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SOME REMARKS ON THE FLAVOUR ACCEPTANCE OF PHENOLS
ISOLATED FROM WOOD SMOKE

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Some Remarks on the Flavour Acceptance of Phenols Isolated from Wood Smoke.

S u m m a r y

Solutions of phenols isolated from wood smoke and subjected thereafter to four different additional procedures were obtained. Their flavour acceptance was assessed by a sensoric panel, which described also verbally the flavour of each solution. GLC analyses of these solutions were performed by means of a Pye Argon Gas Chromatograph. It was found that at least two /or more/ different substances contribute to the typical "smoked" flavour. It is also postulated that more basic research on odour sensations in general has to be performed in order to elucidate the rôle of the individual components of the tested solutions in the formation of the "smoked" flavour.

Einige Bemerkungen zum Genusswert des Geruches von Phenolen, die aus dem Räucherrauch isoliert worden sind.

Z u s a m m e n f a s s u n g

Lösungen von Phenolen, die aus dem Räucherrauch isoliert wurden und danach auf vier verschiedene Weisen zusätzlich behandelt waren, sind erhalten worden. Der Genusswert des Geruches dieser Lösungen wurde durch eine organoleptische Kommission bestimmt und der Geruch benannt worden. Gaschromatographische Analysen mit Hilfe eines Pye Argon Gaschromatographen wurden ausgeführt. Es wurde festgestellt, dass mindestens zwei /oder mehr/ Substanzen zum Vorkommen des typischen Räuchergeruches beitragen. Es ist postuliert mehr Grundforschung über Geruchsempfindungen im Allgemeinen aus zu führen um die Rolle der individuellen Komponenten der Lösungen in der Bildung des Räuchergeruches zu klären.

Phenols are one of the most active groups of compounds wood smoke is consisting of. Their antioxidative and bactericidal properties are well known and reviewed elsewhere¹. This group of compounds is also mainly responsible for the typical aroma of smoked goods, what has been demonstrated experimentally in one of the preceding papers² and used as the basis for a method of producing liquid smoke³.

However, as experienced in our laboratory, solutions of phenols, which were isolated in different ways from wood smoke condensates, showed differences in the acceptance of their flavour. It was thought worthwhile to follow these differences in acceptance and to search whether they are related to any differences in the composition of the phenolic solutions.

EXPERIMENTAL

A. Preparation of solutions of phenols isolated from wood smoke:

Wood smoke was produced from hardwood /oak and beech/ by combustion of the sawdust at a 6-10-fold air surplus. The smoke was trapped and the phenolic substances isolated by means of the procedure No. 2 described in a preceding paper². The obtained solution /solution A/ contained 4,5 mgs of dry substance per milliliter. This solution was subsequently subjected to one of the following procedures:

- 1/ 100 mls of solution A were condensed to a volume of 25 milliliters /solution B/
- 2/ 40 mls of solution A were evaporated to dryness on a steam-bath and the residue was dissolved in 0,5 ml of purified diethyl ether /solution C/
- 3/ 100 mls of solution A were evaporated to dryness in an all-glass distillation apparatus, and after removing the condenser the residue was left for 10 min. on the steam-bath in order to remove almost all traces of diethyl ether. Thereafter the residue was dissolved in 25 mls of purified petroleum ether with a b.p 30 - 60 °C, and filtered through a filter paper of medium hardness /solution D/.

B. Analytical methods:

- 1/ GLC analysis: Samples of the a/m. four solutions /A - D/ were chromatographed without any further condensation on a Pye Argon Gas Chromatograph with a Sr⁹⁰ detector. Glass columns /4 feet, ID 4 mm/ filled with 80 mesh celite impregnated with 15% /by weight/ of Polyethyleneglycol Adipate were used. Column temperature was 190°C, detector voltage: 1000 Volts, rate of argon flow: 100 mls/min., chart speed: 2 1/4 inches/hr., sample size: 0,1 mcl. Attenuation: as required.
- 2/ Organoleptic analysis: Samples of the a/m. four solutions were assessed for the acceptance of their flavour in the following concentrations: a/ each solution was diluted tenfold with the respective solvent /diethyl or petroleum ether/, b/ each solution was diluted by 100 times with the respective solvent. These solutions were given to a 5-members sensoric panel which had to assess whether the flavour of the solutions was acceptable or not. Besides, the panel was asked to describe verbally the flavour of each solution. The technique of assessments was as follows: Each member of the panel dipped a strip of filter paper into the assessed solution and after having it taken out waited until the solvent evaporated from the filter paper. Thereafter the judge sniffed the flavour which remained on the strip and wrote the note for its acceptance. Next the judge wrote the verbal definition for the assessed flavour.

