

# **Effect of heat treatment and microwave radiation on the antioxidant properties of honeydew honey.**

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## **Abstract**

Antioxidant activity of honeydew honey were measured before and after thermal and microwave processing. Total phenolic content were measured using Folin-Ciocalteu reagent and the results were expressed as mg of gallic acid per 100 g of honey sample. The antioxidant activity with stable ABTS<sup>•+</sup> radical cation and the antioxidant activity against DPPH<sup>•</sup> were also done.

It has been shown that the antioxidant potential of honey-dew has decreased under the influence of both conventional heating and microwave radiation (expressed as% reduction of ABTS and total phenolic content). There was an increase of antioxidant properties of conventional heating under the influence (expressed as% reduction of DPPH).

## **Introduction**

Honey is well known as a healthy, natural food with high concentration of monosaccharides, bioactive compounds and antioxidants (Al-Mamary, Al-Meer, i Al-Habori 2002; Erejuwa, Sulaiman, i Ab Wahab 2012). Especially this last feature is extensively emphasized lately (Al-Mamary, Al-Meer, i Al-Habori 2002; Bertonecclj et al. 2007; Erejuwa, Sulaiman, i Ab Wahab 2012; Wilczynska 2010).

Microwave irradiation is a commonly use in food technology for heating, defrosting and preservative purposes. The influence of microwaves on enzymes and microorganism

allows to lower both contamination and sterilization of the product (Decareau i Schweigert 1985).

Microwave irradiation may be the solution for liquefying of honey without the lost of bioactivity. Microwaves as an example of volumetric heating will influence on the state of aggregation and due to the microwave matter interaction may be applied at short time. It results in reducing of quality losses in honey (Kowalski et al. 2012).

The main aim of the study was to determine the effect of microwave radiation on antioxidant activity of honeydew honey.

## **Materials and Methods**

Honeydew honey was heated at 90°C for 60 minutes and treated with microwave radiation at constant power level of 1.26 W / g for 6 minutes. During processing the temperature profiles were recorded using two-channel fiberoptic thermometer Reflex RFX-2 (Neoptix, Canada).

Total phenolic content were measured using Folin-Ciocalteau reagent (Meda et al. 2005). Standard curve were made for gallic acid in the range from 40 to 200 mg/L ( $R^2=0.9987$ ) with limits of detection and quantification of 7.95 and 24.09 mg/L respectively. Results were expressed as mg of gallic acid per 100 g of honey sample. Measurements were done in duplicated.

The antioxidant activity with stable  $ABTS^{*+}$  radical cation were done according to Baltrusaityte et al. (Baltrusaityte, Venskutonis, i Ceksteryte 2007) based on work of Re at al. (Re et al. 1999) and the antioxidant activity against  $DPPH^*$  were done according to Turkmen et al. (Turkmen et al. 2006). The scavenging activity (both against  $ABTS^{*+}$  and  $DPPH^*$ ) was expressed as a percent of suppression of  $DPPH^*$  or  $ABTS^{*+}$  radical and calculated as follows:

$$SA[\%]=\frac{(Abs_{blank} - Abs_{sample})}{Abs_{blank}} \times 100\%$$

where SA =  $DPPH^*$  or  $ABTS^{*+}$  inhibition;  $Abs_{blank}$  = absorption of a blank sample);  $Abs_{sample}$  = absorption of a tested honey sample

## Results and discussion

Temperature variations profiles during conventional as well as microwave processes are shown on figures 1 and 2. As shown on Figure 1, during conventional heating after about 20 minutes, the temperature has reached the value of 90°C. During action of microwave field, a continuous increase in temperature was observed. After 6 minutes, honey temperature was 95°C.

