THE EFFECT OF THERMAL TRATAMENT ON FRESH MONOFLORAL HONEY TYPES FROM BIHOR COUNTY

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Abstract

The processing methods used for honey together with the storage condition can affect his quality especially regarding the temperature of the treatments. Thermal treatment is used for facilitating the filling and for delaying the crystallization process In this study, we determined the HMF content and we examined the effects of the thermal treatment, which is applied in practice by the producers on two monofloral types of honey - Chestnut (Castanea sativa L.) and Lime ((Tilia SPP). The samples were heated at 50, 60, 70, 90 and 100 °C for 1, 4 , 8, 1, and 24 hours and the HMF content was determined after the treatment. So we could determine that overheating is not needed for processing means/ purposes like filling and packaging for artisanal honey. For the Chestnut honey the limit of 40 mg/kg was exceeded after 4 hours at 90^0C and for Lime honey (bio) after 24 hours at 70 °C.

Key words: artisanal fresh honey, HMF, thermal treatment

INTRODUCTION

As is well known, honey is an animal origin food, very important both for his nutritional characteristics as for its benefits for the human health mainly because of his antioxidants constituents (Meda et al, 2007, Bertoncelj et al, 2007) and antimicrobial properties (Varga, 2006, Gomes et al, 2010). Honey is not only an important energy source, but it is also used for manufactured food especially for cereal-based products (Rodrigues et al, 2004) and dairy products (Varga, 2006).

According to Council Directive 2001/110/Ec **"**Honey is the natural sweet substance produced by *Apis mellifera* bees from the nectar of plants or from secretions of living parts of plants or excretions of plant-sucking insects on the living parts of plants, which the bees collect, transform by combining with specific substances of their own, deposit, dehydrate, store and leave in honeycombs to ripen and mature". So according to their origin, we have blossom honey or nectar honey obtained from the nectar of plants and honeydew honey obtained mainly from excretions of plant sucking insects (*Hemiptera*) on the living part of plants or secretions of living parts of plants. Baker's honey is a honey which is suitable for industrial uses or as an ingredient in other foodstuffs which are then processed and may have a

foreign taste or odour, or have begun to ferment or have fermented, or have been overheated.

The composition and the properties of the honey depends, first of all, on the floral origin in relation with the geographic area and the climate regime (Turhan et al., 2007). But the processing methods used together with the storage condition can affect the honey quality (White, 1994) especially regarding the temperature of the treatments applied (Nagai et al, 2001).

Thermal treatment is used for facilitating the filling and for delaying the crystallization process (Tosi et al, 2002). Hydroxymethylfurfural (HMF) is considered the most important degradative product of heated honey especially at pH 5 or lower or by the Maillard reaction (Fennema, 1996 quoted by Turhan, 2007). So it is considerate an excellent indicator of the honey's freshness. According to ANNEX II - Composition Criteria for Honey of the Council Directive 2001/110/Ec, HMF content of honey should be under 40 mg kg^{-1} in general, except baker's honey and under 80 mg kg^{-1} for honeys of declared origin from regions with tropical climate

In this study, we determined the HMF content on untratated honey and we examined the effects of thermal treatment which is applied in practice by the producers.

MATERIALS AND METHODS

Materials

The samples consist in two monofloral type of honey Chestnut (*Castanea sativa L.*) and Lime ((*Tilia SPP*) which ware purchased in the market in Oradea town. The source was three different beekeepers for Chestnut honey and two different beekeepers for Lime honey. The Lime honey was labeled as "bio". The samples were purchased from local beekeepers in glass bottles of 1 kg for each honey type.

All samples were from the 2010.

Methods

HMF content

For the determination of HMF, the spectrophotometric White method (White, 1979) was used (Zappal et al, 2005, Bogdanov, 1999). This method involves measurement of UV absorbance of clarified aqueous honey solutions with and without metabisulphite. So 5g honey were dissolved in 25 ml of distilled water, transferred quantitatively into a 50 ml volumetric flask, added by 0.5 ml of Carrez solution I and 0.5 ml of Carez solution II and made up to 50 ml with water. The solution was filtered through paper, rejecting the first 10 ml of the filtrate. Aliquots of 5 ml were put in two test tubes; 5 ml of distilled water were added to one tube; 5 ml of sodium metabisulphite solution 0.2% (reference solution) were added to the second

tube. The absorbance of the solutions at 284 and 336 nm was determined using an UV-Visible mini – 1240 Shimadzu spectrophotometer. HMF is formed during acid-catalyzed dehydration of hexoses and it is connected to the chemical properties of honey.

