

Spectrophotometric Determination of the Honey Bee Quality

Mohammed H. Alsafran^{1,2}, Mohammed Akkbiq¹, Ahmad Ahmadi¹, Mohammad I. Ahmad*¹



جامعة قطر
QATAR UNIVERSITY

Faculty and Postdoc, Energy and Environment

¹ Central Laboratories Unit (QUCLU), Qatar University, Doha, Qatar

² Agricultural Research Station (QUARC), Qatar University, Doha, Qatar

Correspondence: * mohammad.ibrahim@qu.edu.qa

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Abstract



Honey bee, produced by bees from nectar in flowers and plants, is an aqueous supersaturated sugar solution, mainly monosaccharide (fructose and glucose) (70%–80%) and water (10%–20%). 5-Hydroxymethylfurfural (5-HMF) content in honey bee is an indicator of the purity. High concentration of 5-HMF in honey bee indicate over heating and poor storage conditions (The chemical properties of honey, free acids and total acids) significantly correlation with HMF content and provide parameters that used to make quick assessments of honey quality (Khalil et al., 2010). The recommended value of 5-HMF (Alinorm 01/25, 2000) and the European Union (Directive 110/2001) in honey usually should not exceed 80 or 40 mg/kg, respectively. This work aims to examine the concentration of 5-Hydroxymethylfurfural (5-HMF) content in different Qatari honey bee samples as an indicator of the honey bee quality by using the reference White Method.

Fig (1): Qatar University Agricultural Research Apiary

White Method for Determination of 5-Hydroxymethylfurfural (5-HMF)

