Applicability of skatole measurement in boar fat as a rapid method in the slaughtering procedure

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SUMMARY: A Danish research group reported that they have developped a fully automatic, spectrophotometric, a rapid and reliable method to measure skatole in extracts of backfat. The method was proved under practical conditions. The procedure is based on the measurement of a colour complex by a flowcell of 50 mm in the LAMBDA 2-spectrophotometer. The skatole content in 59 samples ranged from 0.05 to 0.86 ppm. The limiting value for samples containing boar taint was fixed at 0.25 ppm by the Danish group. In this investigation 12 values were above the limit. The sensory test yielded boar taint in one of the samples with the highest skatole contents.

INTRODUCTION: The judgement on a deviating quality of boar meat in the FRG is performed by sensorial test. This method according to the German "Meat Hygiene Regulations" is inexact, because of the individual varying perceptibility.

Against the use of boar meat as a food in Germany pleads the sometimes penetratin gcharacteristic smell of urine or sweat caused by the steroid androstenone (EDELHÄUSER, 1989). The taint increases in male pigs and in hybrids during the sexual maturity. Moreover skatole is connected with the rise of boar taint as a further substance (HANSSON et al., 1980).

Meanwhile the determination of skatole has been carried through as a sensitive indicator for the boar taint (LUNDSTRØM et al., 1984; MORTENSEN and SØRENSEN, 1984). A Danish research group reported about the development of a fully automatic spectroscopic method to measure skatole in extracts of backfat of the pigs during the slaughtering procedure (MORTENSEN and SØRENSEN, 1984; BORUP, 1989). The difficulties for a photometric determination of skatole modified for the laboratory scale are by the side of a very small concentration of skatole especially in the complex background caused by effects of matrix and chemicals. Since compounds with qualities like skatole besides interfere with the analysis, the results received are to interpret as skatole equivalents (SE-units).

MATERIALS and METHODS: The determination of skatole was carried out according to a modified method of MORTENSEN and SØRENSEN (1984). 20 to 30 g backfat of the pigs were melted out about 10 minutes in a microwave oven at 600 W. About 4 g of fat were homogenized in an Ultraturrax with 40 ml of a 3:1 mixture of acetone p.a. and 0.1 M Tris (pH 7.5), 0.001 M Na_2SO_3. Than the sample was filtered. Colour reagent is prepared by dissolving of 8 g 4-dimethylaminobenzaldehyde in 480 ml ethanol abs., addition of 240 ml conc. H_2SO_4 and 80 ml dist. water. Colour reaction is performed by mixing the filtered extract with colour reagent in the ratio of 0.7:1. After 3 minutes exactly (because of further reactions an exact timing is observed) the colour complex is measured in a flowcell of 50 mm in the LAMBDA 2-spectro-photometer (PERKIN-ELMER). A 3-wavelength-analysis at 500 nm, 580 nm (maximum of absorption) and 620 nm including a compensation of background was applied (**Fig. 1**).

RESULTS and DISCUSSION: The results showed in the **Table 1** are the concentrations of skatole in ppm of 59 different samples of backfat and represent the mean values of a double determinations. The ppm-concentrations in brackets are the values of the investigations of the Danish group MORTENSEN (1991) carried out with identical samples. The skatole content ranged from 0.05 to 0.86 ppm in this investigation and in the data of MORTENSEN (1991). In both research groups were found out low and high values of skatole in the same order. Nevertheless the values on an average ($\bar{x}$) were a little different with 0.20 and 0.23 ppm respectively.

A distribution of the accumulation of skatole values showed a clear different arrangement of maxima, regarding discreet barriers of concentration (Fig. 2). These barriers were fixed with 0.05 to 0.09 ppm, 0.10 to 0.14 ppm, 0.15 to 0.19 ppm etc. Most of the samples revealed thus a skatole content between 0.15 to 0.19 ppm. The investigations of MORTENSEN (1991) however showed values between 0.20 to 0.24 ppm. The reason could be, that the investigations of MORTENSEN took place a few months earlier and the skatole in the tissue of fat was reduced during the cold storage period.

