Honey harvesting and extraction

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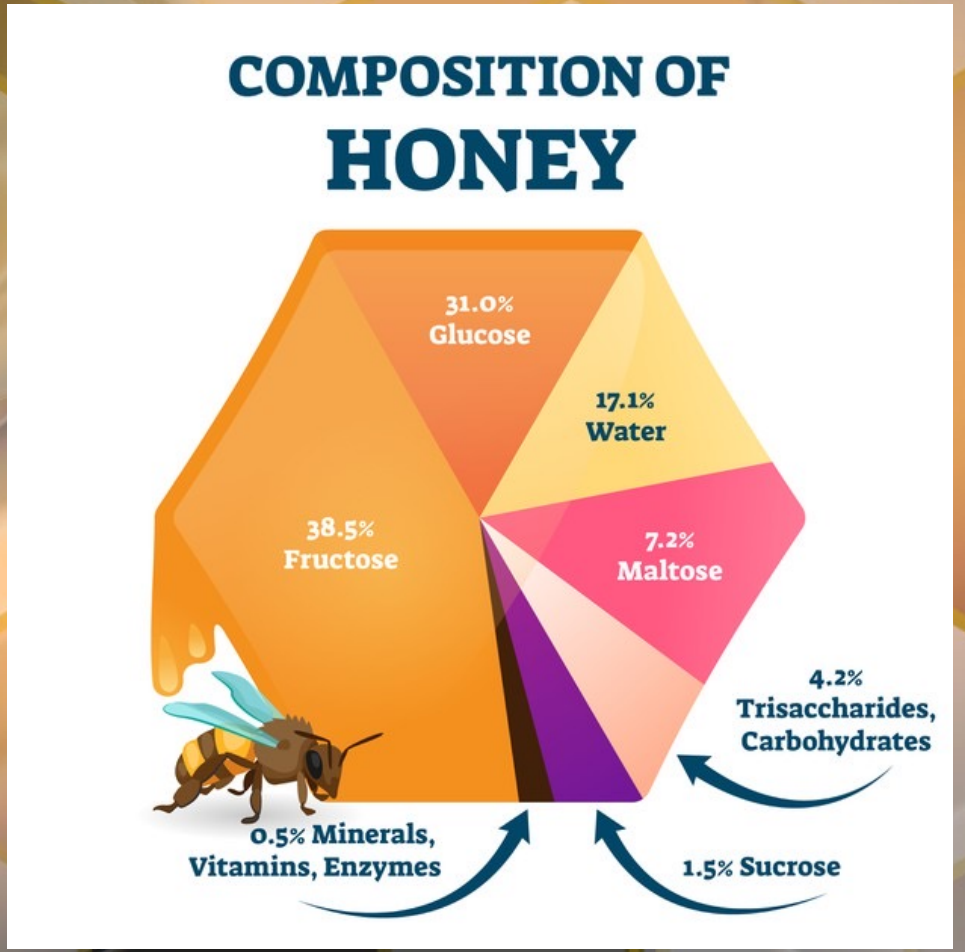
What is honey ?

Honey is a very sweet food made by bees from nectar and used as an energy source for their various activities.

Honey is mainly composed of :

- Glucose
- Fructose
- Water
- Other carbohydrates
- Minerals
- Small amount of enzymes (proteins)

Honey is acidic pH range from 3.4 to 6.1
Composition varies from one nectar source to another



3 predominants enzymes in honey:

Diastase (amylase): convert starch to dextrose, maltose and glucose

Invertase (saccharase or alfa-glucosidase): breaks down sucrose into glucose and fructose

Glucose oxydase: Breaks down glucose and gives honey its acidity and anti-microbian properties

