HONEY STORAGE

Storage containers should be made out of aluminium, stainless steel or plastic material. Corrosive metal containers should be coated with appropriate coatings, resistant to acidity. Honey is offered in a great variety of jars. Glass is used mostly, but other materials, e.g. plastic, earthenware can be also used, provided that they are resistant to the action of honey.

Honey can be stored for longer period of time, if stored under optimum conditions. Honey should be stored in airtight containerts to prevent damage due to odours and humidity. Optimum temperature is 10-16°. The relative humidity of the storage rooms should be less than 65 %. Honey quality decreases with increasing temperature: the HMF content increases, while the enzyme activity decreases (see below). Prolonged storage at 50°C results in a decrease of aroma compounds.

Storage and influence on honey parameters
(after White, 1975)

<table>
<thead>
<tr>
<th>Storage temperature °C</th>
<th>Time for the formation of 40 mg HMF/kg</th>
<th>Half-life* of Amylase activity</th>
<th>Half-life* of Invertase activity</th>
</tr>
</thead>
<tbody>
<tr>
<td>10</td>
<td>10-20 years</td>
<td>35 years</td>
<td>26 years</td>
</tr>
<tr>
<td>20</td>
<td>2 - 4 years</td>
<td>4 years</td>
<td>2 years</td>
</tr>
<tr>
<td>30</td>
<td>0,5 - 1 years</td>
<td>200 days</td>
<td>83 days</td>
</tr>
<tr>
<td>40</td>
<td>1 - 2 months</td>
<td>31 days</td>
<td>9,6 days</td>
</tr>
<tr>
<td>50</td>
<td>5 - 10 days</td>
<td>5,4 days</td>
<td>1,3 days</td>
</tr>
<tr>
<td>60</td>
<td>1 - 2 days</td>
<td>1 day</td>
<td>4,7 hours</td>
</tr>
<tr>
<td>70</td>
<td>6 - 20 hours</td>
<td>5,3 hours</td>
<td>47 minutes</td>
</tr>
</tbody>
</table>

* Half-life: Time necessary for a decrease of the enzyme activity by 50 %.

Change of honey colour

left: in the light at room temperature
middle: in the dark at room temperature
right: in the dark at 15°;
CRISTALLISATION

The honey crystallization is a natural process. This depends on the following factors:

Sugar content

The higher the glucose content, the faster the crystallization. Honeys with more than 28% glucose crystallize fast. Honeys dew honeys with more than 10% melezitose crystallize to so-called cement honey.

Temperature

The optimal temperature for honey crystallization lies between 10 and 18°C constant temperature of 14°C is regarded as optimal. At low temperatures crystallization is slowed down. In the deep-freezer honey remains liquid for longer time. Very fast crystallizing honeys like rape honey crystallize in a fine-crystalline texture. At higher temperatures (more than 25°C) the crystallization is slowed down. At these temperatures the honey crystallizes with a rough crystalline texture.

Water content

Honeys with a water content between 15 and 18% crystallize optimally. Honeys with more and less and water crystallize more slowly. Best spreadability have crystalized honeys with water content between 17 and 18%. Honeys with lower water content have harder crystallization texture, those with more than 18% to remain softer.

Guided crystallization

The guided crystallization is applied with fast crystallizing blossom honeys in order to avoid the building of frost and coarse crystallisation. There are two procedures: mechanical cutting of the crystals up by agitating the honey inoculate the honey with 5–10% finely crystalline starter honey and following agitating. Agitating can pass agitating devices with motor drive, e.g. stronger hand drills by hand with a triangular staff, with larger quantities is better suitable (with more than 800 W) with special agitating staffs: (Illustration)

Crystallization defects

Formation of frosting

In some honeys with low humidity frosting arises on the surface of the honeys. These are cavities, which are formed by air during the crystallization. Frosting is a natural process, which does not impair the honey quality. It can be prevented by applying of vacuum to the honey before filing and following the guided crystallization. With guided granulaton and storage at constant temperature around 14°C one frosting can be avoided.

