



Wax and wax foundations

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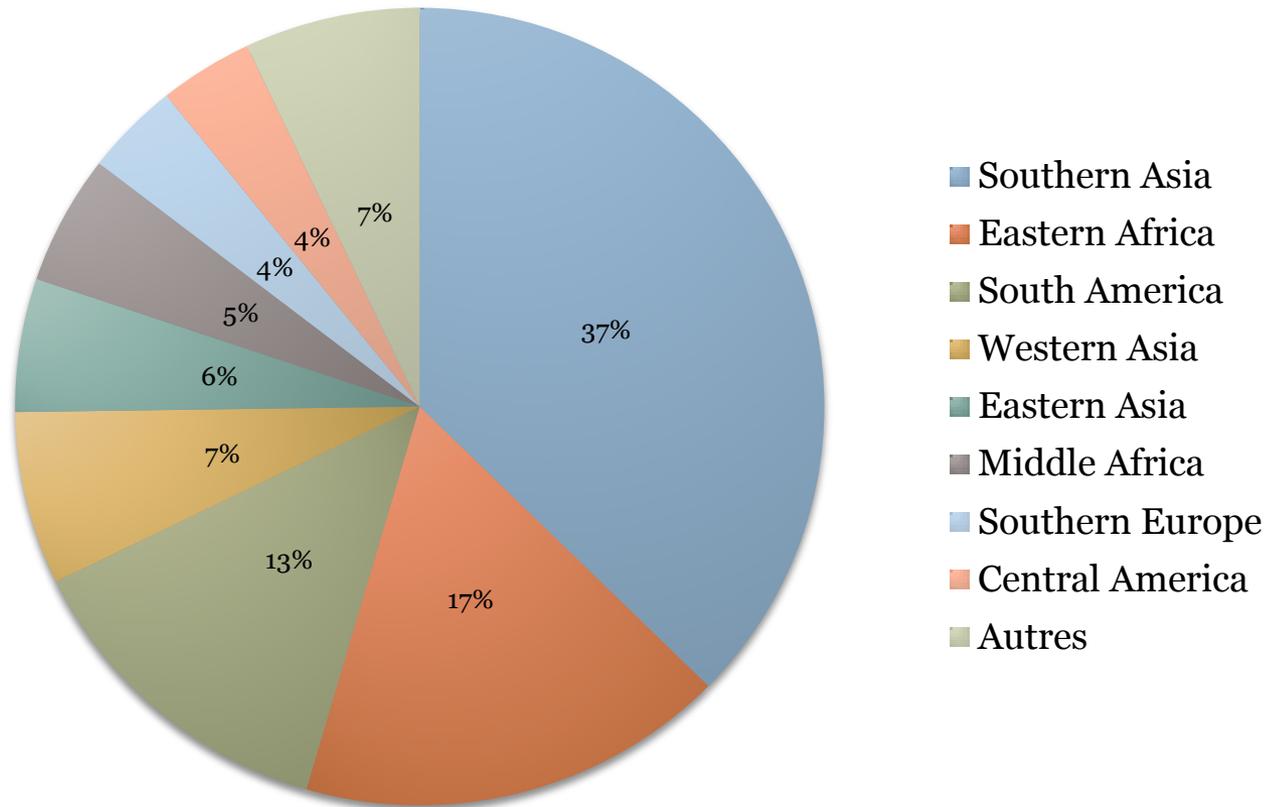




Beeswax.

- Defined only in certain countries (Polish standard PN-72 / R-78890, 1996)
- Considered a food additive at an international level :
 - **E901**
 - **number EINECS 232-383-7)**
- European pharmacopea - Question N° EFSA-Q-2006-021
 - **Yellow beeswax** Chemical Abstracts Service (No. 8012-89-3) wax obtained from the overhaul of frames of bees by hot water by removing the exogenous material there.
 - **White beeswax** (CAS No. 8006-40-4) wax obtained by bleaching yellow wax.

Beeswax.



Problem waxes 2016

- Problems revealed in NL, BE, DE, FR :
 - Brood development (mosaic)
 - Difficulty to build combs...
 - Destroyed comb,
 - Disrupted chemical communication
 - Decreased honey production...
- On line questionnaires for beekeepers
- Replies sent to the authorities
- =>Ongoing analyzes: chemical residues, waxes composition, wetting products ...