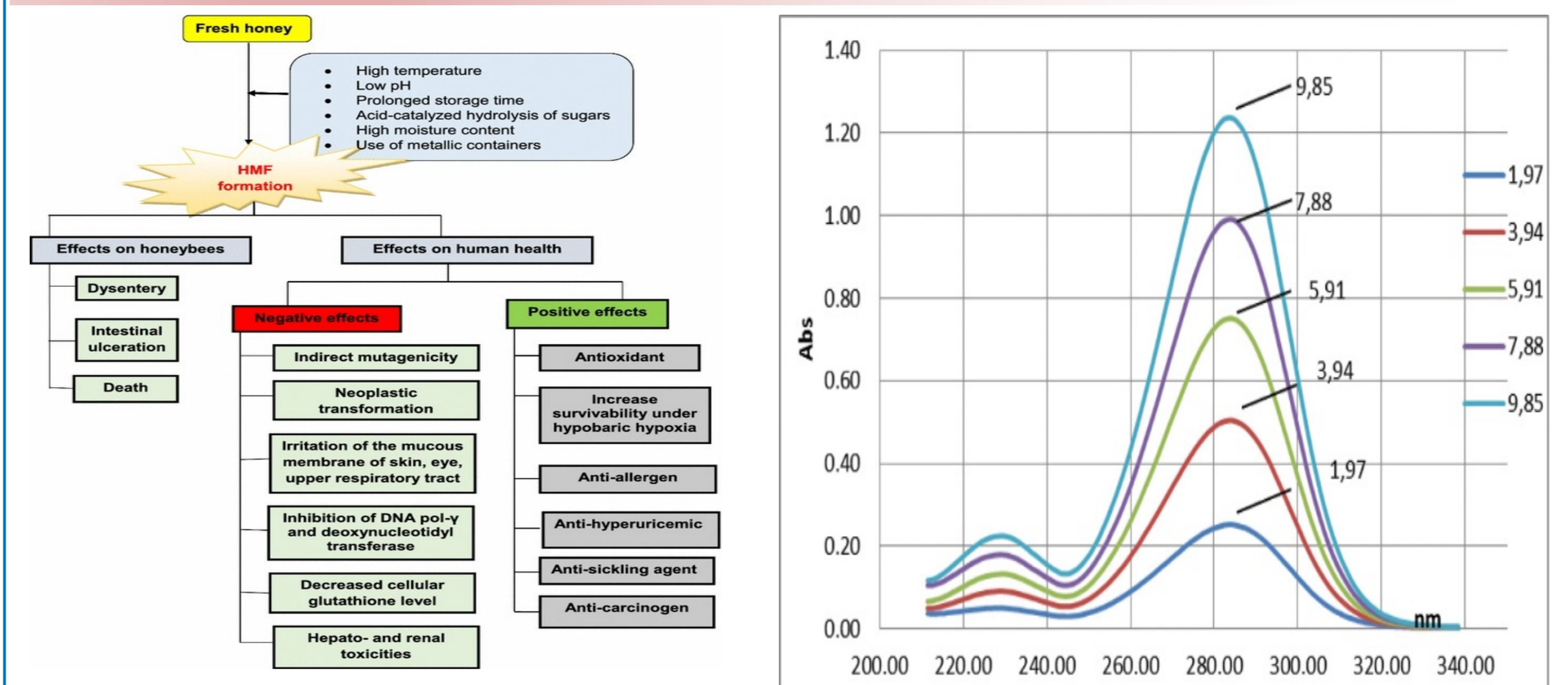


Fig (3): HMF effects on honey bee and human health (Shapla UM et al. 2018).

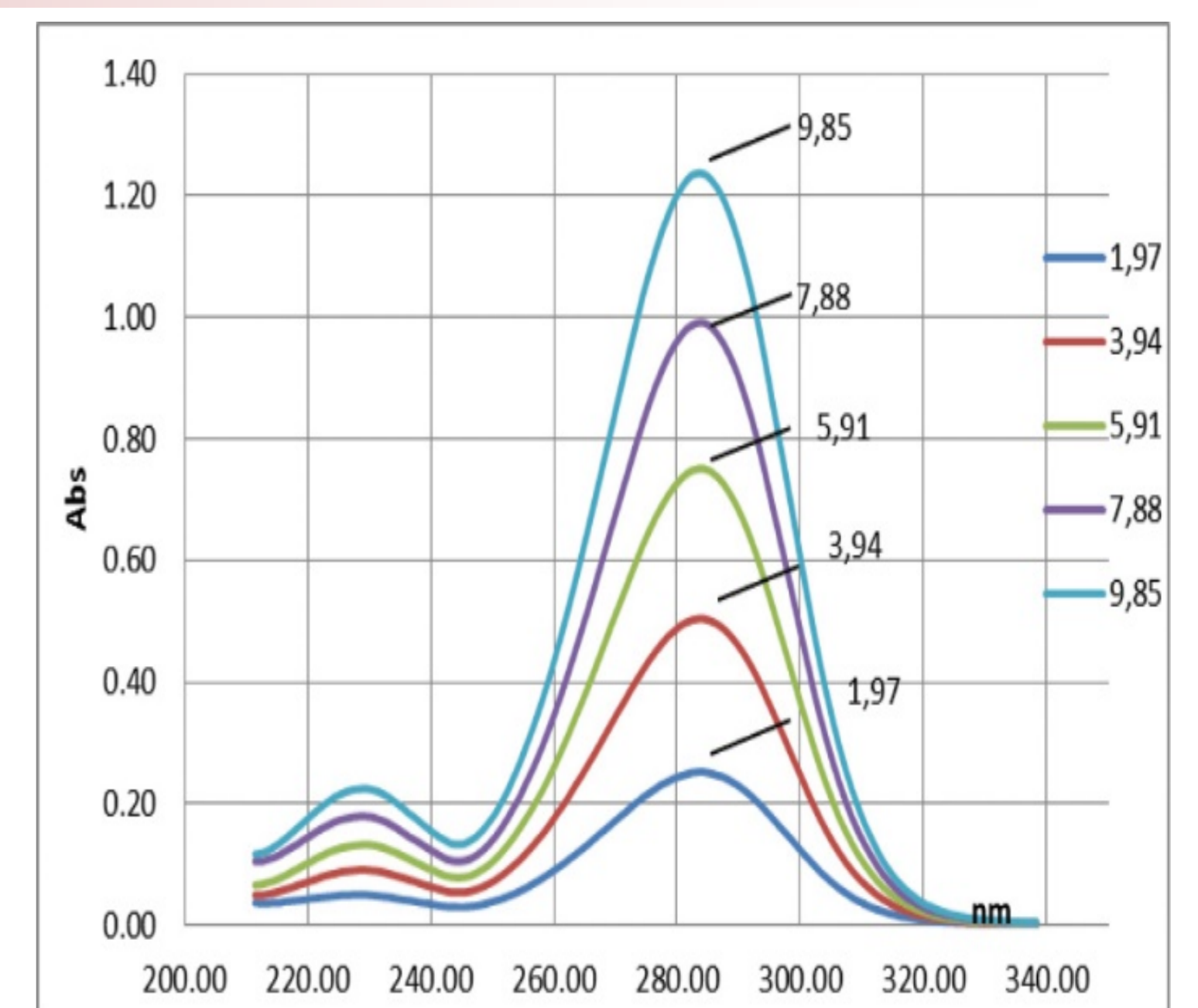


Fig (4): Spectra of 5-HMF at different concentrations (Hudz et al. 2018).

