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FLAVOUR VOLATILES IN DRY COCOA BEANS

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ABSTRACT

Cocoa (*Theobroma cacao* L.) beans contain more than 400 volatile compounds, some of which may attract insect pests. Trained panelists assessed dry cocoa beans for volatile compounds and recorded the description of the aroma and the time of the peak when the flavour volatiles were detected using gas chromatography. Using the frequency of the flavour volatile, the time of the peak and the computer library of volatile compounds, esters and aldehydes were identified as significant volatiles.

INTRODUCTION

Aroma is one of the most important quality attributes of cocoa (*Theobroma cacao* L.) beans and their products. It is significantly affected by the fermentation of the beans. Fermentation decreases bitterness and astringency of the beans but increases acidity as well as aroma precursors and aroma volatiles. Cocoa beans contain more than 400 distinct flavour volatiles (Www – 1), some of which attract insect pests. Insects can perceive many combinations of the flavour volatiles, which are not perceived by humans. Storage beetles are attracted to the traditional type of dry cocoa beans (composed of mixed genotypes) and cause damage by boring holes in the beans or feeding on the nib.

The potential damage caused by such beetles to dry cocoa beans in storage is very important, but it is not yet known which flavour volatiles in the beans are responsible for attracting the pests. In this study, identification of the significant odourants of cocoa beans detected by humans using olfactometric (sniffing) analysis has been used to ascertain the spectrum of flavour volatiles produced in dry cocoa beans.

MATERIALS AND METHOD

Dry cocoa beans of the traditional type, i.e. mixed genotypes, were collected from the Cocoa Research Institute of Ghana. Volatile compounds were collected on a Tenax trap by passing air through the beans in a sealed sample bottle at a flow rate of 50 ml/min for 15 minutes. Using a CHISA injector at 240°C, the volatiles were

thermally desorbed for 10 minutes into an HP 5890 series II GC (Hewlett-Packard, Avondale, PA) equipped with a BP-1 column of 25m length, 0.22 mm i.d., 1.00 μ m phase thickness. Forty cm of the column was submerged in liquid nitrogen during the injection to focus the volatile compounds on the column. Helium was used as carrier gas at 20 psi. The oven was kept at 30°C initially and then increased to 220°C at 4°C/min. The GC was attached to a Fison MD 800 Mass Spectrometer with ionisation at 70eV. The spectra were recorded from 25 to 250 Da and Mass Spectrometer data were analysed using MassLynx software.

The column outlet was connected to a sniffing port. Sniffing of the chromatogram, which took a total of 28 minutes, was divided into two parts. Each of eight trained panellists participated in the sniffing of both parts but during two distinct sessions to avoid lassitude. Elution of relevant flavour volatiles was recorded on a time-odour chart. The eight individual aromagrams of the samples were summed to produce a master aromagram. The time of the peaks and the description of flavour volatiles were put on a Microsoft excel spreadsheet and aligned. Compounds were identified from the frequency of the flavour volatile, the time of the peak and the computer library of volatiles.

RESULTS AND DISCUSSION

The fermentation process is believed to be important for the liberation of flavour precursors by enzymic reaction. This liberation of flavour precursors continues during the drying process, though the typical aroma of cocoa is mainly formed by chemical reactions occurring during roasting of the beans.

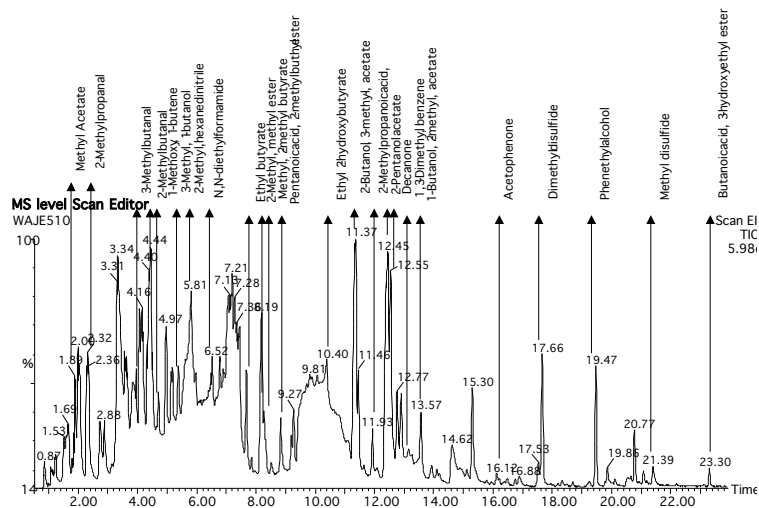


Figure 1: Chromatogram of volatiles in dry volatiles cocoa beans showing significant odourants

Many volatiles were liberated (Figure 1), but the panellists recorded only eighty-seven (87) relevant flavour volatiles on a time-odour chart. On the basis of 50% detection, only 26 odour-active volatiles were considered as significant odorants in the dry cocoa beans (Figure 1 and Table 1). The most significant odorants in dry cocoa beans detected by the panellists were considered to be the fruity, sweet smelling butanoic acid, ethyl ester; 2-methylbutyl ester; pentanoic acid, 2-methylbutyl ester; the fruity, banana smell of 2-butanol, 3-methyl-, acetate; the fruity smell of butanoic acid, 3-hydroxy ethyl ester and the sweet, pungent smell of acetophenone.

TABLE 1
Significant flavour detected by panellists

Significant odourant	Odour quality (description)	Frequency	% Detection
Methyl acetate	Fruity, Chocolate	5	63
2-Methyl propanal	Fruity, Roasty	6	75
3-Methylbutanal (3-methylbutyraldehyde)	Choking, Pungent	7	88
2-Methyl butanal (2-methylbutyraldehyde)	Choking, Chocolate	5	63
1-Butene, 1-methoxy	Fruity, Chocolate	4	50
2-Methyl, methyl ester	Fruity, Sweet	4	50
1-Butanol, 3-methyl acetate	Fruity, Banana	5	63
Hexanedinitrile, 2-methyl	Spicy, Gallic	5	63
N,N-diethyl formamide	Roasty, Fishy, Acidic	5	63
Butanoic acid, ethyl ester (ethyl butyr)	Fruity, Sweet	8	100
Methyl 2-methyl butyrate	Sweet, Fruity	5	63
2-Methylbutyl ester	Fruity, Sweet	8	100
Methyl 2-methyl butyrate	Sweet, Fruity	5	63
Pentanoic acid, 2-methylbutyl ester	Fruity, Sweet	8	100
Ethyl 3-hydroxybutyrate	Sweet	4	50
2-Butanol, 3-methyl acetate	Fruity, Banana	8	100
2-Methyl propanoic acid,	Sweet, Fruity	5	63
2-Pentanol acetate	Fruity, Banana	5	63
Decanone	Fruity, Orange, Oily	4	50
1,3Dimethyl, benzene	Smokey	6	75
1-Butanol, 2-methyl, acetate	Fruity, Banana	5	63
Acetophenone	Sweet, Pungent	8	100
Dimethyl disulfide	Spicy, Strong onionlike	6	75
Phenethyl alcohol	Sweet, Spicy	7	88
Methyl disulfide	Spicy, Strong onionlike	7	88
Butanoic acid, 3-hydroxy ethyl ester	Fruity	8	100

CONCLUSION

Significant flavour volatiles identified were mainly esters and aldehydes.

FUTURE WORK

Standards of some significant flavour volatiles will be run on the GCMS to confirm the compounds identified. This will be used for olfactometric analysis.

REFERENCES

http://www.chocolateweek.co.uk/realchoc_n.php?realchoc_id=4

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