Message aux fédérations d'apiculture

Utilisation de rayons de cire achetés et vente du miel

Suite à la réunion d'information qui s'est tenu le 14 septembre et vu l'état actuel de l'enquête concernant la mortalité élevée du couvain suite à l'utilisation de nouveaux rayons de cire préfabriqués, le SPF Santé publique demande aux apiculteurs belges de ne pas utiliser provisoirement les surplus ou réserves de rayons de cire qui ont été achetés. Ceci en attente des résultats des recherches en cours.

Cela concerne les rayons de cire (coulés ou laminés) avec les numéros de lot **212225 jusque 213110** qui ont été achetés dans la **période de février 2015 jusque septembre 2016**.

Il est demandé aux apiculteurs de conserver provisoirement ces rayons de cire, y compris les mauvais rayons de cire qui ont été retirés des ruches, et donc de ne pas les refondre (ou les faire refondre) pour réutilisation.

Il a aussi été demandé au fabricant de ces rayons de cire d'arrêter la vente et la distribution de ceux-ci dans l'attente des résultats des recherches en cours.

Dès que le SPF Santé publique aura clarifié la cause exacte des problèmes vous en serez informés.

Information de l'Agence pour la Sécurité de la Chaîne Alimentaire (AFSCA) :

Une évaluation concernant les risques éventuels liés à la consommation du miel a été effectuée. Selon cette première évaluation, il n'y a pas de risque pour le consommateur. L'AFSCA attend toutefois les résultats d'analyses de laboratoire supplémentaires afin de confirmer cette évaluation.

En ce qui concerne le miel, l'AFSCA rappelle que les apiculteurs restent responsables de la sécurité et la qualité du produit qu'ils mettent sur le marché.



Controls waxes

- The quality of the wax is related to its purity.
 - Residues study of 60 samples
 - <http://www.sciencedirect.com/science/article/pii/S004565351630892X>
 - derivatives of amitraz of 5 micrograms to 464 $\mu\text{g kg}^{-1}$
 - organophosphorus insecticides of 1 to 464 $\mu\text{g kg}^{-1}$
 - miticides $> 9 \mu\text{g kg}^{-1}$
 - fungicides 1 to 23 $\mu\text{g kg}^{-1}$
 - herbicides 1 to 5.9 $\mu\text{g kg}^{-1}$

Beeswax adulteration issue: *aspects of contamination and outcome*

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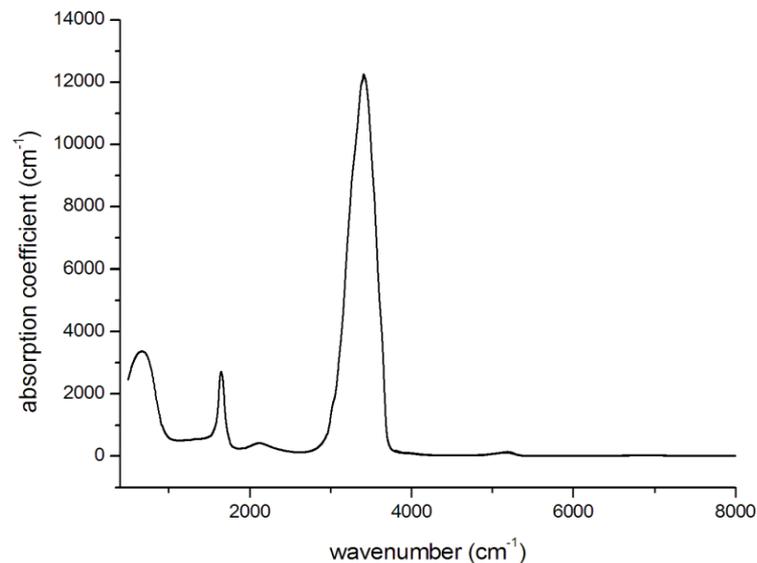
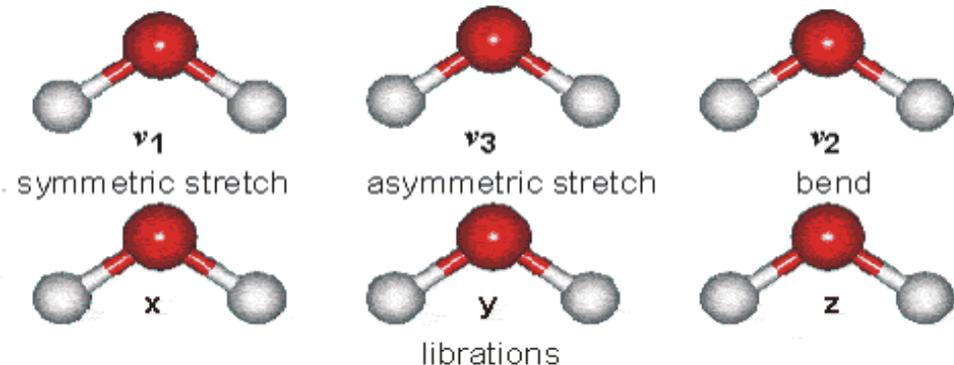
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FTIR spectroscopy - basics, advantages and analytical procedure development

