BEESWAX QUALITY IN POLAND

Workshop D: WG Authenticity of Bee Products

Meeting of the International Honey Commission, 7th May 2019, Malta

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Problem with beeswax quality on the EU market

- **Insufficient production of beeswax.**
- **Lack of EU regulatory specification for beeswax.**
- **Lack of an official method for detection of beeswax adulteration.**

Requirements for physicochemical properties of beeswax

Features	Polish Standard (PN-R-78890, 1996)		Proposal of IHC (Bogdanov, 2006)
	Class I	Class II	–
Water content (%)	–		<1
Refractive index (75°C)	–		0.4398 – 1.4451
Melting point (°C)	62 – 64	62 – 65	61 – 65
Mechanical impurities (% m/m), not more than	0.1	2.0	Absent
Glycerols, polyols, fatty acids, fats	–		Absent
Acid number (mg KOH/g)	17.0 – 21.0	16.0 – 22.0	17 – 22
Ester number	–		70 – 90
Ester/acid ratio	–		3.3 – 4.3
Saponification number, (mg KOH/g)	87.0 – 101.0	84.0 – 103.5	87 – 102
Total content of hydrocarbons (% m/m), not more than	16.5		14.5
Iodine number (g J_2/100g)	7.0 –11.0[1)]	6.0 – 11.0*	–

* For extracted beeswax the iodine number can be higher, max 17.5

Detection of beeswax adulteration with hydrocarbons

Column chromatography combined with weight analysis is recommended by PN-R-78890 („Beeswax”).

The method is time – consuming and allows only the determination of total hydrocarbons occurring in beeswax.

- **Moreover, inappropriate preparation of silica-column resulted in elution and weighting of esters together with hydrocarbons.**

GC-MS METHOD

- **Detection of beeswax adulteration with hydrocarbons of alien origin (e.g. paraffin) using GC-MS, according to procedure developed in the Laboratory *(Waś et al., 2014a, 2014b, 2015, 2016)*.***
- **The method allows for identification of n-alkanes, alkenes and dienes and quantification of n-alkanes.**

***Waś et al., (2014a) Determination of beeswax hydrocarbons by gas chromatography with a mass detector (GC-MS) technique. *Journal of Apiculture Science* 58(1): 145-157.**

Waś et al., (2014b) Hydrocarbon composition of beeswax *(Apis mellifera)* collected from light and dark coloured combs. *Journal of Apiculture Science 58(2): 99-106.

***Waś et al., (2015) Application of gas chromatography with the mass detector (GC-MS) technique for detection of beeswax adulteration with paraffin. *Journal of Apicultural Science* 59 (1): 143-152.**

***Waś et al., (2016) Efficiency of GC-MS method in detection of beeswax adulteration with paraffin. *Journal of Apicultural Science* 60 (1): 131-147.**

Svečnjak et al., (2019) The Coloss Beebook – Volume III, Part 1: Standard methods for *Apis mellifera* beeswax research. *Journal of Apicultural Research*, Volume 58, Issue 2.

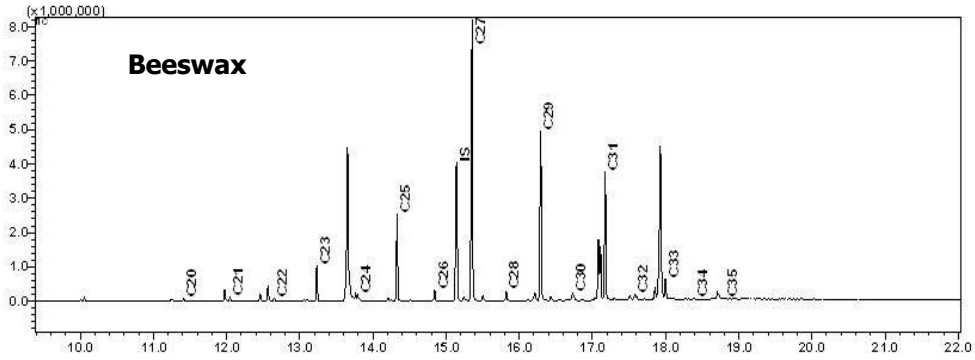
Criteria indicating the adulteration of beeswax with hydrocarbons of alien origin (e.g. paraffin)

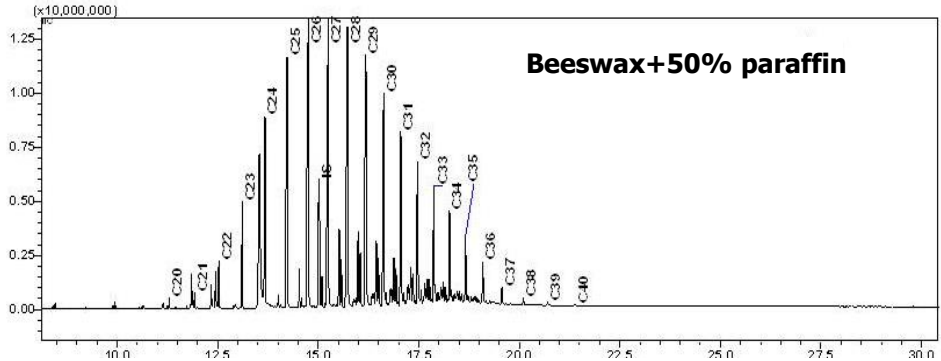
- **The presence of hydrocarbons containing more than 35 carbon atoms in the molecule, which do not occur in beeswax.**
- **Higher contents in comparison to the maximum amounts found in pure beeswax of individual n-alkanes ($C_{20}H_{42}$-$C_{35}H_{72}$) and for the total of these compounds (> 11.7 g/100 g).**
- **Higher contents of even-numbered alkanes occurred in small amounts (ca. 1 g/100 g in total).**

