POTENTIAL USES OF AN ODOUR PROFILE FOR THE WESTERN AUSTRALIAN HONEY INDUSTRY

Angela Downey[1], Sasha Kazemi[1], Brian Hayter[1],
Kenneth Dods[1], Rob Manning[2], Lynne Milne[2]
ChemCentre[1], Private Consultant[2]

Introduction

The aroma of honey is one of its most readily distinguishable characteristics, the volatile compounds which make up this aroma are equally distinguishable by advanced spectroscopic techniques. Does the volatile signature of a honey have any applicability to the honey Industry?

Scope

Determination of the odour profiles of monofloral honeys'. Isolate any characteristic patterns in the volatile signatures and identify potential applicability to the West Australian honey industry.

Materials and Methods

For this trial assessment, pollen references Jarrah, Marri, Yate, Powderbark and blended honeys, field collected to capture natural variation characteristics were sourced from the ChemCentre industry database of honey certified for its source and monofloral status using palynological techniques. All samples were analysed on a Teledyne Tekmar Atomx purge and trap system connected to an Agilent 6890 gas chromatograph coupled to a 5973-mass selective detector.

A 60-meter x 0.25 mm i.d. DB-VRX capillary column with a 1.4µm film thickness was used for separation. The GC injection port was set to 200°C and a 20:1 split was used during the injection step. The GC oven was maintained at 40°C during the desorption and extraction process, after which the oven was temperature programmed from 40°C to 190°C at a rate of 8°C per minute and from 190°C to 240°C at a rate of 6°C per min for the total ion chromatogram.

Sample sizes of 1ml of each honey were pipetted into 40ml VOA vials and left unheated during the sample purge. Samples were sparged with high purity helium at 40 mL/min for 11 minutes with an additional 2 minute 200mL/min minute dry purge. The gas extracted volatile analytes were then swept onto a Strat-Trap #9 U-shaped trap (TEKMAR Pt. No.14-9908-403). This method also incorporated the use of the VOCs deuterated internal standards (chlorobenzene-d5 and 1, 4-dichlorobenzene-d4)

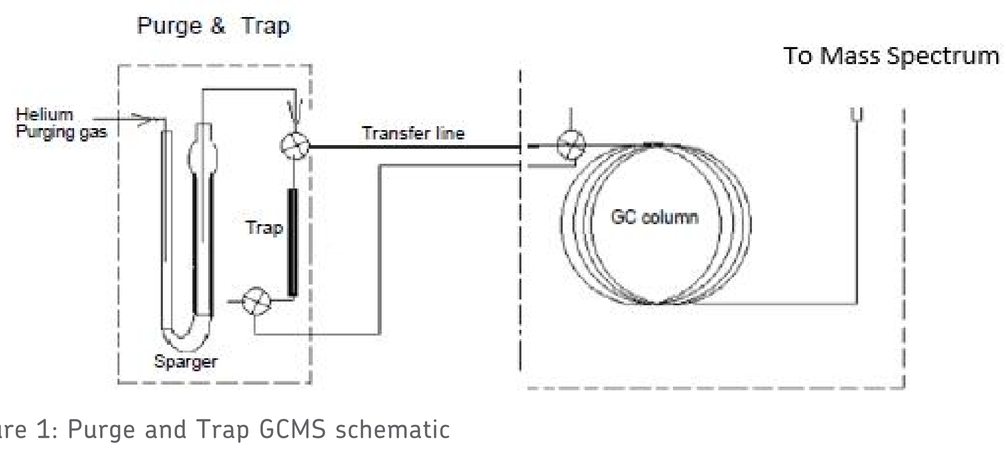

Figure 1: Purge and Trap GCMS schematic

Acknowledgements

This research is supported by DPIRD funding Industry Grants for International Competitiveness — IGIC 2016019 — Certified distributor driven outcomes that drive export sustainability for the WA honey industry.

