

# Problems of quality and adulteration of honey in Russia

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## The sources of saccharides for adulteration of honey

The source of saccharides	Composition	Method of analysis
Maltose golden syrup	8% glucose, 37% maltose, high-molecular oligosaccharides	HPLC with Refractive Index Detector (HPLC-RID)
Starch acid golden syrup	15% glucose, 12% maltose, high-molecular oligosaccharides	
Starch golden syrup with high content of saccharides	25% glucose, 22% maltose, high-molecular oligosaccharides	
Caramel dark molasses	14% glucose, 11% maltose, high-molecular oligosaccharides	
Inverted syrup	39% glucose, 36% fructose, may be present 1 – 5% sucrose	

Honey

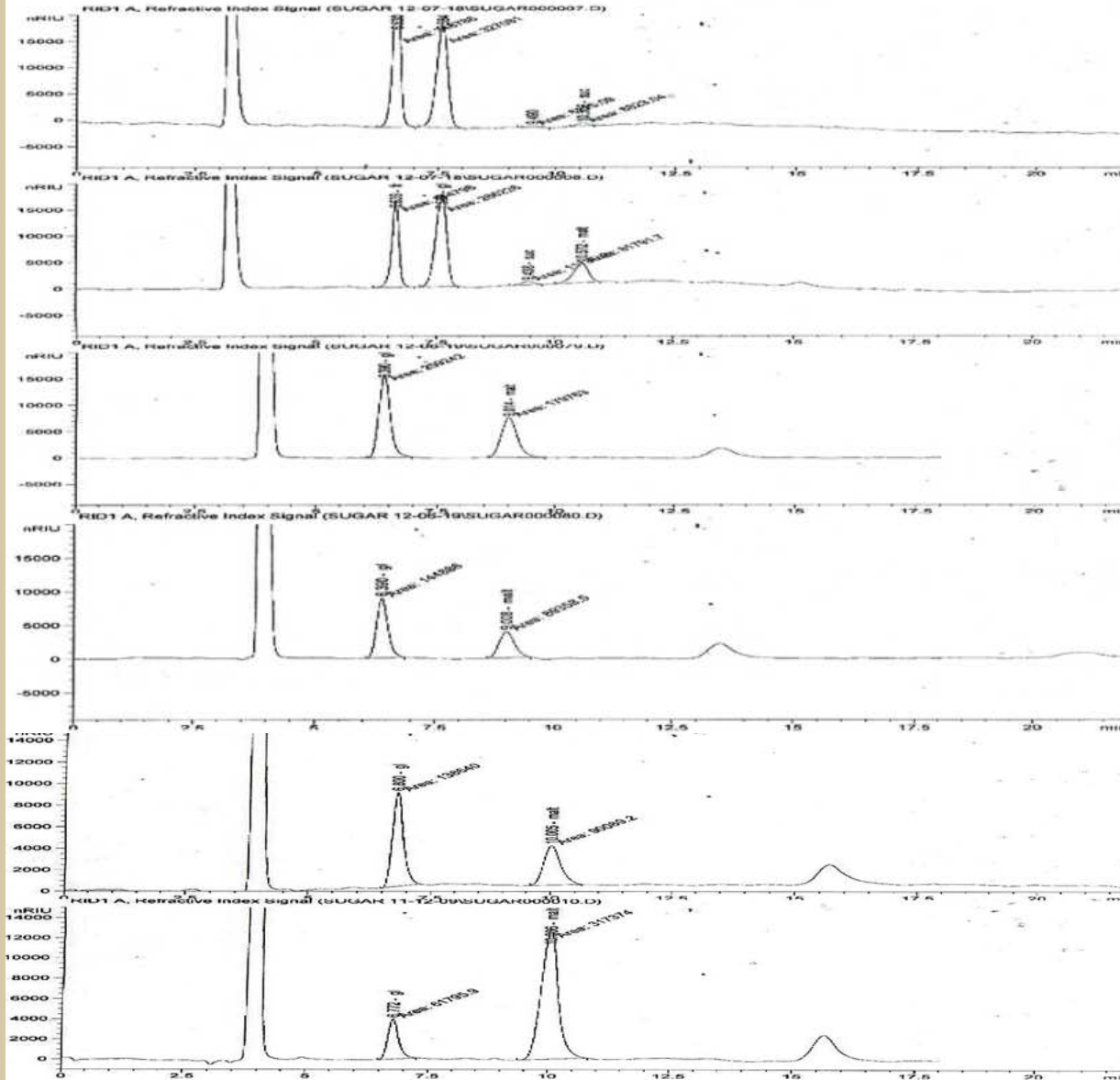
Honey with golden syrup

Starch golden syrup with high content of saccharides

Starch acid golden syrup

Caramel dark molasses

Maltose golden syrup



## Samples from Moscow honey fair



sample № 1 - honey

sample № 2 - adulterated honey



sample № 1 - sainfoin honey

sample № 2 - honey with propolis

sample № 3 - clove honey

sample № 4 - flower honey

sample № 5 - flower honey

## Test results

Sample	Parameter /The value							
	Water content, %	Sugars by HPLC (dry weight), %	Sucrose by HPLC (dry weight), %	HMF by HPLC, mg/kg	Diastase activity (dry weight, Gothe unit)	Total acidity, cm <sup>3</sup>	Pollen analysis	Insoluble matter, %
Norm	≤ 21	≥ 82	≤ 6	≤ 25	≥ 7	≤ 4	Not normalized	≤ 0,1%