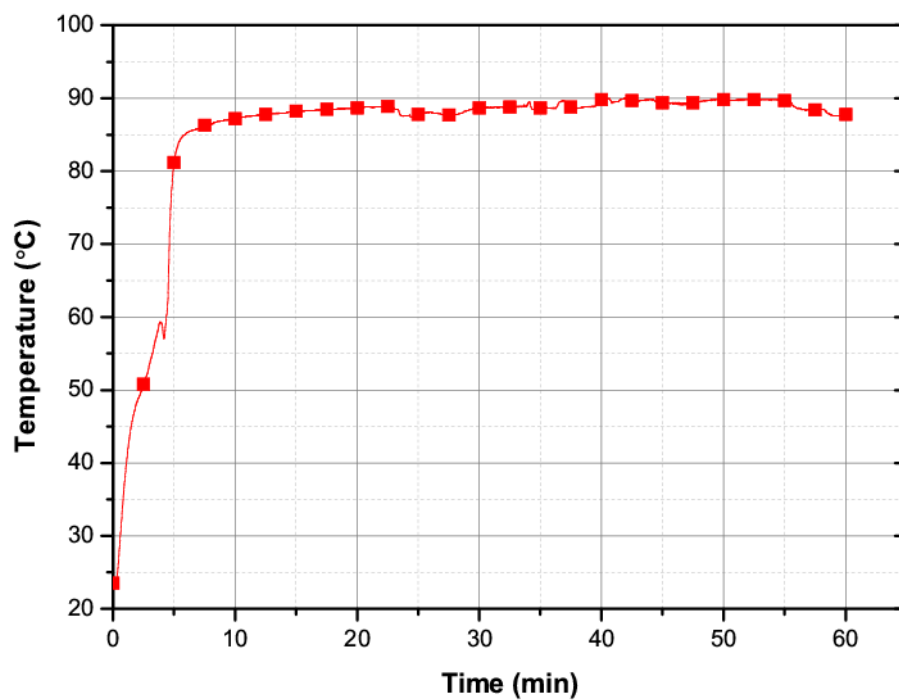


Figure 1 Temperature profile of conventional heated honeydew honey.

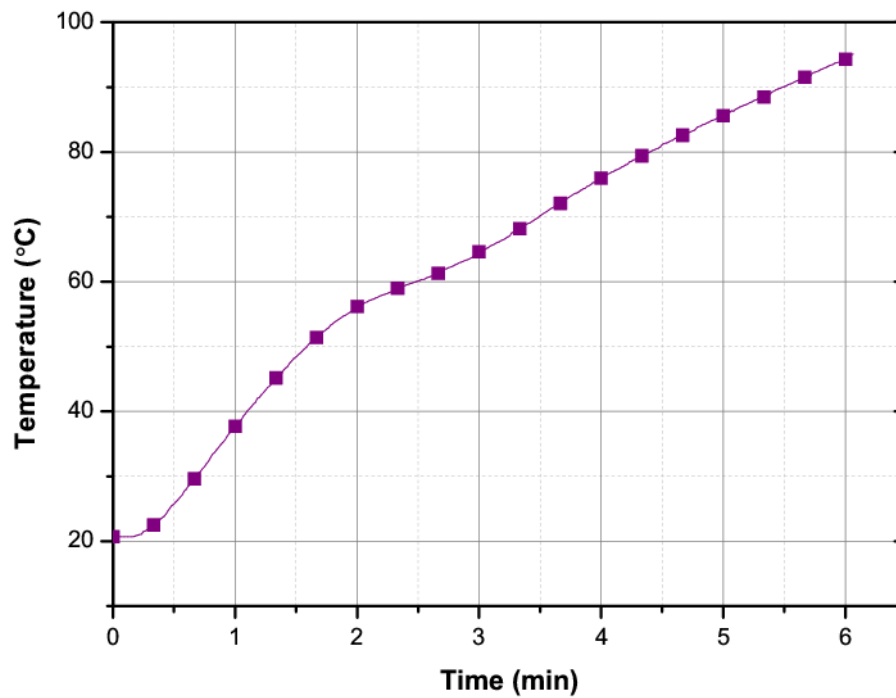


Figure 2 Temperature profile of microwave heated honeydew honey.

It well known that honeys can exhibit same antioxidant activates. This features are botanical origin dependent. The effect of the thermal processes and the impact of microwave field on the antioxidant properties of honeydew honey were examined. Changes in the antioxidant properties of honey before and after thermal processing were measured by the reaction with  $ABTS^{*+}$ ,  $DPPH^*$  and Folin-Ciocalteau reagent. Honeydew honey antioxidant activity was 109.2 mg GAE/100g and 86.9, and 60% (percentage of scavenging of  $DPPH^*$  and  $ABTS^{*+}$  respectively) (figure 3 and 4).