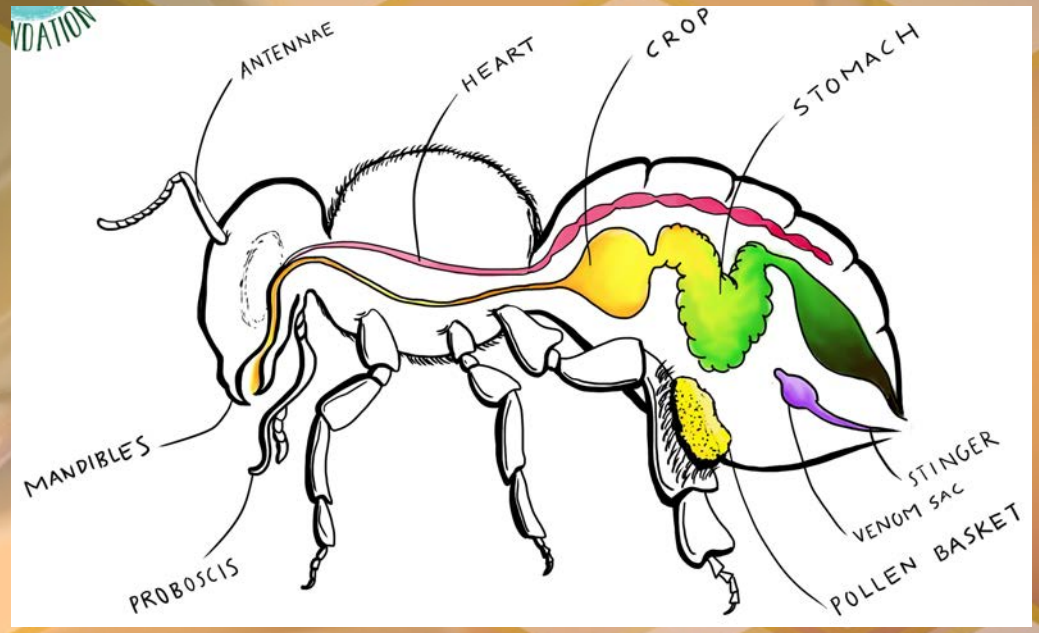
A good quality honey has high level of this enzymes. But because enzymes are destroyed by heat, honey heated too much will loose its properties

The ratio of glucose/fructose is an indication of the ability to crystalise.
The higher the glucose content, the most chance it will crystallise

Honey crystallising

How honey is made ?

Forager bees collect the nectar in the hollow of the honey flowers.
She sucks it in and keeps it in her crop, or “honey stomach,” without digesting it.
Once back at the hive, it regurgitates the nectar in the crop of a recipient bee. This is when the chemical transformation begins.
The recipient bee then transmits the drop of nectar to another bee, who herself transmits it to another worker. This is called trophallaxis.

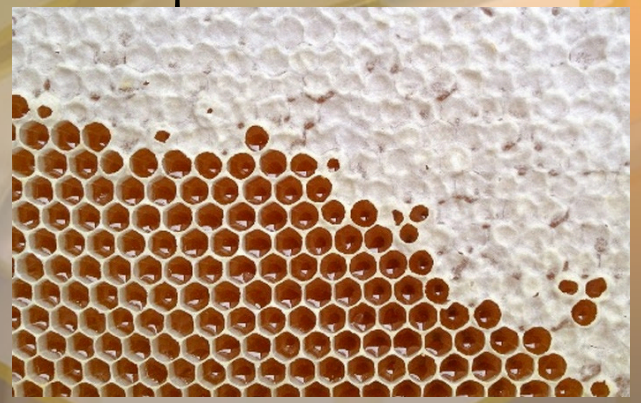


Bees practicing trophallaxis

During these successive exchanges, the nectar concentrates in invertase, an enzyme which transforms the sugars into simple sugars, mainly glucose and fructose.
The nectar then gradually becomes honey.
The last worker will regurgitate it in a cell. At this time, a second enzyme, glucose oxidase transforms part the glucose into gluconic acid and hydrogen peroxide.

- **Gluconic acid** helps give honey a strong acidity, thus protecting it from bacteria, fungi and molds.
- **Hydrogen peroxide**, on the other hand, allows honey to be preserved during its maturation in its cell or during its dilution to feed the larvae.