- ❖ 5g of honey bee sample was dissolved in 25 ml of water and transferred into a 50 ml volumetric flask.
- ❖ Then, 0.5 ml of Carrez solution I [consisting of 15 g of potassium hexacyano ferrate (II), $K_4Fe(CN)_6 \cdot 3H_2O$ in 100 ml of water] and 0.5 ml of Carrez solution II [consisting of 30 g of zinc acetate, $Zn(CH_3COO)_2$.
- ❖ 100ml of water were added, and the mixture was made up to 50 ml.
- ❖ The solution was filtered using filter paper after rejecting the first 10ml of the filtrate. Then, aliquots of 5ml were transferred into two test tubes.
- ❖ To the first tube, 5ml of distilled water was added, while 5ml of sodium bisulphate solution 0.2% was added to the second tube.
- ❖ The absorbance of the solutions at 284 and 336nm was determined.

Purpose

HMF

(5-Hydroxymethylfurfural)

As an Indicator of the quality of

your honey! by using the

White Method for analysis.

Beware of fake honey



Fig (2): 5-Hydroxymethylfurfural (5-HMF)

- ❖ **5-Hydroxymethylfurfural (5-HMF)** is a cyclic aldehyde produced by acids as a result of sugar degradation.
- ❖ **5-Hydroxymethylfurfural (5-HMF)** toxicological relevance has been clearly demonstrated (Khalil et al., 2010, Al-Farsi et al., 2018,).
- ❖ Cytotoxic, mutagenic, carcinogenic and genotoxic effects are among in vitro-activities attributed to **5-Hydroxymethylfurfural (5-HMF)** (Rizelio et al., 2012).
- ❖ **5-Hydroxymethylfurfural (5-HMF)** is usually absent in fresh and untreated honey but its concentration is also reported to increase as a result of heating processes or long-term storage (Al-Farsi et al., 2018; Erbakan et al., 2020).
- ❖ Due to the health concerns, **5-Hydroxymethylfurfural (5-HMF)** level in honey bee should be determined (Erbakan et al., 2020).

Measurements Results

Sample Code	Absorbion (Reagent 1)		Absorbion (Reagent 2)		Absorbion HMF (Difference)		Method	Data Interpretation	
	284 nm	336 nm	284 nm	336 nm	284 nm	336 nm		Pure Honey	None Pure Honey
QUCLU-21- 001-B1	0.375	0.1442	0.3384	0.1213	0.0366	0.0229	White Method	QUCLU-21- 001-B1	
QUCLU-21- 002-B1	1.4155	0.5084	1.429	0.4918	-0.0135	0.0166		QUCLU-21- 002-B1	
QUCLU-21- 003-B1	0.3334	0.1243	0.339	0.1192	-0.0056	0.0051		QUCLU-21- 003-B1	QUCLU-21- 004-B1
QUCLU-21- 004-B1	3.966	1.978	3.331	1.8922	0.635	0.0858		QUCLU-21- 005-B2	QUCLU-21- 007-B2
QUCLU-21- ARS-B1	0.5297	0.1814	0.4775	0.1561	0.0522	0.0253		QUCLU-21- ARS-B1	QUCLU-21- 009-DBH
QUCLU-21- 005-B2	0.5187	0.2134	0.5	0.1936	0.0187	0.0198		QUCLU-21- 005-B2	QUCLU-21- 010-BH
QUCLU-21- 006-B2	0.5752	0.1936	0.6009	0.1917	-0.0257	0.0019		QUCLU-21- 006-B2	
QUCLU-21- 007-B2	0.9859	0.1558	0.4484	0.1366	0.5375	0.0192		QUCLU-21- 007-B2	
QUCLU-21- 008-B2	0.9012	0.3079	0.8558	0.2765	0.0454	0.0314		QUCLU-21- 008-B2	
QUCLU-21- 009-DBH	2.4993	0.8607	1.7432	0.7736	0.7561	0.0871		QUCLU-21- 009-DBH	
QUCLU-21- 010-BH	2.7595	0.6122	1.278	0.5583	1.4815	0.0539		QUCLU-21- 010-BH	

