



HONEY PROCESSING

Introduction

Many species of bees collect nectar which they convert into honey and store as a food source. However, only bees that live together in large colonies store appreciable quantities of honey. These are bees of the genus *Apis* and some of the *Meliponinae* (stingless bees). Bees make honey mainly from the nectar of flowers, but they also use other plant saps and honeydew. As a bee sucks the liquid up through its proboscis and into its honey sac, it adds a small amount of enzymes, and some of the water in the nectar is evaporated. The enzymes convert sugars in the nectar into different types of sugars; honeys always contain a wide range of sugars that vary according to the nectar source. The bees then place the liquid nectar into cells in the honeycomb. The temperature inside the hive is usually around 35°C and, together with ventilation caused by bees fanning their wings, this temperature causes further evaporation of water from the nectar. When the water content is less than 20%, the bees seal the cell with a wax capping. The honey is now 'ripe' and will not ferment.

Honey consists of a mixture of sugars, mostly glucose and fructose. In addition to water (usually 17-20%) it also contains very small amounts of other substances, including minerals, vitamins, proteins and amino acids. A minor, but important component of most types of honey is pollen. These components contribute to the different flavours that honey can have, and make honey a nutritious food that has a high demand in many regions of the world.

Processing

Cut-comb honey

The simplest processing is to remove the honeycomb from frame hives, top-bar hives or traditional hives and sell or consume it as 'cut-comb' honey. When producing this from frame hives it is necessary to use a wax foundation that does not contain strengthening wires and is thinner than that normally used in wired frames. The process involves collecting pieces of sealed and undamaged honeycomb, cutting them into uniform sized pieces and packaging them carefully in bags or cartons to avoid damaging the honeycomb. Because the honeycomb is unopened, it is readily seen to be pure, and it has a finer flavour than honey that is exposed to air or processed further. Cut-comb honey can therefore have a high local demand and fetch a higher price than processed honey. However, the honeycomb is easily damaged by handling and transport, which makes distribution for retail sale more difficult. It requires protection by packaging materials that will absorb shocks or vibration (e.g. cushioning plastics such as 'bubble-wrap' and/or corrugated cardboard cartons) and packs should be carried carefully and not stacked, thrown or dropped to avoid damage to the honeycombs.

Strained honey

This is honey that is processed to a minimal extent and is usually sold locally. It is prepared by removing the wax cappings of the honeycomb using a long sharp knife that has been heated by standing it in warm water. (unsealed combs containing unripe honey should not be used). The honeycombs are then broken into pieces and the honey is strained to remove wax and other debris. A fairly coarse strainer is used at first to remove large particles, and the honey is then strained through successively finer strainers such as cotton or muslin cloths. The clear honey is collected in a clean, dry container. When most of the honey has drained (often over many hours depending on the temperature) the combs are squeezed inside a cloth bag to remove as much of the remaining honey as possible. The wax is collected and formed into a block by melting it gently in a warm waterbath or solar wax extractor. This beeswax byproduct often has a high value as a wax polish or for candle-making. The strained honey can either be dispensed from the collection pan into customers' own containers or packed into glass jars or plastic bags for sale.

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Packaged honey

The wax cappings are removed from the honeycombs as for strained honey. At larger scales of production, electrically heated honey knives or 'planes' may be used (Figure.1).

When extracting honey from top-bar frames, the frame is placed over a dish, and the thin layer of wax capping is cut from the bottom to the top of the frame and allowed to fall into the dish below. The frame is then turned and the capping on the other side is removed. Honey that is stuck to the wax cappings is strained using cloth bags as above.



Figure 1: Electric uncapping plane. Photo courtesy of Mazant Honey Processing Equipment.

The frame is then placed in a honey extractor (Figure. 2). Honey extractors can be manually or electrically operated, depending on the scale of production, and can be either 'tangential' or 'radial' type machines.

They extract the honey by spinning the frames at high speed. In a tangential machine, the frames lie against the barrel of a drum and the outer side of the frame empties when the drum is spinning. The frames are then turned so that the other face of the honeycomb faces outwards, and the machine spun until this side is empty. This prevents the inner part from bursting through the empty outer combs and so prevents the combs from breaking. Although each frame has to be handled four times to load, turn and unload them, more complete extraction can be achieved and this design is more compact and cheaper than radial types. In a radial machine, the frames sit between rings, arranged like the spokes of a wheel and honey is extracted from both sides simultaneously. Radial machines are larger than tangential machines to ensure that the frames are far enough from the centre to extract properly, but they can hold more frames than a tangential machine (e.g. a 20-frame radial extractor compared to an 8-frame tangential machine).



Figure 2: Nine-frame electric honey extractor. Photo courtesy of Mazant Honey Processing Equipment.

The honey is collected in a pan, preferably made from food grade plastic or stainless steel, and filtered through a nylon or stainless steel filter unit that has progressively finer filters as the honey moves to the outside of the filter unit. Some filters are fitted with heaters to make the honey flow faster, but these are not necessary in tropical climates and any increase in temperature risks a reduction in the quality of the honey (see below). The clear honey is then collected and packaged into glass or plastic containers and labelled. The package should be moistureproof to prevent the honey picking up moisture from the air during storage.

