

Liquefaction of Honey for Analysis by Fourier Transform Infrared Spectroscopy

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Fourier Transform Infrared Spectroscopy (FT-IR) is a rapid method for quantitatively determining several physico-chemical quality criteria of honey. For FT-IR, the honey samples are routinely liquefied at 55 °C for 8 h prior to analysis. However, we have experienced difficulties in liquefying some honey samples under these conditions. Therefore we tested different temperatures, time periods and honey quantities and investigated whether these different liquefaction conditions affected the physico-chemical measurands determined by FT-IR.

We used eight polyfloral honeys, which had previously been difficult to liquefy, as well as two dandelion honeys and two creamed honeys. Three samples of the polyfloral honeys as well as the creamed and dandelion honeys were successfully liquefied under all the conditions, two polyfloral honeys were liquefied at 60 °C 8 and 10 hours, but not at 55 °C 8 hours, and three polyfloral honeys could only be liquefied at 75 °C 4 and 6 hours.



Honeys liquefied at 55 °C 8h

Honeys liquefied at 75 °C 6h

25 honey samples with an electrical conductivity ranging from 0.3 to 1.3 mS/cm, fructose ranging from 30 to 43 g/100 g and glucose ranging from 22-40 g/100 g were liquefied at 55 °C 8 h and 75 °C 6 h. The samples were analyzed by FT-IR.

Honey	El. Conductivity		Fructose		Glucose		Water		pH	
	mS/cm		g/100g		g/100g		g/100g		g/100g	
	55 °C - 8h	75 °C - 6h	55 °C - 8h	75 °C - 6h	55 °C - 8h	75 °C - 6h	55 °C - 8h	75 °C - 6h	55 °C - 8h	75 °C - 6h
84217_1	1.0292	1.0516	30.67	30.57	22.67	22.63	15.06	15.14	4.62	4.60
84661_10	0.4083	0.4345	38.12	37.66	33.80	34.00	15.18	15.21	4.38	4.34
84661_12	0.2851	0.3159	43.12	42.59	25.67	25.70	15.84	15.97	4.14	4.18
88078_3	0.2932	0.3304	37.66	37.51	36.11	36.10	16.77	16.73	4.25	4.23

Table 1: Values of physico-chemical measurands of some examples of honeys liquefied at 55 °C 8 h and 75 °C 6 h

El. Conductivity	Fructose	Glucose	Water	pH
<0.001	<0.001	0.012	<0.001	0.002

Table 2: Wilcoxon Signed Ranks Test Probability comparing honey liquefaction at 55 °C and 75 °C (n = 25)

El. Conductivity	Fructose	Glucose	Water	pH
0.037 (6.90%)	0.237 (0.65%)	0.103 (0.32%)	0.048 (0.30%)	0.13 (3.00%)

Table 3: Mean difference (g/100 g) comparing the honey liquefaction at 55 °C vs. 75 °C (mean difference as % of mean of honeys liquefied at 55 °C 8h) (n = 25)

El. Conductivity	Fructose	Glucose	Water	pH
0.055	0.188	0.215	0.271	0.158

Table 4: Repeatability limit r of the method; r = 2.83 Sr

Analysis by FT-IR on the liquefied samples showed that when the temperature was raised from 55 °C to 75 °C the honey measurands electrical conductivity, fructose, glucose, water content and pH did change according to the Wilcoxon test (p-Value < 0.05) (SYSTAT V12). However, the change of glucose, fructose, water content and pH were in a range that is not critical for our analysis. Furthermore, the mean difference of the measurands glucose, water content and pH were within the repeatability limit of the method. The electrical conductivity, however, did not meet our requirements of accuracy and therefore recalibration is recommended.

Conclusion:

Liquefaction at 75 °C for 6 h is a suitable liquefaction condition for analysis of honeys that are difficult to liquefy. The honeys liquefied at 75 °C 6 h stayed clear for longer times and contained less air bubbles or foam than honeys liquefied at 55 °C 8 h.

The honey measurands glucose, fructose, water and pH differ within a range that is acceptable for our analysis. Therefore, honeys can be liquefied at 55 °C 8 h or 75 °C 6 h without the need of recalibration for analysis of these measurands.

The electrical conductivity is affected by temperature increase to an extent that is not suitable for our analysis. We recommend recalibration with honeys liquefied at 75 °C 6 h in order to obtain reliable results.