

Honey Adulteration 2.0 Unauthorized Addition of Products for Quality Manipulation

The detection of unauthorized additions of various sugar syrups from different sources (corn, rice, sugar beet, sugar cane, wheat, etc.) has been the focus of honey analysis for years. In the meantime, however, these foreign sugar, additives can be detected very well with the available analytical methods, whereby modern analysis by means of NMR or LC-HRMS has proven to be particularly powerful for this detection.

Such sugar syrups are used according to experience in an order of magnitude of 10-20% or higher and must therefore also be able to be detected in this range by laboratories. However, the situation is quite different with new types of products on the market which are "merely" used in the range of less than 1% in order to already significantly influence certain quality parameters in honey. It is therefore not a matter of adding sugar syrups foreign to honey simply to increase the margin, but rather the products used aim to positively influence or conceal the quality of defective honey. Nevertheless, such an additive is not allowed and violates the European Directive 2001/110/EC, so that the honey must be considered inauthentic.

In a first step, we would therefore like to provide information about two such products for the first time, as well as demonstrate the possibilities and limitations of analytics.

1. **Addition of Products for the Unauthorized Lowering of the Hydroxymethylfurfural Content (HMF-LESS products).**

Hydroxymethylfurfural (HMF) is an extremely important quality parameter in honey analysis, regulated in the European Honey Regulation and limited to 40mg/kg for table honeys (exceptions are honeys of tropical origin and mixtures thereof. For these honeys, a maximum value of 80 mg/kg HMF is permissible).

The HMF content in honeys increases due to storage and/or heating. Increased HMF values therefore represent a quality defect.

Table honeys with HMF contents greater than 40 mg/kg must therefore be labelled as industrial honeys. They are therefore only used in a limited range and achieve significantly lower prices on the international honey market.

With the illegal use of the new HMF- LESS products can now be treated honeys that have an increased HMF value. The treatment is carried out exclusively by addition and a certain exposure time to the honey. The HMF value decreases, other honey parameters (diastase, saccharase), which would also indicate a quality deficiency, remain unaffected. The added product remains in the honey and is thus also consumed! This circumstance is particularly critical, because currently there is no information about the harmlessness of such treatments in relation to human consumption.

In summary, the use of HMF-LESS products fools the buyer into believing that the honey is of good quality, even though it is illegally embellished with potentially questionable additives.

FoodQS has therefore addressed this issue by characterizing HMF- LESS products to develop an analytical method that detects treatment or addition.

Display of individual quality parameters after addition of "HMF-LESS" product

Type of honey	Measured values			Measured values after heating			Measured values after heating PLUS "HMF-LESS"		
	HMF (mg/kg)	diastase (DZ)	saccharase (U/kg)	HMF (mg/kg)	diastase (DZ)	saccharase (U/kg)	HMF (mg/kg)	diastase (DZ)	saccharase (U/kg)
Flower	5,7	13,6	32,0	21,7	7,2	<5	2,7	11,2	32,2
Flower	5,0	25,9	102,2	8,9	18,1	10,6	5,3	21,5	44,5
Flower	6,2	12,7	48,0	19,4	6,6	<5	1	11,3	41
Flower	87,0	13,0	24,2	110,8	7,5	<5	44,7	12,2	27,9
Flower	18,2	13,6	48,1	21,0	7,0	<5	1	11,2	50,6
Flower	9,1	21,6	63,7	25,1	11,7	<5	6,5	17,5	56,3
Flower	10,6	17,3	48,8	27,6	11,6	<5	1	15,9	39,8
Linden	3,5	16,3	80,0	8,6	12,5	11,1	1	15,7	41,8
Pine	11,6	21,3	76,4	27,6	14,7	9,2	7	17,5	56,3
Forest	5,8	24,7	102,6	27,2	19,2	19,0	3,8	23,6	66,9
Forest	4,3	33,5	119,1	23,3	26,2	14,1	5,4	32,8	70
Fir tree	6,5	27,2	72,9	19,1	20	12,3	1	23,9	45,8

The decrease of the HMF content as well as the stability of the diastase activity are clearly visible. Even the activity of saccharase is hardly affected; only some honeys with high invertase activities show a weak loss of activity.

Extensive testing of HMF-LESS products, using a breadth of analytical methods, reveals many potential characteristics that can be used to detect treatment.

Realistically, however, only a small part of these characteristics is suitable for analytical detection of honey treatment, since many potential "markers", due to the very low dosage (less than 1%) of HMF-LESS products, practically disappear in treated honeys.

Some honeys treated with HMF-LESS products are already in circulation, as we could prove with our newly developed method.

The majority of the samples originated from Eastern or South-eastern Europe, and their HMF values were mostly in the range <10 mg/kg.

Proof of the application of an HMF-LESS product can be clearly established and is carried out by means of several different measurement techniques.

2. Addition of Products for Unauthorized Increase of Diastase Activity (Diastase-PLUS products).

The enzyme diastase, analytically detectable as diastase activity (unit: diastase number (DZ) according to Schade), is added by the bee to the nectar and is thus a component of each honey. Depending on the different types of honey, the natural diastase activity varies from approx. 10 -60

The diastase activity, like the HMF content, is a quality indicator for possible heat exposure or long storage. In case of unsuitable storage, the heat-sensitive enzyme in the honey is damaged and the diastase number decreases. Thus, in the European honey regulation, the diastase activity is set at a minimum value of 8, with some exceptions.

Honeys with diastase activities less than 8 may therefore (as a rule) no longer be declared as table honey.



With the unauthorized use, i.e. the addition of Diastase-PLUS products to honey, the diastase activity can be increased and a better quality is feigned.

The addition of Diastase-PLUS products takes place in the range smaller than 0.5% and increases the diastase activity by 15-25 units. It is thus also possible to bring a honey stretched with sugar syrup to a desired diastase value.

The diastases in Diastase-PLUS products are very similar to the bee's own diastase and are also detected in honeys using the established analytical methods for diastase determination (Schade, Phadebas, Nitrophenol method).

However, existing and established analytical detection methods for the determination of non-honey diastase activities (heat-stable diastase or non-honey diastase) do not indicate such an addition. These detection methods were developed to detect honey foreign diastases used in the production of sugar syrups.

FoodQS has addressed this issue and developed a detection method for an addition of diastases from Diastase-PLUS products.

This novel method thus allows the distinction between honeyed diastase and added ("false") diastase.

Many internal tests of honeys from all over the world have already shown positive results for Diastase PLUS products. The majority of the affected samples originate from Eastern or South-eastern Europe.

We are now pleased to officially offer this analysis to interested customers:

Detection HMF-LESS products:	FoodQS Code 951: €125,00
Detection Diastase-PLUS products:	FoodQS Code 952: €125,00

Of course, the analytics are accredited according to DIN EN ISO/IEC 17025:2018.

We're pleased to be able to offer with this analysis two additional possibilities, which are a part of advancing the authenticity of honey analysis.

We're at your disposal to answer all questions you may have.

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