Because customers regard the colour of honey as an important quality characteristic, the containers should preferably be transparent so that customers can see the product. Glass jars with screw-on lids or plastic pots with heat-sealed foil or plastic lids may be used. In countries where glass or plastic containers are difficult to obtain, heat-sealed plastic sachets are an alternative.

The label on the container is important for attracting customers and a professionally designed label that describes the source of the honey (e.g. sunflower, mixed blossom, tree honey etc.), its purity, and the district it was produced in, can give a marketing advantage. Legally, in most countries the label should have the following information:

- The name of the product (i.e. pure honey)

- The name and address of the producer.
- The weight of honey in the container (the net weight).

Other information may be included to benefit the customer: for example, the label on comb honey may indicate that the whole comb including the wax is edible, or strained honey may have a note to explain granulation (see below).

Quality Assurance

Honey is preserved because of its high sugar content (or conversely its low moisture content), which prevents micro-organisms (bacteria, yeasts and moulds) from growing in it. Despite this, it must be handled hygienically, and all equipment must be properly cleaned (see below).

The aroma and taste of honey are its most important quality characteristics, but honey is often judged according to its colour. The colour of honey depends mainly on the source of the nectar. Usually dark-coloured honeys have a strong flavour whereas pale honeys have a more delicate flavour. Generally light-coloured honeys are more highly valued than dark products. Some honeys have a high pollen content, which makes them appear cloudy, and this may be considered as lower quality by some customers.

The main causes of loss in quality of honey are:

- An increase in moisture content - too much water in honey (greater than 19-20%) causes it to ferment. Honey is 'hygroscopic', meaning that it will absorb moisture, and all honey processing equipment must therefore be completely dry. Honey should also be processed as soon as possible after removal from the hive to prevent it absorbing moisture from the air, especially in humid climates. In areas with a very high humidity it can be difficult to produce honey of sufficiently low water content.
- Development of HMF (Hydroxymethylfurfural). This is a break-down product of fructose (one of the main sugars in honey) that is formed slowly during storage but very quickly when honey is heated. Colour can also be an indicator of quality because honey becomes darker during storage and heating. The amount of HMF present in honey is used as a guide to the age of the honey and/or the amount of heating that has taken place. Some countries set an HMF limit for imported honey. HMF is measured by laboratory tests and technical advice from a Bureau of Standards should be sought if export is being considered.
- Contamination by insects. Honey processing is a sticky operation, and the sugar in honey attracts ants, cockroaches and flying insects. Careful protection is needed at all stages of processing, including insect screens on doors and windows to prevent contamination by insects. All honey residues on equipment should be removed by proper cleaning to prevent them attracting insects. The presence of any other contaminations (e.g. particles of wax, parts of bees, splinters of wood, dust etc.) make the honey very low value.

A note on granulation

Glucose is one of the main sugars in honey and when it crystallises (i.e. it changes from a liquid to a solid), the liquid honey also becomes solid (or granulated). Depending on the source of the nectar collected by bees, some types of honey are more likely to granulate than others, but almost all honey will granulate if its temperature falls sufficiently. Granulation is a natural process and there is no difference in nutritional value between solid and liquid honey. Although there is obviously a difference in the texture between liquid and granulated honey, there is no difference in the flavour or other quality characteristics. Some customers prefer granulated honey, and if liquid honey is slow to granulate, the addition of 20% finely granulated honey will cause it to granulate.



Figure 3: Honey tanks with filters. Photo courtesy of Camelot Country Products.

Quality checks

The routine quality checks on honey are a visual inspection to detect clarity, any contamination by insects or other materials such as particles of beeswax, and checking that the pack contains the correct weight of honey. In humid climates, or if a batch of honey is suspected of containing high a level of water (e.g. honey that is returned because it has started to ferment), it can be checked for moisture content. Because honey is mostly sugar (around 80%) and water (19-20%) the sugar content can be measured using a refractometer, and the value subtracted from 100 to measure the moisture content. However, refractometers are expensive and it may be more affordable to send samples to a laboratory for checking if a problem with the moisture content is suspected. If during production, the level of moisture is too high, it can be reduced by blowing air for several hours over a pan of honey using an electric fan. Honey should never be heated to remove water because this will increase the amount of HMF and significantly reduce its quality.

Cleaning

The other important quality assurance check is to ensure that the correct cleaning procedure is in place and is being properly followed by production staff. All equipment, floors and work surfaces should be washed daily with hot water and detergent, and rinsed with clean water. They should be allowed to dry completely in the air before production starts again. Cloths should not be used to dry surfaces and equipment because they can contain sugar residues that recontaminate cleaned surfaces.

Equipment suppliers

Please note this is a selective list of suppliers, not implying endorsement by Practical Action.