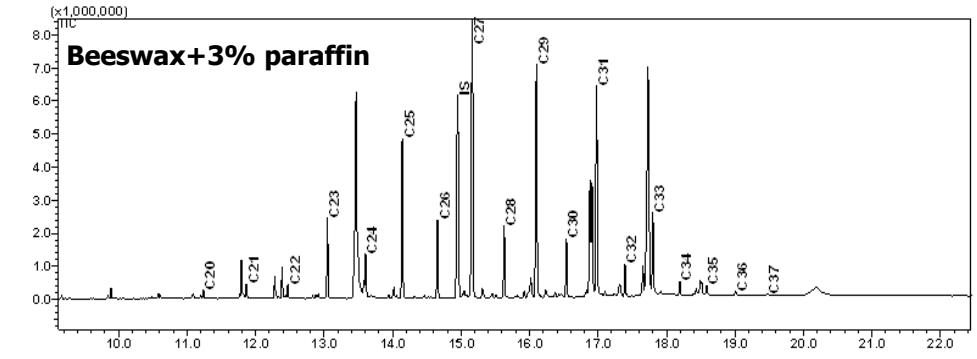
Formula of n-akane	Contents of n-alkanes (g/100 g)
$C_{20}H_{42}$	0.01 – 0.06
$C_{21}H_{44}$	0.03 – 0.10
$C_{22}H_{46}$	0.02 – 0.09
$C_{23}H_{48}$	0.12 – 0.68
$C_{24}H_{50}$	0.03 – 0.13
$C_{25}H_{52}$	0.42 – 1.47
$C_{26}H_{54}$	0.06 – 0.22
$C_{27}H_{56}$	2.44 – 4.40
$C_{28}H_{58}$	0.06 – 0.19
$C_{29}H_{60}$	1.68 – 2.73
$C_{30}H_{62}$	0.05 – 0.19
$C_{31}H_{64}$	1.53 – 2.64
$C_{32}H_{66}$	0.01- 0.12
$C_{33}H_{68}$	0.31 – 0.76
$C_{34}H_{70}$	< 0.025* – 0.03
$C_{35}H_{72}$	< 0.025* – 0.03
Suma	8.27 – 11.66

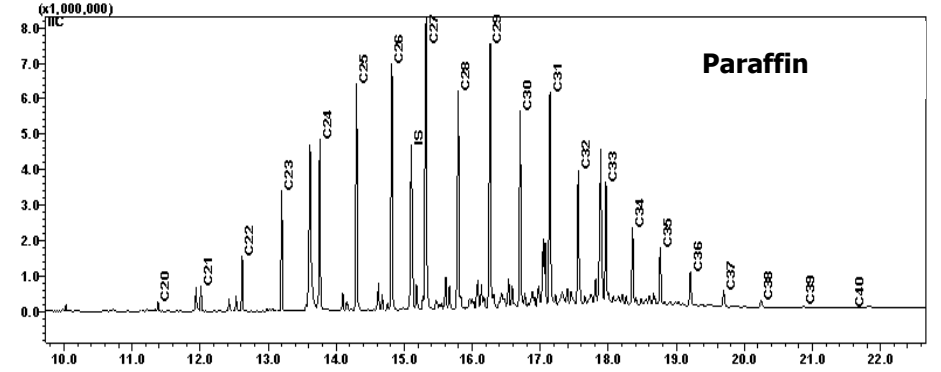
* Limit of determination for $C_{34}H_{70}$ and $C_{35}H_{72}$

Chromatograms of n-alkanes in beeswax and paraffin – detection of beeswax adulteration









Results of beeswax quality control in BPQTL in Puławy (2015-2018)

Year	Number of samples	Number of adulterated samples	% of adulterated samples
2015	15	11	73
2016	38	19	50
2017	13	11	85
2018	31	28	90
Total	97	69*	71

*Adulterated beeswax – 28 samples of wax bloks and 41 samples of comb foundation

Results of beeswax quality control in BPQTL in Puławy (2015-2018)

Degree of adulteration	Number of samples	% of samples
3 – 5%	18	26
around 10%	32	46
15 – 25%	10	14
30 – 40%	9	13
Number of adulterated samples = 69		

Effects of adulteration on bee colonies

SUMMARY

The results of monitoring indicate unambiguously the problem of beeswax adulteration, although the scale of the problem in the domestic market is not well-known.

Thank you for your very kind attention

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