Rough granulation

This occurs particularly in slowly crystallizing honeys and also after the liquefaction of honey, which decreases honey granulations speed. This can be prevented with guided crystallization.
LIQUEFACTION AND SOFTENING OF GRANULATED HONEY

Heating

Heating is the most widely used method. According to the Codex Alimentarius and other honey regulations it is forbidden to heat honey as to impair significantly its quality. Therefore, honey should be liquefied in such a way as to avoid heat damages. The liquefaction time depends on the glucose concentration and on the crystal form: the higher the glucose content and the larger the crystals, the longer the liquefaction time. Heating at higher temperatures of for a longer period of time will cause honey damage, decrease of aroma and in extreme cases building of a caramel like taste. Overheating is determined most easily by the measurement of hydroxymethyl furfural and honey enzyme activity (see table below). Honey should be heated with care to prevent overheating.

Heating at lower temperatures

It is often prescribed not to heat honey at temperatures higher than 40° C in order to prevent overheating. However, higher temperatures are needed for a complete dissolution of all crystals. Granulated honey is a very poor heat conductor and thus should be stirred to decrease granulation time. Heating for 1-2 days at 40-50° will not damage honey. There are different means of honey heating.

Heating by water bath

From point of view of optimal heat transfer this type of heating is the best one. A 25 kg honey recipient is heated in a water bath up to 40° for 43 hours, while 72 hours are necessary for heating by air. Due to practical reasons, heating in water baths is used in recipients of up to 25 kg size. There are only few commercially available heating water bath systems.

Heating by air

Heating by air is widely used. Compared to a water bath, air heating needs a longer period of time. When heating greater amounts of honey, air circulation should be used to prevent overheating. For liquefaction of a granulated blossom honey with 17.5 % water, following relation between vessel size, temperature and liquefaction time was found:

<table>
<thead>
<tr>
<th>Recipient capacity</th>
<th>40 °C</th>
<th>45° C</th>
<th>50° C</th>
</tr>
</thead>
<tbody>
<tr>
<td>20 kg</td>
<td>24 hours</td>
<td>18 hours</td>
<td>16 hours</td>
</tr>
<tr>
<td>50 kg</td>
<td>48 hours</td>
<td>36 hours</td>
<td>24 hours</td>
</tr>
<tr>
<td>80 kg</td>
<td>108 hours</td>
<td>72 hours</td>
<td>60 hours</td>
</tr>
<tr>
<td>300 kg</td>
<td>-</td>
<td>108 hours</td>
<td>72 hours</td>
</tr>
</tbody>
</table>

Other methods of heating

Honey can be liquefied by placing the vessels on electric plates. This type of heating is widely used by small beekeepers and it is practical for up to 25 kg recipients. However, in order to prevent overheating...
overheating, there should be an air layer of 5-6 cm between the plate and the vessel. According to the producers, heating to 45 °C of a 25 kg vessel will liquify the honey within 24 to 48 hours.

**Immersion heaters** can be placed on the granulated honey, which progressively sink upon honey melting.

**“Melitherm” heaters**, developed by Spürgin are used for honey liquifying in some European countries. This liquifaction method is particularly gentle and does not cause any honey damage, but the honey crystals are not completely liquefied.

*Heating at higher temperatures: pasteurisation*

In some countries, honey is heated to destroy honey crystals and yeasts through pasteurisation. Commercial pasteurisation practice is flash-heating for a few seconds at 70-78 °C and then rapidly cooling for minimisation of heat damage. The commercial practice is described in detail. After pasteurisation, diastase activity and HMF content remain almost unchanged, while invertase is damaged.

Pressure filtering, for a clarification of honey, is carried out mostly in North America, after honey pasteurisation. The resulting honey is very clear and remains liquid for a longer period of time. Liquified, pasteurised honey will crystallise slowly to build coarse crystals. The drawback of this procedure is that it filters off pollen, making it impossible to control claims of specific declaration of botanical and geographical origin.

*Wave application*

There are different kind of waves, which can be used for honey liquefaction:

- Ultrasonic waves
- Microwave oven
- Infrared oven

Microwave and infrared ovens are well distributed commercially and are suitable for use. Honey can be liquefied very quickly, due to its specific composition. Microwaves with frequency between 915 MHz and 2450 MHz are widely used in for food heating and can be used for honey liquefaction. However, the research results cited above show than both types of ovens cause HMF increase and enzyme activity decrease, the effects depending on the time and the energy amount applied, and also on the type of honey. Thus, special microwave ovens for liquefaction of honey, taking into account the above mentioned factors should be constructed in order to avoid honey damage.

References