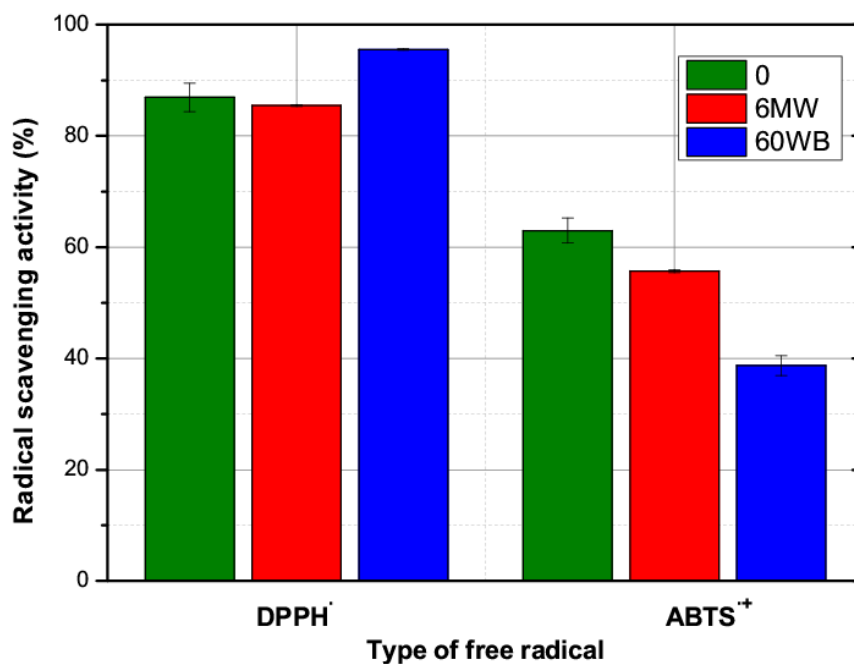


Figure 3 Radical scavenging activity of honeydew honey against DPPH• and ABTS•+

In studies on the antioxidant activity of Polish honey was found that these values for honeydew honey are 58-72, 72-83, 9-12, (mg GAE/100g;% DPPH•, %ABTS•+), respectively (Wilczynska, 2010). In the present study, the total polyphenols content of honeydew honey was higher as well as the values obtained by the reaction with ABTS•+. It should be noted that in the Wilczynska's studies (Wilczynska, 2010) all values, obtained for wild range of honeys with different botanical origin, in the reaction with ABTS•+ were very low, and not exceeded 30%. Other authors have reported that the antioxidant activity of honey as measured by reaction with ABTS•+ were in the range of 50 to 95% of the free radical scavenging (Baltrusaityte et al., 2007).

Certain similarities in the changes of antioxidant properties expressed by reaction with Folin-Ciocalteu reagent and ABTS•+ has been found.

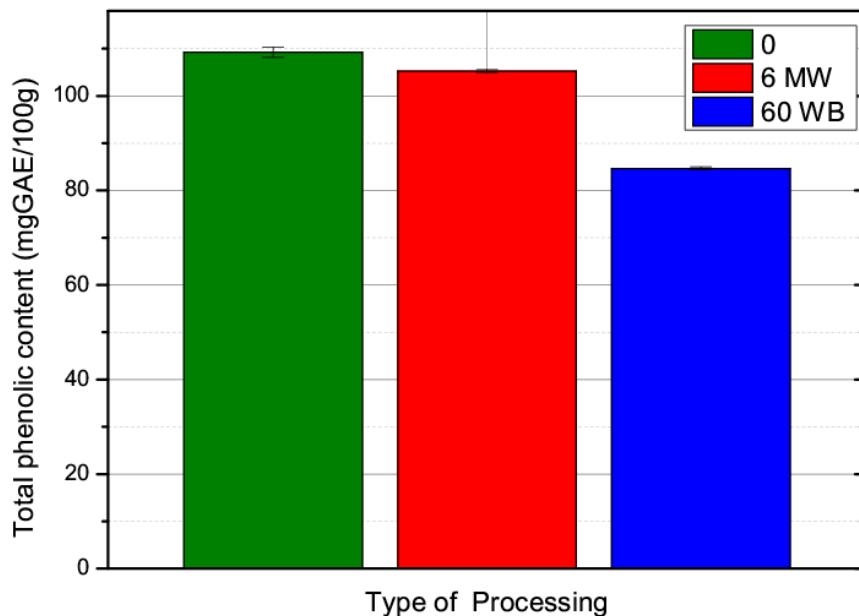


Figure 4 Total phenolic content of honeydew honey

Going into the details, there was a decrease in antioxidant properties of honeydew honey after processing. These decreases were statistically significant for honey treated with microwave field as well as conventionally heated ones. In the latter case, the changes were the greatest.

### Conclusions

Operating parameters of thermal honey processing (time, temperature, microwave power of fields) used in this experiment were much stricter than those used for casual honey confectioning. However, even so did not induce significant changes in the quality of honey (with respect to antioxidant activity). The observed changes were associated usually with an increase in antioxidant potential of honey. Thus, it can be expected that using more gentle parameters of treatment such quality features of honey will not be changed

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