smoke generator (380 - 860 °C)

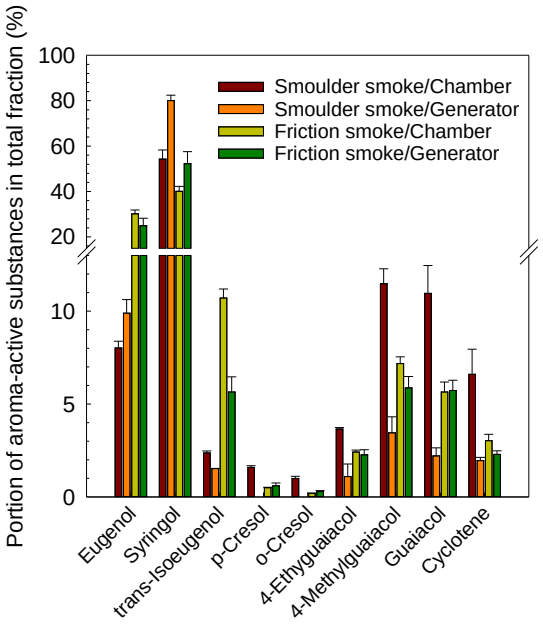

Figure 2. Percentages of marker aroma-active components in friction and smoulder smoke measured in the generator and the chamber

IV. CONCLUSION

Both the type of smoke generation and the smoke generation temperature influenced the aroma-active composition of beechwood smoke, however, also depending on the measurement location. Particularly in the case of the smoulder smoke generator, there are clear differences in the percentage composition of the aroma-active components depending on the measurement location. For future trials, a method needs to be implemented to allow the generation of smoulder smoke in a narrow and stable temperature range. Furthermore, they should also focus on the resulting aroma profiles in meat products.

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