- development of an **analytical procedure** for reliable beeswax **adulteration detection** (Svečnjak et al., 2015)
- feasibility study - Maia et al. (2013) - good detection limits (5%)
- information on the **total chemical composition** of a sample
- detection of **functional group vibrations** - bands with specific position and intensity in IR spectrum
- **unique IR fingerprint** of a sample

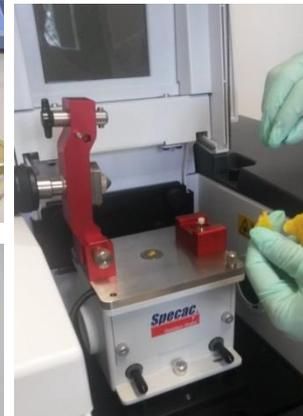
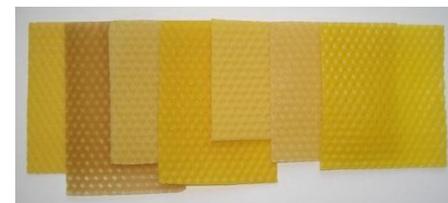
H₂O molecule



Materials and methods

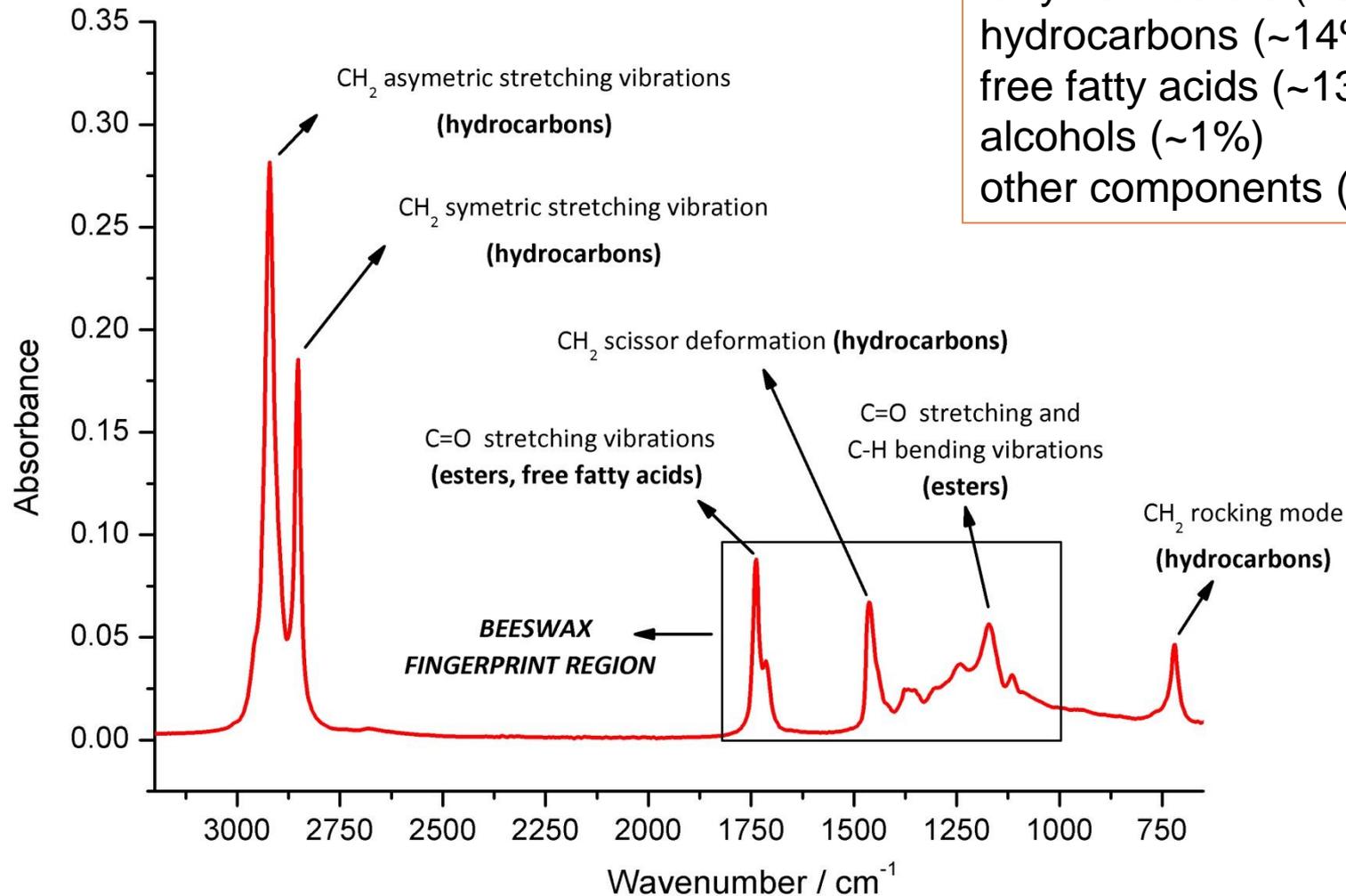
Sampling and IR spectra acquisition

- comb foundations containing **90% of paraffin** placed in **15 *Apis mellifera* colonies** (1 frame / LR hive)
- left in the hives until full comb construction
- **honeyombs** constructed on experimental paraffin foundations **melted and recorded** by FTIR spectroscopy (separately)
- **236 comb foundation** samples collected from 2014 to 2016 - manufacturers and/or specialized beekeeping shops - 14 European countries (Austria, Bosnia and Herzegovina, Croatia, Germany, France, Hungary, Italy, Kosovo, Macedonia, Netherlands, Poland, Serbia, Slovenia, Sweden) + 5 countries outside EU (Australia, Argentina, Cameroon, China, Russia)