Honey processing equipment

- Camelot Country Products, Curry Rivel, Somerset, TA10 0HB, UK., Tel: +44 (0)1458 253098 Mobile: +44 07973 905606, email: enquire@honeystore.co.uk, Website: <http://www.honeystore.co.uk/equipment.html>
- E.H. Thorne Ltd., Beehive Works, Wragby, Market Rasen, LN8 5LA, U.K., Tel: +44 (0)1 673 858555, Fax: +44 (0)1 673 857004, email: sales@thorne.co.uk, Website: <https://secure.thorne.co.uk/index.htm>
- Korea Beekeeping Association and Korea Bee Product's Research institute, 6F The Farmer's Hall, 436-3 Hwaseo-dong, Jangan-gu, Suwon, 440-150, South Korea, Tel: +82 331 291 6622/1223, Fax: +82 331 291 6682, E-mail: apiary@chollian.net, Website: <http://www.korapis.or.kr>
- Maxant Industries, PO Box 454, Ayer, MA., 01432 USA., Tel: 1 978 7720576, Fax: 1 978 7726365, Email: sales@maxantindustries.com, Website: <http://www.maxantindustries.com/>
- Steele & Brodie Limited Beehive Works, Kilmany Road, Wormit, Newport-on-Tay, Fife, DD6 8PG, UK., Tel: +44 (0) 1382 541728, Fax: +44 (0) 1382 543022, E-mail: steele&brodie@taynet.co.uk
- Swienty A S, Hortoftvej 16, DK 6400 Sonderborg, Denmark, Tel: +45 74 486969, Fax: +45 74 488001, E-mail: swienty@aof.dk
- The Bee Keeper's Supermarket, 38 Milner Road, Maitland, Cape Town 7450, South Africa, Tel: +27 21 5114567, Fax: +27 21 5119962.
- Thomas Apiculture, 86 rue Abbé Thomas, Fay aux Loges, F-45450, France, Tel: +33 (0)2 38 468800, Fax: +33 (0)2 38 592828, E-mail: thomapi@wanadoo.fr, Website: <http://www.thomas-apiculture.com>

Larger scale honey processing equipment

- SSP Private Ltd., 13 Milestone, Mathura Road, Faridabad, Haryana-121 003, India, Tel: +(91)-(129)-2277442/2275968, Fax : +(91)-(129)-2277441, E-mail : info@sspindia.com, Website: <http://www.sspindia.com/enquiry.html#contact> .

Refractometers

- Locally available from laboratory equipment suppliers/agents.
- Bellingham and Stanley Ltd., Longfield Road, North Farm Industrial Estate, Tunbridge Wells, Kent, TN2 3EY, UK., Tel: +44 1892 500400, Fax: +44 1892 543115, E-mail: sales@bs-ltd.com, Website: <http://www.bs-ltd.com/>

Further reading

- *Basic Honey Processing*, Allan, M., available at www.beedata.com/data2/basic_honey_processing.htm
- *Beekeeping in Africa*, FAO Agricultural Services Bulletin 68/6, Food and Agriculture Organization of the United Nations, Rome, 1990.
- *Beekeeping in the Tropics: Agrodok 32*, Segeren, Mulder, Beetsma, Sommeijer, Agromisa, 1991.
- Directory of suppliers of beekeeping equipment worldwide, International Bee Research Association, 1982
- The Complete Book on Beekeeping and Honey Processing, NPCS Board of Consultants & Engineers, NIIR Project Consultancy Services, 2007.
- The Golden Insect: A handbook on Beekeeping, Adjare, S., Practical Action Publishing, 1984.
- Tools for Agriculture: A guide to Appropriate Equipment for Smallholder Farmers, 4th Edition, Carruthers, I. and Rodriguez, M., Practical Action Publishing, 1992.

Useful contacts

- Apimondia, Corso Vittorio Emanuele II, 101, I-00186 Rome, Italy, Tel: +39 668 52286, Fax: +39 668 52286 or 683 08578, E-mail: APIMONDIA@MCLINK.IT, Website: <http://web.inter.nl.net/hcc/beenet/apimintr.htm>
Apimondia is an international organization including 55 national beekeeping associations representing all continents. Members include institutes studying beekeeping as well as institutions and firms promoting and trading products and equipment.
- Bees for Development, Troy, Monmouth, NP5 4AB, UK., Tel: +44 (0) 16007 13648, Fax: +44 (0) 16007 16167, E-mail: info@beesfordevelopment.org, Website: www.beesfordevelopment.org
Bees for Development produce a quarterly magazine, Beekeeping and Development, and produce books that are available through mail order.
- International Bee Research Association, 18 North Road, Cardiff, CF10 3DT, UK., Tel: +44 (0)29 2037 3409, Fax: +44 (0)29 2066 5522, E-mail: mail@ibra.org.uk, Website: <http://www.ibra.org.uk/>
The International Bee Research Association are a not-for-profit organization that aims to increase awareness of the vital role of bees in the environment and encourages the use of bees as wealth creators. IBRA has published a full list that includes over 265 suppliers, listed under their countries (a total of 40), and with an index to suppliers of specialised equipment.

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