BUSINESS

MANAGING THE RISK OF FERMENTING HONEY

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Many beekeepers and processors have had to deal with fermenting honey in the past. It is caused by naturally occurring yeasts growing in the honey, and high moisture content is a key risk factor which makes fermentation more likely. This article describes why honey ferments, and provides some ideas about how to manage the risk of it happening.

Many people involved in the honey industry have first-hand experience of fermenting honey. Drums with rounded ends that are a telltale sign of pressure that has built up inside, and honey gushing out when the cap is screwed off the top of a drum (or even drums exploding).

Apart from the challenge of dealing with pressurised honey drums, fermentation changes the flavour and smell of the honey. All in all, something to be avoided!

If comments from honey producers are anything to go by, this last season has been a bad one for fermenting honey. This article draws on a United States Department of Agriculture (USDA) publication to describe some of the reasons why honey ferments, with suggestions about things you can do if you want to manage the risk of it happening. (USDA, 1980, pages 88–89.)

Fermentation in honey is caused by yeasts consuming sugars in the honey

Fermentation is a natural process where yeasts digest sugars to maintain themselves and grow. As they do, they create carbon dioxide (CO_2) gas and alcohol. If there is oxygen present, the alcohol will then turn into acetic acid and water.

Yeasts will find their way into honey resulting from bees foraging for things like nectar, honeydew, and pollen. Yeasts already in the hive may be moved around by bees as they work. They can also be introduced during the extraction process if the extraction facility is not clean, or drums are not sterile.

Bakers and brewers use fermentation positively when making bread, beer, and wine. Unfortunately, when yeasts grow inside drums of honey, the results are less desirable. The CO_2 gas builds up pressure inside the drums to sometimes dangerous levels, and acetic acid changes the taste and smell of the honey.

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"When good drums go bad …" This photo, submitted by Mana Kai Honey, Kaitaia, won the 'Oh darn' and People's Choice categories in the Ecrotek photographic competition, 2016.

The risk of a particular drum of honey fermenting depends on four things:

1. the number of osmophilic yeasts in the honey
2. the moisture content of the honey
3. whether the honey has crystallised
4. the temperature at which the honey is stored.

The more osmophilic yeast there is in the honey, the higher the risk of fermentation

Yeasts are a micro-organism, and are found everywhere around us. So the first assumption to make with honey is that there will be yeasts in there.

The very high sugar content of honey makes it an environment that most bacteria and yeasts can't grow in. One group of yeasts (called osmophilic yeasts) are more tolerant of high sugar environments, and they have potential to grow in honey—they are the ones we need to be concerned about when considering fermentation. Some labs can test for osmophilic yeasts—this test is far more useful than a general yeast and mould test, because it targets only the yeasts that will grow in honey.

If an osmophilic yeast test is carried out, a count of more than 100 yeasts per gram is high, and above 1000 yeasts per gram of honey is very high. The risk of fermentation increases as numbers of yeasts in the honey increase. In practice, a count of even 10 yeasts per gram presents a meaningful risk of fermentation in honey where moisture levels are higher than ideal.

The higher the moisture content, the higher the risk of fermentation

Moisture in honey dilutes the sugars that are in there. As moisture content increases, the sugar concentration decreases, improving conditions for osmophilic yeasts to grow in. According to the USDA publication, honey with moisture content of less than 17.1% will not ferment in a year, but once you get above this level, the risk starts to increase. Above 19% moisture, honey can be expected to ferment in the year following harvest, even with low osmophilic yeast levels.

Bees will naturally remove a lot of the moisture from honey before capping, and therefore it is safe to say that capped honey is much less likely to pose a risk of fermenting. It is common for people to harvest uncapped mānuka honey with moisture content in the 18–20% range.

As honey crystallises, the risk of fermentation increases

When honey crystallises, the sugars join to form a solid sugar crystal. This reduces the amount of sugar which remains dissolved in the liquid honey, and in doing so increases the moisture content of that liquid honey. Also, when glucose crystals form, water molecules are released as part of the process.

This takes us back to the previous point—the risk of fermentation increases in honey with a higher moisture content. Stored honey that has crystallised is therefore a greater fermentation risk.

Honey stored at temperatures between 10°C and 27°C is at risk of fermenting

Yeast growth occurs in the range of 10°C to 27°C. Unfortunately, most normal bulk honey storage in New Zealand falls inside this temperature range. If you have fermenting honey you want to stabilise while you decide what you want to do with it, refrigeration at a temperature below 10°C is likely to help with this.

A summary of the risk of honey fermentation

- Fermentation is caused by osmophilic yeasts in honey, and all honey should be considered to contain yeasts. If an osmophilic yeast test is carried out, a count of more than 10 yeasts per gram represents a fermentation risk, particularly if moisture content is above 18%.
- Honey with moisture content of 17% or less is unlikely to ferment. Between 17% and 19% moisture the risk of fermentation increases, and fermentation is highly likely in honey with moisture content above 19%.
- Granulated honey is more likely to ferment.
- Storing honey in cool conditions (below 10°C) will stop fermentation, but only while the honey remains at that temperature.

Reference

United States Department of Agriculture. (Revised October 1980.) *Beekeeping in the United States – Agriculture Handbook Number 335*.

Practical ideas to manage the risk of fermentation

Measure the moisture content of honey at extraction. This especially applies to uncapped honey, where bees will not have finished removing excess moisture. You can buy moisture meters for use on-site at your extraction, storage, or processing facility—or get a lab to do a moisture test for you. If using your own meter, it is advisable to regularly send some samples you have tested to an accredited laboratory, to make sure your meter is giving accurate results.

Make sure your extraction process is as clean as possible. Use clean extraction facilities, with good operating processes, and sterile drums to put extracted honey into.

Consider heat treatment of high moisture honey to (1) remove moisture and (2) kill yeasts in the honey. A range of honey processing options are available to remove excess moisture from honey and/or heat treat the honey so that yeasts and other micro-organisms are killed. You should seek advice from experts, but as a guideline if honey is heated to about 68°C for a minute, or 72°C for 20 seconds, then this should kill the osmophilic yeasts in the honey and largely eliminate the risk of fermentation. Be aware that any heat treatment of honey will increase its HMF (hydroxymethylfurfural), so any use of heat treatment needs to be carefully managed.

Remember that honey stored for more than a year will be at increased risk of fermentation. Older honey is more likely to crystallise, and provides a longer time for yeasts to grow at normal storage temperatures. Consider both a moisture and osmophilic yeast test in honey that is likely to be stored for a long period. If one or both tests are high, consider heat treatment of the honey to reduce fermentation risk.