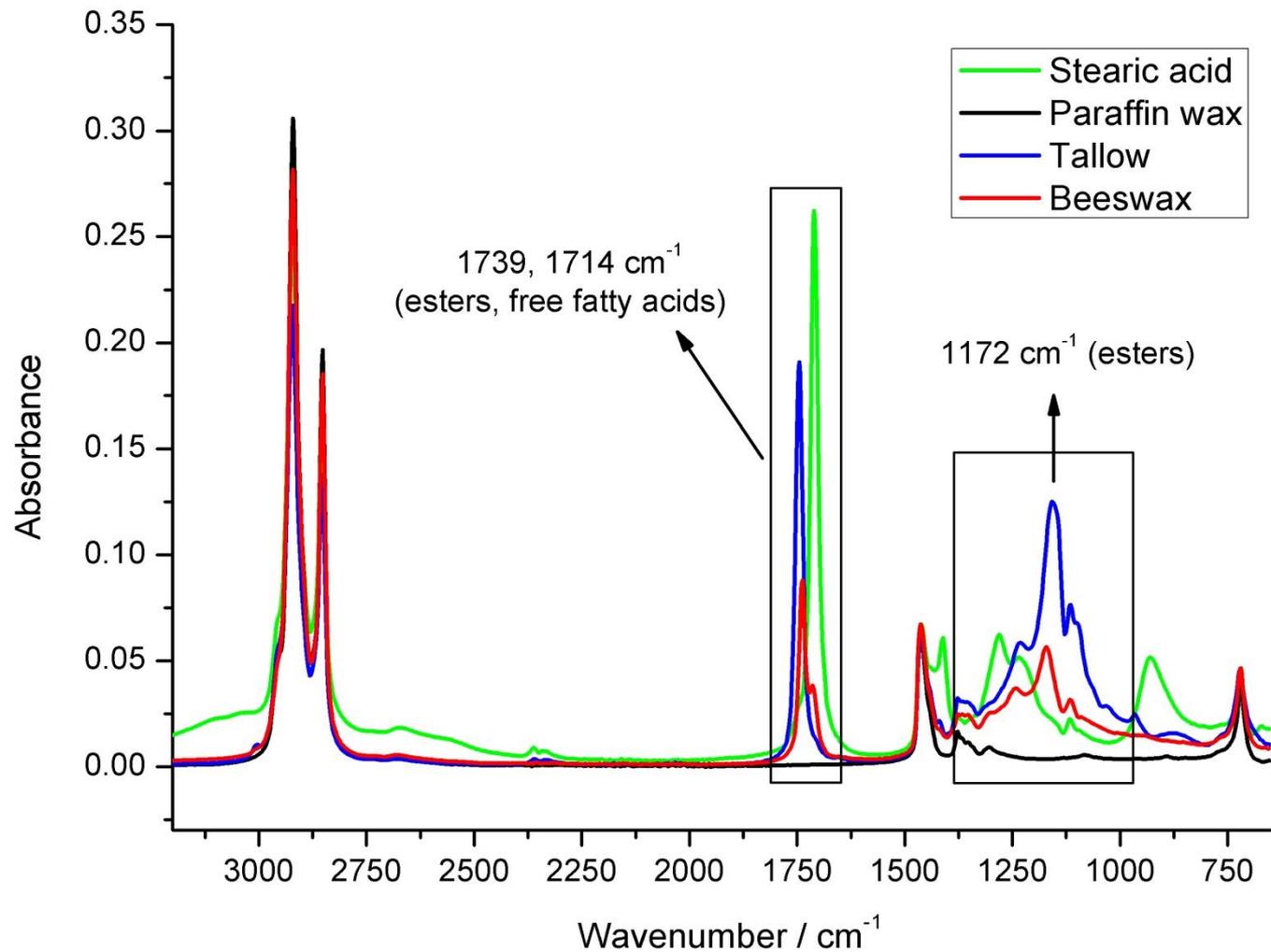


Characteristic FTIR-ATR spectrum of genuine beeswax and underlying molecular vibrations

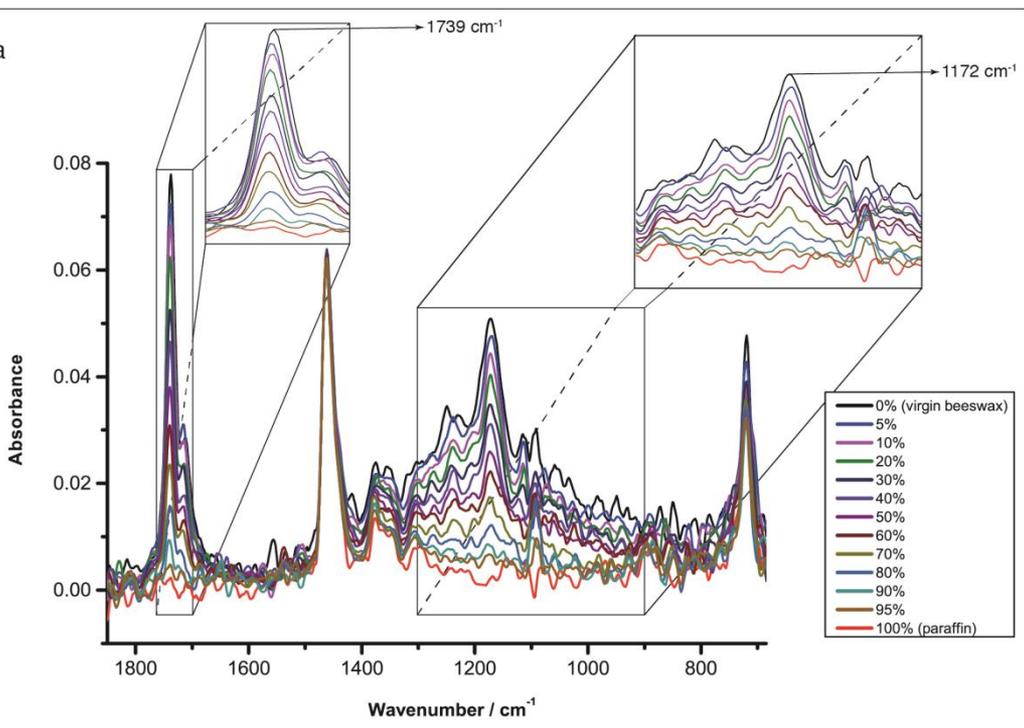
Beeswax chemical composition:
fatty acid esters (~67%)
hydrocarbons (~14%)
free fatty acids (~13%)
alcohols (~1%)
other components (~5%)



Comparison of typical FTIR-ATR spectrum of genuine beeswax and selected adulterants