RESULTS AND DISCUSSION

The solutions of phenols were firstly examined by the sensoric panel. The results of the assessments are tabulated below.

Table 1

Results of organoleptic assessments of solutions of phenols

Solution:		A	B	C	D
Verbal description	dil.: 1:10	smoky	charry	furfural	cresolic
	dil.: 1:100	smoky	smoky	furfural	cresolic
acceptance	dil.: 1:10	acc.	less acc.	not acc.	not acc.
	dil.: 1:100	acc.	acc.	not acc.	not acc.

As can be seen from the above table, solution A has a typical "smoky" flavour which has been found acceptable by the sensoric panel. The flavour of solution B, although still acceptable, is less desired than that one displayed by solution A. It is assumed that this decrease in the acceptance note is due to the charry off-flavour noticeable in higher concentrations of this solution. Solutions C and D were not acceptable at all with regard to their flavours. The sensoric panel described the flavour of solution C as "furfural-like" - it resembled the flavour of strongly burned caramel. The flavour of solution D had a very unpleasant cresolic taint.

As already said, the four solutions of phenols isolated from wood smoke, were also chromatographed by means of the GLC method. Altogether 12 distinct peaks were found on the chromatograms. The relative retention volumes V_r /recounted on the retention volume of C_6H_5OH read under the same conditions/ and the percentage share P of each peak in the sum of the under-peak area /sum = 100%/ for each solution have been calculated and are listed below.

Table 2

Results of GLC analysis of solutions of phenols					
Peak		Percentage share in the sum of under-peak area			
No.	V_r	Soln. A	Soln. B	Soln. C	Soln. D
1	0,86	14,65	10,72	7,88	22,56
2	0,96	10,81	6,87	5,24	19,34
3	1,18	17,04	12,49	10,54	21,56
4	1,36	11,34	6,10	4,51	22,66
8	3,60	20,35	29,57	31,65	6,04
10	4,64	20,24	26,92	32,70	5,44
11	5,42	5,58	7,39	7,47	2,42

Peaks no. 5, 6, 7, 9, and 12 had a very small sub-peak area, which could be neglected in the calculations. The relative retention volumes of these peaks are: 1,02; 2,26; 2,68; 4,05 and 8,18.

As can be seen from the above table, in solution A the peaks with a relative retention volume below 2,00 share by approx. 50% in the sum of under-peak area of substances found in this solution. In solution B the percentage share of these peaks is less than 40%, and

in solution C it is below 30%. In solution D the share of these peaks is above 85%. If we now take in account the verbal descriptions of the same solutions, given in table 1, so we can say that most probably the peaks with a relative retention volume below 2,00 correspond to substances with a cresol-like flavour. However, from the other side solution C which consists in more than 70% of substances with a retention volume V_r above 3,50, has also an undesirable "furfural-like" flavour, which is not typical for smoked goods. In comparison with these two, the solutions A and B have a typical "smoked" flavour /although B has a slightly charry taint/, and as follows from table 2, the ratio of substances with a V_r below 2,00 to those with a V_r above 3,5 in both these solutions is close to the number 1.

From the above one can derive the conclusions, that:

- a/ most probably the "smoked" flavour is a sensation evoked in the human odour receptors not by a single substance, but by the simultaneous action of at least two /or more/ substances.
- b/ at present it is hardly to state to what degree any of the substances being present in the four assessed solutions, contributes to the typical "smoked" flavour. The author is of the opinion that more basic research on odour sensations in general has to be performed in order to elucidate this problem.

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- 3/ Polish Patent Office, patent no. 14677, May 12th, 1965