Table (1): Quality testing results of nine samples of honey at the Central Laboratories Unit (QUCLU)

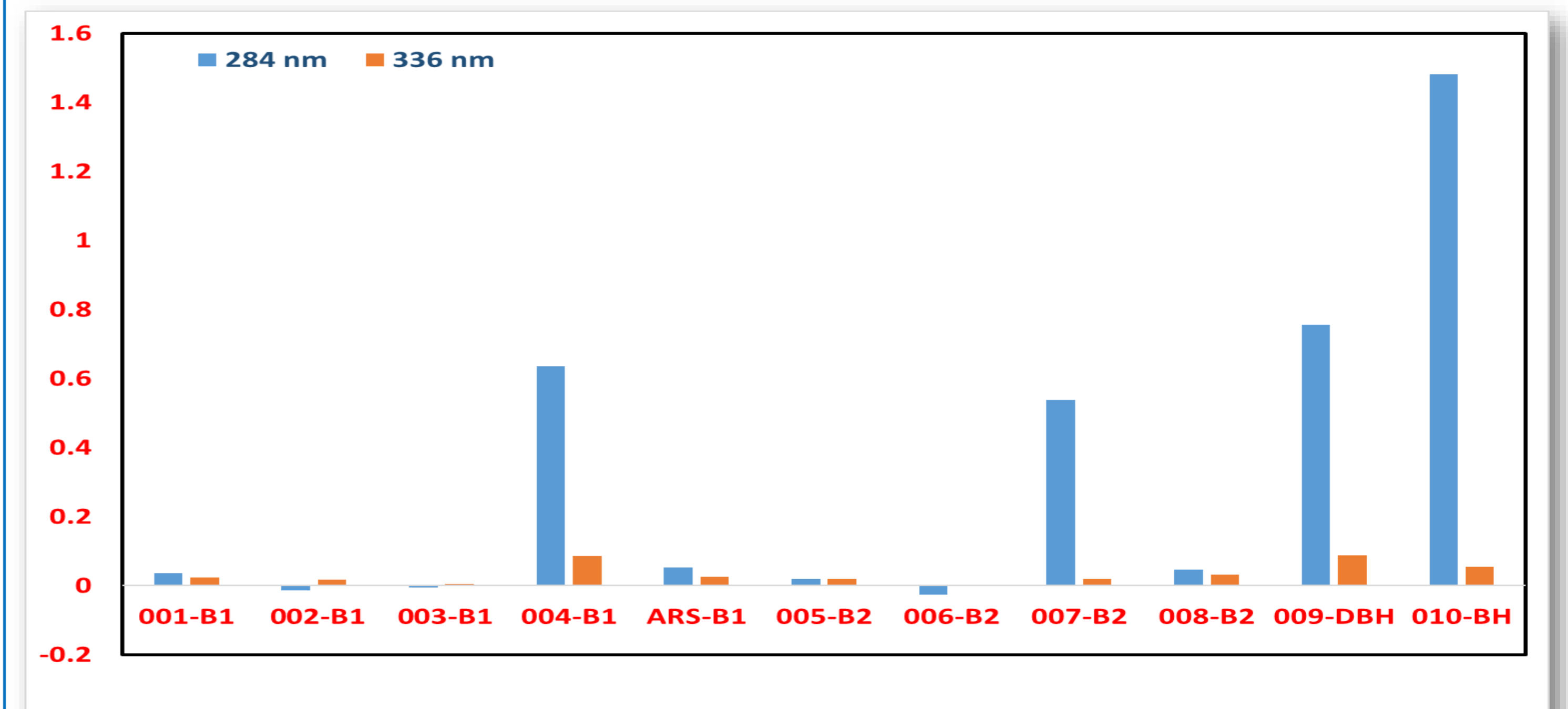


Fig (5): Quality testing results of 11 samples of honey at the Central Laboratories Unit (QUCLU)



Fig (6): Lambda 25 UV/VIS Spectrophotometer at the Central Laboratories Unit (QUCLU)

- ❖ The method was successfully applied on 11 collected honey bee samples at the Central Laboratories Unit (QUCLU), Qatar University by using Lambda 25 UV/VIS spectrophotometer.

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