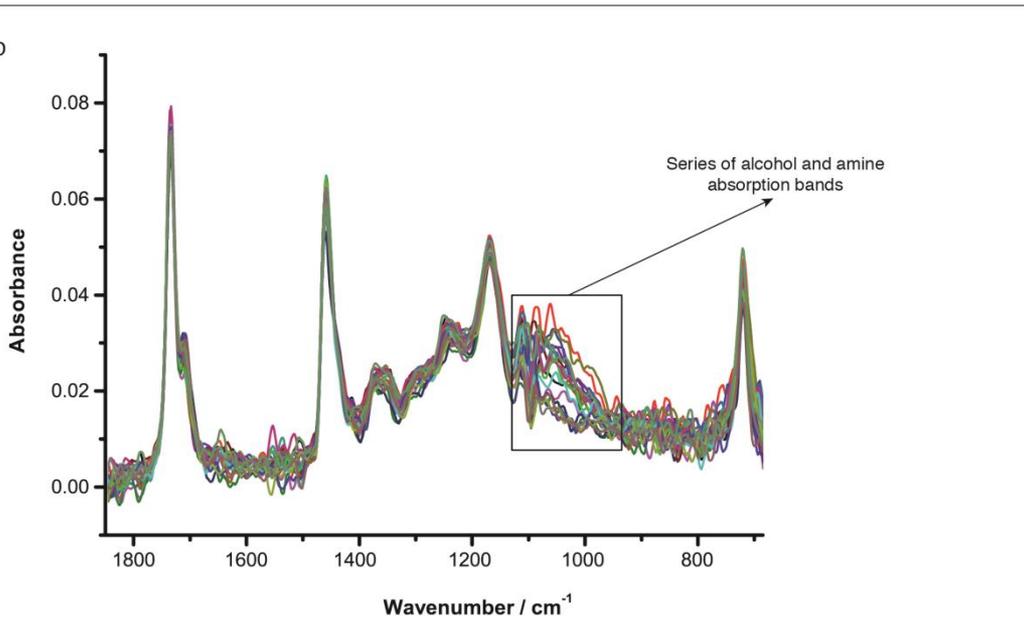


2a



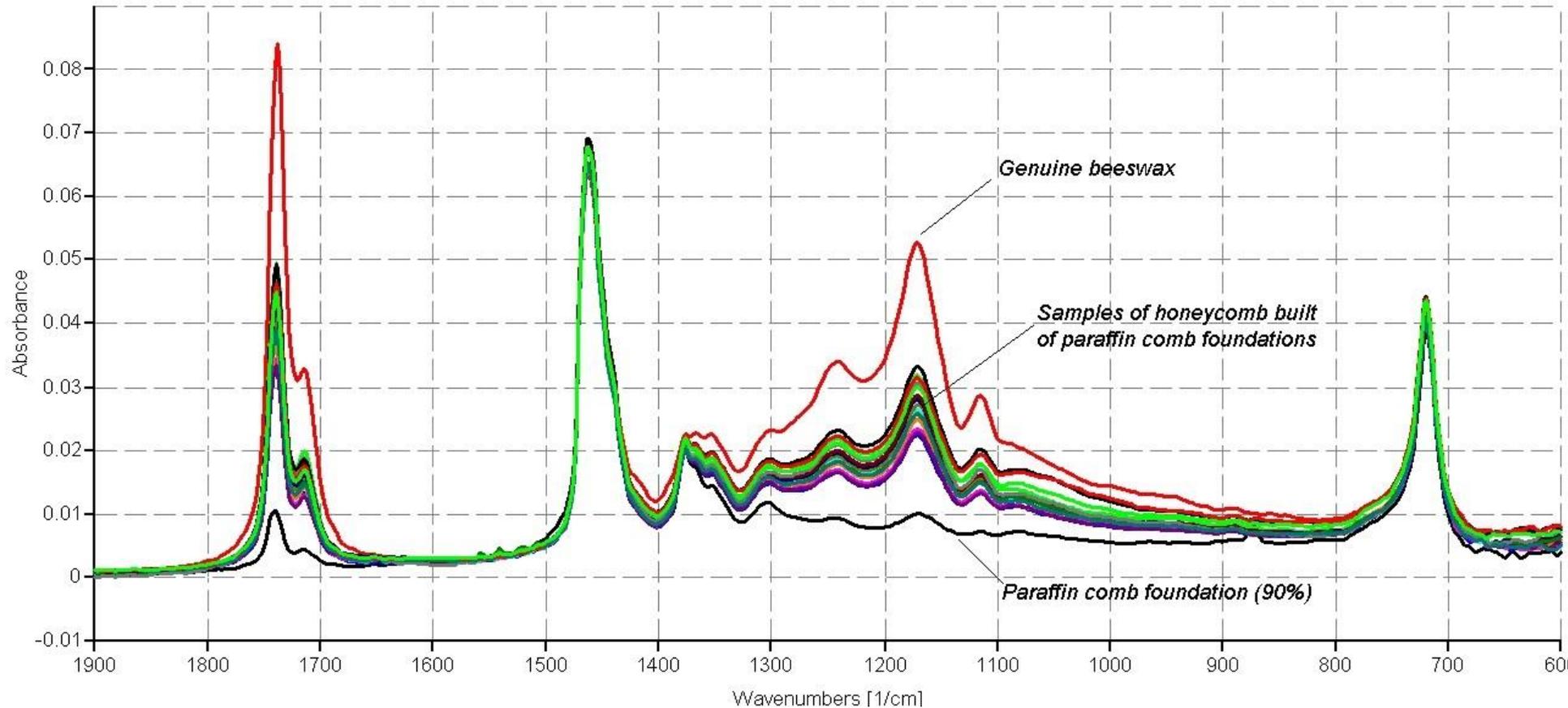
IR spectra of virgin beeswax, paraffin and prepared virgin beeswax-paraffin mixtures containing different proportion of paraffin (5-95%) (2a)