At the same time, the water in the nectar is removed by the heat of the hive and and fanning with wing movement from the workers.
Honey is ripe when its water content is 18% or less (which prevents the growth of microbes).
At this point, it can be stored in other cells, closed with a wax seal.
This protects it from the humidity in the air and it is then ready for consumption.



Honey ready to be capped

Honey fermenting inside cells

When can I harvest ?

Honey can be harvest when the super frames are 80% capped or when it's very dry and the content of the cells doesn't drop when vigorously shacked, cells opening down.
Never harvest frames from the broodbox unless you are making brood box manipulation.

Water content should be under 18% to prevent fermentation.
It could be checked with a honey refractometer

Removing honey crop from a hive can be stressful for the colony which can lead to over aggressivity.

Extraction is best conducted in a sunny day, during the afternoon which gives the bees time to resettle during the night, but it can also be done in mid-morning when all the foragers are out.
Avoid hot hours of the day for yourself and the bees which can overheat and rainy or stormy weather.

Have a smoker always near as smoke will calm the bees and mask the alarm pheromones.

Honey refractometer

Equipment and security

- PPE (gloves, veil, long trousers, enclosed shoes, …)
- Smoker and plenty of fuel
- Hive tool
- Bee brush or electric “leaf blower”
- Spray bottle with sugar water (2 volume of water : 1 volume of sugar)
- Crate(s) with lid(s) to put honey frames
- Trolley to carry the boxes or crates
- Few spare frame
- Pen and notepad to record
- Not the time for inspection, BUT anything suspicious should be checked

- Use caution when harvesting with neighbours around as harvesting honey can lead to bee attacks.
- Warn them that you are going to harvest.
- Don’t do it when the temperature is above 30ºC.
- Conventional smoker or electronic smoker must be available.
- Avoid squashing too many bees, be gentle when removing frames or replacing frames
- Minimise stress.

Differents styles of harvesting

Frame by frame collection

The most used technique.
The method consists of lightly smoking the bees in order to push them back to the bottom of the hive while the frames of the hive are removed, shaken and brushed gently in order to keep recalcitrant individuals away.

Pros: can be done in one go, no need of extra equipment, no bees left on frames, frames can be selected
Cons: Takes time, hive opened for a long time, lot of manipulation, bees more stressed

Brush and smoker are used for frame by frame collection

Tip: use the less smoke as possible or use an electronic smoker otherwise your honey will have a smoky taste

Electronic « smoker »

Differents styles of harvesting

Full box collection

This technique requires the use of a escape board or clearer board.
The clearer board is placed below the super(s) to be harvested 1 or 2 days before harvest.
It is necessary to check before the maturity of the honey in each super.
While in place, the bees can easily descend below the clearer board by the vast opening, but can very difficultly climb back up by the tiny holes.
However, if the clearer board is left too long, they organize themselves to find a solution in order to climb back up.

Pros: Less stress, quick removal of a full box, can be also used as an inner lid
Cons: Needs to install 1 or 2 days before harvesting, 1 per hive, weight of the full super, some bees can be left in the super, no possibility of frame by frame check.

Differents escape board styles

Differents styles of harvesting

Use of a bee blower

This technique requires the use of bee blower and is often used by professional beekeepers.
The supers are removed and placed vertically then the blower dislodge all the bees on each frame.

Pros: Less stress, very quick
Cons: Extra equipment, needs two people to be efficient, lot of bees flying around, not appropriate for backyard

Different kind of blowers and methods

Extracting at home

Whatever the technique you are using you must comply with food handling practices at home.

One rule: everything must be perfectly cleaned before and after use including tools and containers. Wearing disposables gloves and mop head cap is a very good idea.

Different tools and use for uncapping

Fork

Tip: Progress slowly. Keep the fork with a slight angle. Don't go deep.