sample № 1 - sainfoin honey	18,0	87,8 inc. fructose -41,7 glucose -46,1	sucrose 1,2 maltose 2,4	3,0	8,2	0,5	Single pollen grains of lime	> 1
sample № 2 - honey with propolis	19,8	88,7 inc. fructose -44,3 glucose -47,2	sucrose 1,7	17,0	10,6	1,6	Single pollen grains	> 1
sample № 3 - clove honey	18,0	91,9 inc fructose -44,2 glucose -47,7	sucrose 1,7	7,5	14,6	1,4	Single pollen grains of clove	> 1
sample № 4 - flower honey	20,2	83,5 inc fructose -39,8 glucose -43,7	sucrose 0,8 maltose 2,3	16	7,9	0,9	Single pollen grains of lime	> 1
sample № 5 - flower honey	18,0	75,1 inc fructose -35,6 glucose -39,5	Not detected	18,0	7,0	0,8	pollen grains not detected	> 1

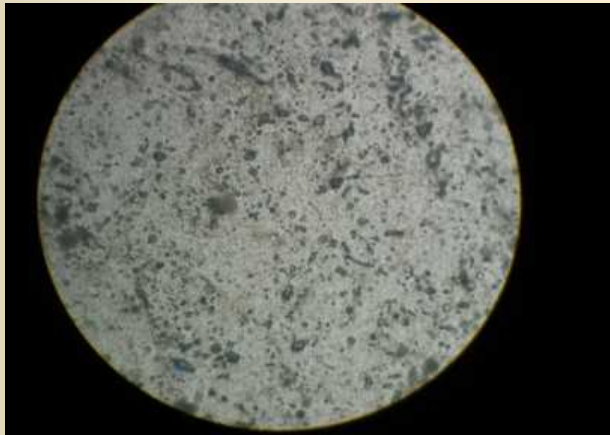
## Microscopic analysis



sample № 1 - sainfoin honey



sample № 3 - clove honey



sample № 5 - flower honey



Starch modified

"Apis Analytical Centre" received some other samples of honey



**Lime Far East  
(cream)**

**Sunflower  
(cream)**

**Honey**

**Lime Far East  
(cream-honey)**



**Mountain Tian Shan  
honey**



## Water solutions of Lime Honey



**Natural**

**Adulterated**

**The solution of falsified honey is opaque and heterogeneous.**

**When stirred we observe light opalescent layers like a gelatinous mass.**

## Melting of Lime Honey



**At 60°C adulterated honey does not melt.**

**Even at 80°C we did not able to obtain a melt.**

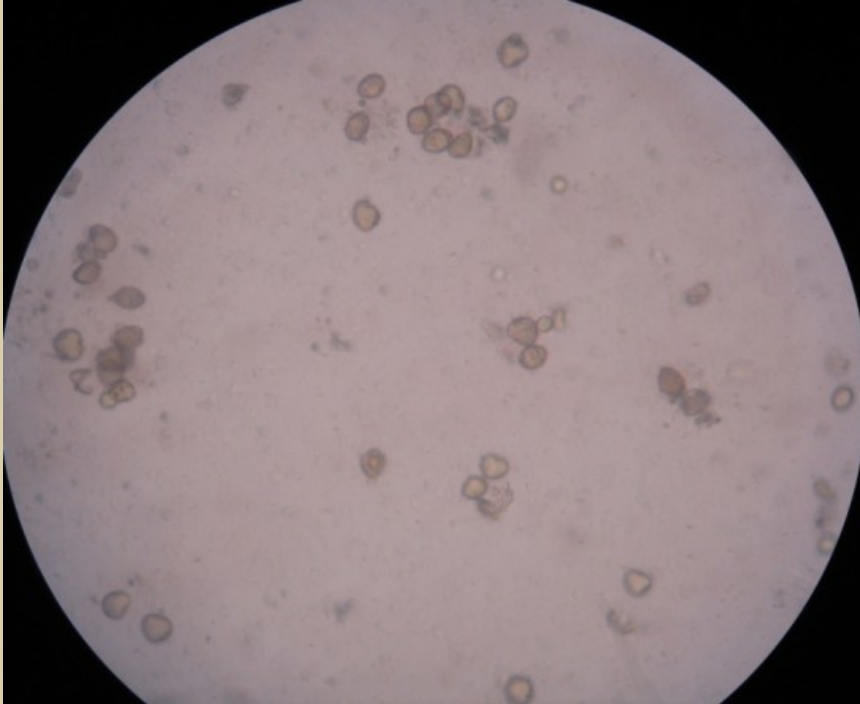
**Upon heating the surface of the sample formed significant layer of foam.**