The sensorial limiting value for just noticeable boar taint was fixed at 0.25 ppm skatole by the Danish group. In this regard 12 samples were found above the fixed limit. In comparison MORTENSEN (1991) determined 18 samples. In a sensory test it was possible to identify at least boar taint in the samples with the highest values of skatole (above 0.35 ppm).

About a possible correlation between the concentrations of skatole or androstenone respectively and the boar taint the opinions of authors deviate very much. HANSSON et al. (1980) reported of a significant correlation between the boar taint and skatole. Just as the androstenone with the skatole is correlating. Against that JUDGE et al. (1990) could not establish a correlation between skatole or androstenone respectively and the boar taint. MORTENSEN and SØRENSEN (1984) however found out also a significant correlation between boar taint and skatole, moreover should correlate the skatole with the boar taint better than androstenone.

CONCLUSIONS: The method proved to be quick and reliable for tracing the skatole content. Further investigations have to be performed to verify the practicability of skatole as a "detection-substance". In case of this correlation skatole/androstenone is settled, the determination of skatole may be a real help for an objective estimation of the boar taint.

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20 to 30g of backfat were melt out in a microwave (10 min, 600W)

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4 g were homogenized with 40 ml Tris-acetone-buffer (1:3)* in a Ultra-Turrax and filtered

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3.5 ml filtrate were mixed with 5 ml colour reagent**, after 3 min (exactly) in a 50 mm flow cell is measured***

* 3 parts acetone p.a.
1 part 0.1 M Tris(pH 7.5)+
0.001 M Na_2SO_3

** 8 g 4-dimethylaminobenzaldehyde
in 480 ml ethanol abs. p.a. +
240 ml H_2SO_4 conc. + 80 ml dist. water

*** Spectrophotometer Lambda 2 (PE):
1. 3-wavelength-analysis at 500, 580 and 620 nm
2. compensation of background

Fig. 1: Flow diagram for determination of skatole

Figure 2: Distribution of accumulation of skatole contents

Skatole

sample	ppm	sample	ppm
61	0.16 (0.10)	119	0.23 (0.34)
65	0.09 (0.07)	121	0.05 (0.05)
69	0.18 (0.17)	123	0.07 (0.09)
70	0.05 (0.06)	125	0.09 (0.11)
71	0.17 (0.15)	127	0.07 (0.09)
72	0.09 (0.06)	129	0.11 (0.09)
73	0.17 (0.15)	131	0.12 (0.19)
77	0.15 (0.16)	135	0.13 (0.16)
78	0.13 (0.10)	137	0.10 (0.15)
79	0.20 (0.20)	139	0.18 (0.21)
81	0.13 (0.23)	141	0.15 (0.21)
83	0.13 (0.20)	143	0.24 (0.22)
85	0.26 (0.23)	145	0.11 (0.21)
87	0.31 (0.20)	147	0.14 (0.22)
89	0.16 (0.20)	149	0.12 (0.21)
91	0.25 (0.23)	151	0.19 (0.23)
93	0.18 (0.23)	153	0.14 (0.20)
95	0.20 (0.20)	155	0.12 (0.20)
95	0.19 (0.20)	157	0.15 (0.22)
97	0.22 (0.20)	159	0.15 (0.23)
99	0.19 (0.20)	161	0.18 (0.27)
101	0.10 (0.21)	163	0.14 (0.25)
103	0.17 (0.25)	165	0.23 (0.29)
105	0.21 (0.27)	167	0.25 (0.29)
107	0.20 (0.29)	169	0.18 (0.25)
109	0.18 (0.25)	171	0.37 (0.36)
113	0.41 (0.35)	173	0.41 (0.50)
115	0.58 (0.63)	175	0.26 (0.36)
117	0.42 (0.47)	177	0.35 (0.46)
		179	0.86 (0.86)
			11.77(13.78)

$\bar{x}_a$ = 0,20 (0,23)

Table 1: Skatole contents in ppm. In brackets the values of MORTENSEN (1991).