Thermal treatment

The honey samples were heated at 50, 60, 70, 90 and 100 °C for 1, 4 , 8, 12 and 24 hours. Then they were cooled down to 4 °C by immediately plunging the tubes in an ice bath and analyzed. The samples were filled into watertight tubes.

RESULTS AND DISCUSSIONS

Tables 1 and 2 show the values of HMF at different temperatures for different heating times. As we expected, there is an increase of HMF after heating.

Table 1

Chestnut honey, HMF formation at different temperatures (mg kg^{-1}) (*n*=3)

A	Heating temperatures				
	50°C	**60 °C**	**70 °C**	**90 °C**	**100 °C**
	Mean ± sd				
Initial	1,028±0.44				
1	1,041±0.11	1,064±0,07	2,215±0,21	32,021±5,22	44,261±2,09
4	0,961±0,44	1,919±0,04	2,814±0,06	56,058±3,89	68,005±11,28
8	1,215±0,29	2,408±0,23	6,711±0,17	174,601±8,22	312,442±40,01
12	2,241±0,08	5,191±0,81	11,744±0,10	695,113±11,09	708,733±36,34
24	4,147±0.72	7,311±0,59	26,166±0,41	914,207±41,22	1301,116±37,22

Legend: A - Thermal treatment, hours

The results obtained for initial HMF contents in both tested honeys were lower than the maximum limit allowed of 40 mg kg^{-1} recommended by the directive of the European Union Council and Codex Alimentarius, so they were not subject to overheating.

From the results, we have noticed that heating at 70 °C for up to 24 hours in Chestnut honey and up to 12 hours in Lime honey did not cause an increase (lower than 40 mg kg^{-1}) of HMF over the permitted European limits. For Chestnut honey the same result is noticed by heating at 90°C under one hour.

Table 2

Lime honey (bio), HMF formation at different temperatures (mg kg^{-1}) (*n*=2)

A	Heating temperatures				
	50°C	**60 °C**	**70 °C**	**90 °C**	**100 °C**
	Mean ± sd				
Initial	0,806±0.05				
1	0,816±0,07	0,988±0,22	4,488±0,09	40,019±3,11	54,155±6,17
4	1,040±0,02	2,491±0,09	12,912±1,17	44,802±4,53	80,508±11,28
8	1,881±0,19	3,166±0.45	19,223±0,52	202,633±23,11	273,113±38,08
12	3,156±0,98	5,737±0,34	28,215±2,27	710,089±11,44	890,082±25,19
24	5,940±2,14	12,671±1,08	51,128±4,91	1121,311±37,51	1419,019±54,22

Legend: A - Thermal treatment, hours

In Chestnut honey HMF contents were higher than 40 mg kg^{-1} over 4 hours for 90 °C and under 1 hour at 100 °C. This results are in good concordance with that reported by Fallico (Fallico et al, 2004) with the observation that the starting values are higher in this study.

For Lime honey, HMF concentrations were found higher than 40 mg kg^{-1} over 24 hours for 70 °C, over 1 hour at 90 °C and under 1 hour at 100 °C. It was previously reported that there was no direct relationship / connection between the composition of honey and HMF ratio, but botanical origin was considered to affect formation rate (Nozal et al, 2001)

CONCLUSIONS

The results lead to some conclusions:

- both types of tested honey contain low amounts of HMF at normal temperature
- overheating is not needed for processing purposes like filling and packaging for artisanal honeys. For the Chestnut honey the limit was exceeded after 12 hours at 70^0C and for Lime honey (bio) after 48 hours at 60 °C
- both types of honey did not contain significant amounts of HMF at practicable low temperatures used for processing;
- the HMF level can be used as a parameter of over heating but for some monofloral honeys the present limit of 40 mg kg^{-1} seams to be too high.

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