2b



Spectral variations between different virgin beeswax samples (n=21) (2b)

Residual amount of paraffin in melted honeycomb samples



- in average **53.4 %** of **paraffin remains** in the newly built and melted raw wax material (44,6 - 63,2 %)

Categorization and distribution of analysed comb foundation samples (**n=61 / 2014**) by adulteration level (category)

Adulteration category	Paraffin share (%)	Samples (n)	Samples (%)
<i>High level</i>	>70	12	19.7
<i>Higher middle level</i>	45-70	4	6.6
<i>Lower middle level</i>	20-45	6	9.8
<i>Low level</i>	5-20	28	45.9
<i>Genuine beeswax</i>	< 5	11	18.0
Total		61	100%

- **82 %** samples **adulterated with paraffin**
- **up to 92.7 % of** paraffin
- no other adulterant traces found in comb foundations
- prevalence of the paraffin adulteration on the market

Categorization and distribution of analysed comb foundation samples (**n=64 / 2015**) by adulteration level (category)

Adulteration category	Paraffin share (%)	Samples (n)	Samples (%)
<i>High level</i>	>70	7	11.3
<i>Higher middle level</i>	45-70	3	4.8
<i>Lower middle level</i>	20-45	6	9.7
<i>Low level</i>	5-20	32	51.6
<i>Genuine beeswax</i>	< 5	14	22.6
Total		62	100%

- **77.4 %** samples **adulterated with paraffin**
- **up to 95 % of** paraffin
- other adulterants: **tallow** 10% (1 - B&H), **stearic acid** 15% (1 - Poland)
- prevalence of the paraffin adulteration on the market

Categorization and distribution of analysed comb foundation samples (**n=111 / 2016**) by adulteration level (category)

Adulteration category	Paraffin share (%)	Samples (n)	Samples (%)
<i>High level</i>	>70	8	7.6
<i>Higher middle level</i>	45-70	1	1
<i>Lower middle level</i>	20-45	7	6.7
<i>Low level</i>	5-20	58	55.2
<i>Genuine beeswax</i>	< 5	31	29.5
Total		105	100%

- **70.5 %** samples **adulterated with paraffin**
- **up to 94.2 % of** paraffin
- **stearic acid** (20-35 %) found in 6 samples (Netherlands)
- prevalence of the paraffin adulteration on the market

Explanations?

- Use of waxes batches intended for the production of candles
- Wax foundations import from China contaminated with illegal substances
 - 17 lots in France from 12 resellers - analyze: 16 pesticides (8 acaricides, 1 synergist, 3 insecticides...)
- Poisoning caused by the presence of toxic in waxes or on surface:
 - Building insecticide treatment
 - Wetting used during production of foundations ...
- Presence of artificial waxes with too low melting point
- Stearic acid? ...



Thank you
for your
attention

As bees, chose quality
products