## The results of physico-chemical studies

Parameter	Unit	The value		Norm according to GOST 19792-01	Method
		Sunflower cream	Lime Far East (cream)		
Water content	%	20,6	21,6	≤ 21	GOST R 53126-2008
Sugars by HPLC (dry weight))	%	68,3, inc. fructose – 31,7 Glucose – 36,6	84,2, inc. fructose – 39,8 Glucose – 44,4	≥ 82	GOST R 53883-2010
Sucrose by HPLC (dry weight)	%	Not detected	Not detected	≤ 6	GOST R 53883-2010
Diastase activity (dry weight)	Gothe unit	4,9	8,2	≥ 7	GOST R 54386-2011
Insoluble matter	%	0,2	0,7	≤ 0,1%	GOST R 54644-2011
Ash content	%	0,05*	0,16**	0,10 – 0,25* 0,30 – 0,45**	GOST R 52451-2005

## Microscopic analysis of Lime Honey

**Natural**



**A homogeneous background.  
Many pollen grains**

**Adulterated**



**Inhomogeneous background.  
There are one or two pollen  
grains**

## Microscopic analysis of Sunflower Honey



**Natural**



**Adulterated**

## Mountain Tian Shan Honey



**Pollen grains of Sunflower, sainfoin, sage, buckwheat, chestnut, lime, etc. are present.**

**The heterogeneous background indicates the presence of a large number of substances unusual for the natural composition of honey.**

## Conclusion on honey Tian Shan Mountain

The sample does not correspond to standard requirements:

- Content of reducing sugars - 73.7%  
(norm  $\geq 82\%$ )  
Inc. Glucose -37,9%, Fructose 35,8%
- Content of maltose - 7,0%
- Presence of oligosaccharides
- HMF - 153 mg/kg (norm  $\leq 25$  mg/kg)
- Diastase activity - 0 (norm  $\geq 7$  Gothe unit)
- Under microscope - a lot of unusual objects for honey.

The combination of these factors indicates that honeys were diluted.

When the content of water is 21% and room temperature of 20 ° C and a thick honeys are not stratified, it may be a result of presence of a thickening agent or gelling agent.

**Conclusion: honeys are adulterated.**

## Conclusion on Lime Honey

The sample does not correspond to standard requirements:

- Content of water - 21% (norm  $\leq 20\%$ );
- Content of reducing sugars - 95,0%,  
Inc. Glucose -48,6%, Fructose - 46,4%
- Diastase activity - 7,8 Gothe unit  
( norm  $\geq 11$ );
- Ash content - 0,15% (norm  $\geq 0,30\%$ );
- Under microscope - a lot of unusual objects for honey.

## The reactions of honey with iodine solution



The aqueous solutions of honey are colored in yellow.  
An aqueous solutions of honey adulterated with modified starch are  
**colored in reddish-brown when adding the iodine solution.**  
**This is a sign of falsification**



## Conclusions

All samples of falsified honey showed signs of:

- Unnatural color, taste, aroma, texture;
- Presence of impurities while performing microscopic analysis;
- Presence of substances that prevent melting of the sample;
- Prevalence of glucose over fructose;
- Inconsistency of physical-chemical requirements with respect to the state standard;
- High content of water insoluble matter;
- A very small quantity of ash.

## Suggestion

In Russian Federation

to protect consumers and honest beekeepers from falsified products,  
to inform the buyers, we propose to introduce the new term

**«honey product»**

to identify the adulterated honey from natural honey.

**THANK  
YOU  
FOR**

**ATTENTION!**