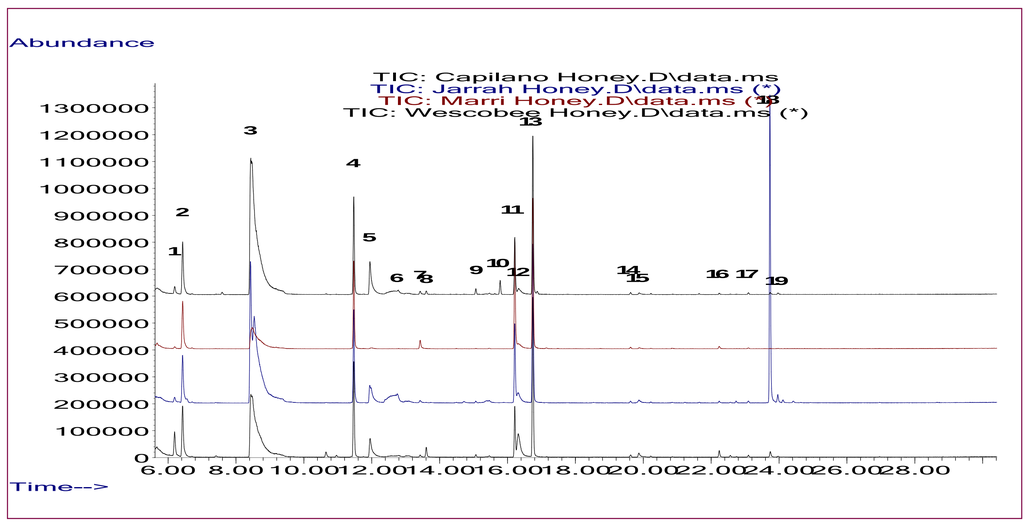

Figure 2: Overlaid total ion chromatograms (TICs) of the four honey samples analysed by purge and trap gas chromatography mass spectrometry (P&T-GCMS). From bottom to top: Wescobee; Jarrah; Marri and Capilano honeys.

Label	Retention Time (min)	Tentative Identification	CAS Number	Odour description
1	6.2	Dimethyl sulfide	75-18-3	Sweet, honey, acrid, cooked vegetables, sulphuric
2	6.4	Methylene chloride (Solvent)	75-09-2	
3	8.5	2,3-Butanedione	431-03-8	butter, cheese
4	11.5	Benzene, 1,4-difluoro-(Internal Standard)	540-36-3	
5	11.9	2,3-Pentanedione	1341-45-3	buttery diacytl-like, fermented dairy and creamy, popcorn buttery.
6	12.8	2-Propanone, 1-hydroxy-	116-09-6	pungent sweet caramellic ethereal
7	13.4	2,3-Pentanedione, 4-methyl-	7493-58-5	sweet fruity buttery creamy fatty
8	13.6	Disulfide, dimethyl	624-92-0	onion, cabbage, putrid
9	15.1	Octane	111-65-9	Gasoline-like
10	15.8	(2-Aziridinylethyl)amine	4025-37-0	-
11	16.2	Acetyl valeryl	96-04-8	butter cheese oily fresh yogurt
12	16.3	Furfural	98-01-1	Sweet, fruit, cherry, soft almond
13	16.7	Chlorobenzene-d5 (Internal Standard)	3114-55-4	
14	17.1	1-butanol	71-36-3	medicinal, phenolic
15	19.9	Benzaldehyde	100-52-7	Sweet, almond, marzipan
16	22.2	Linalool oxide	5989-33-3	Sweet, citrus, forest, geranium
17	23.7	Isophorone	78-59-1	cooling, woody, sweet green camphor, fruity, musty, cedarwood, tobacco, leather
18	24.0	Ketoisophorone	1125-21-9	musty, woody, sweet tea, tobacco leaf

Table 1: Tentative identification of peaks from purge and trap analysis.

Result and Discussion

The chromatograms for the four honey samples examined are shown in Figure 2. Even without a detailed analysis, the profiles of volatiles obtained for the different samples have a certain similarity, although differences between the honey types can also be observed. The identification of each volatile compound detected by GCMS, their retention time, CAS number, and a description of each compound's odour[(1)] are presented in Table 1.

Summary

The chemical fingerprint of a specific honey could be used to differentiate between monofloral honeys from different floral sources providing valuable information concerning the honey's botanical and geographical origin. The volatile profile could help to standardise honey quality and avoid fraudulent labelling of other inferior products.

References

1. Volatile Compounds in Honey: A Review on Their Involvement in Aroma, Botanical Origin Determination and Potential Biomedical Activities; Christy E. Manyi-Loh, Roland N. Ndip, and Anna M. Clarke; Int J Mol Sci. 2011; 12(12): 9514–9532.
2. Aroma features of honey measured by sensory evaluation, gas chromatography-mass spectrometry and electronic nose; Huaixiang Tian, Yongbo Shen, Haiyan Yu, Chen Chen; International Journal of Food Properties;https://doi.org/10.1080/10942912.2016.1213744
3. Learning and discrimination of honey odours by the honey bee; Isabelle BONOD, Jean-Christophe SANDOZ, Yves LOUBLIER, Minh-Hà PHAM-DELÈGUE; Apidologie 34 (2003) 147–159