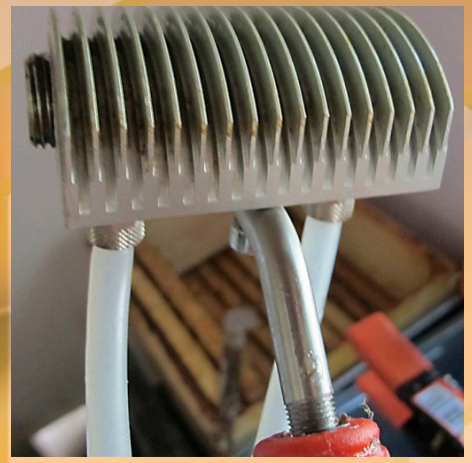
Knife

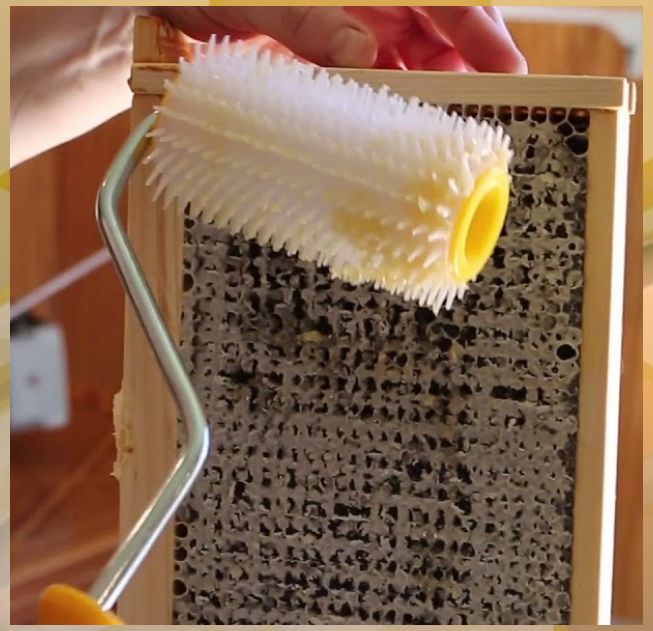
Tip: Always start from top to bottom

Produce capping to process later on for foundation, candles, etc…

Extracting at home

Rollers

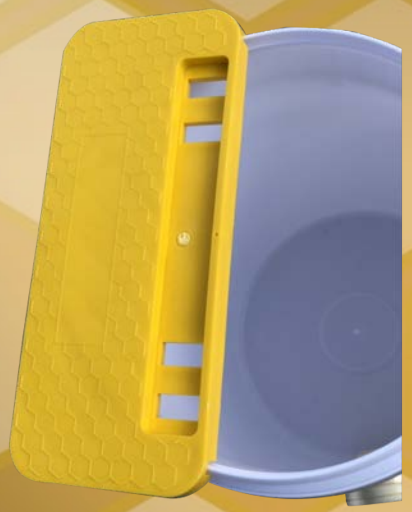




Doesn't remove wax from the frames, therefore the bees don't have to use honey to replace the wax

Extracting at home

Extracting stations



From simple to more complex…
A well suited extracting station make uncapping easier

Tip: Put a nail or a screw pointy end up to secure the frame and prevent it from slipping during uncapping

Extracting at home

Once you have uncapped the frames, you need to spin them inside an extractor to remove the honey.
Extractors use centrifuge force to remove droplets of honey from the cells.
Depending on the viscosity of honey and its state (liquid or crystallised), it ranges from very quick and easy to forever and nightmare!

Electric

Manual

Radial

Tangential

Tip: Always start at slow speed then increase until full speed. Always try to balance the weight

Contamination of honey

Good hygiene is needed to process honey. Never put honey frame on the soil.

Yeast and mould contamination
If honey water content is higher than 19%, it will likely ferment with *Saccharomyces sp* yeast strains)
Be aware that honey is hygroscopic, therefore, it will absorb water from surrounding which increase water content and can cause fermentation.

Bacteria
Spores forming bacteria are found in honey, but don't have any ill effects on humans. Consumption of honey with *Paenibacillus larvae* (AFB) spores is perfectly fine for humans, but not for bees!

Clostridium botulinum can also be found in honey but in a too low level to cause any harm. But if honey is to be used as a wound dressing, it has to be irradiated.

If *coliform* bacteria are found in honey, it's often an indicator of poor hygiene procedure during extraction or contamination.

Filtering and maturation

After extraction, honey will contain some debris. Because of its density, most of the debris will float atop. But, it is easier and quicker to filter the honey while transferring from the extractor to a storage/maturation container.

Double filtration is the way to go as it offers the best results without clogging too much your filter.

But after a while, you will notice a “foam” forming on top. This represents the smaller debris that went through the sieves (mostly wax).
It can be easily removed using a wet cloth. The foam will adhere on the wet cloth after a minute or so.

Double sieve

Foam forming and its removal by the wet cloth technique

Bottling honey

Bottling honey is one of the last process. It is very rewarding to see how your honey can “glow” or “attract the light” when it is free from debris and in a nice transparent jar.
If you want a consistent weight in each jar, use a scale. Do the zero with the clean jar on, then fill it up.
Using a bucket or a honey tank with a gate at the bottom has the double advantage to make filling easier and to have the cleanest honey (debris will be floating on top).

Don’t wait too long before putting your honey in jars, because high glucose content honey will crystallise very quickly making the job harder. You can still warm the honey at 35ºC (40ºC max) to make it liquid again with a honey warmer.

Container with honey gate

Honey warmer

Common 40 kg shop scale

Effect of temperature and time on honey

If honey is heated, it will destroy its enzyme and it will loose its properties

Heat also increase the HMF (hydroxymethylfurfural content produced when fructose breaks down. HMF is naturally present in honey but in a small amount but it increases with time (slighly) and temperature (highly), **especially well over 40ºC**

Honey will also darken over time and if it is heated. Reactions will occurs between proteins and carbohydrates that will darken honey.

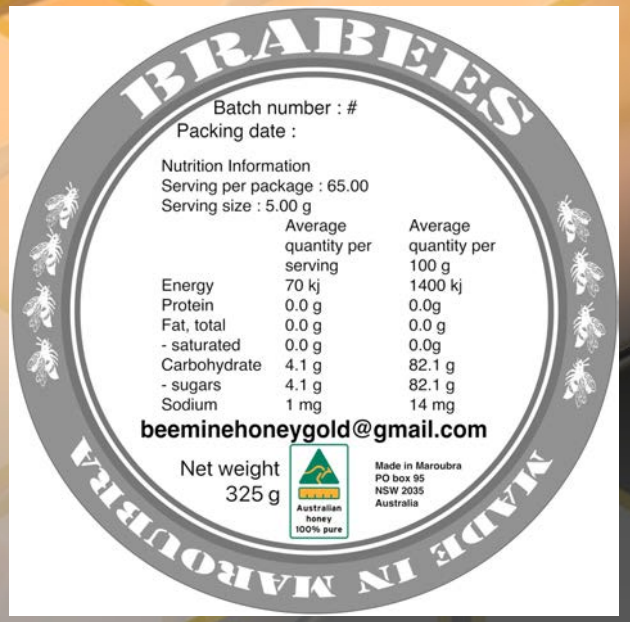
The honey color is measured using the pFund scale from very light (low pFund) to very dark (high pFund).
Dark honeys tend to have a higher anti-oxydant level.

Colour variations in honey

Labelling honey jars

This is the last step. Not compulsory if give your honey to friends or family
If you plan to sell your honey, there are Australian requirements:

- Name of the Food: Honey (raw, unheated)
- Lot Identification
- Date of harvest
- Name and Address of the beekeeper/company
- Packing date
- Nutrition Information Panel (NIP)
- Net weight
- Origin of product (Made in Australia logo)



Thank you

Australian Pollinator Week. 13–21 Nov 2021

Merci