

Honey Crystallization

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Agenda

- What is honey crystallization? Is my honey bad?
- Why does crystallization occur?
- How to prevent crystallization (for the consumer and honey producer)
- How to resolve it (for the consumer and honey producer)
- Crystallizing honey ... on purpose!

This presentation available for download at:
www.justman-honey.com/documents

What is honey crystallization?

Crystallization is the formation of sugar crystals in liquid honey

Why this topic?

- I had significant crystallization in 2014
 - Observed honey crystals during late-season extraction
 - Jars bottled 6 months ago nearly 100% crystallized
- Can I sell it this way? Do I want to?

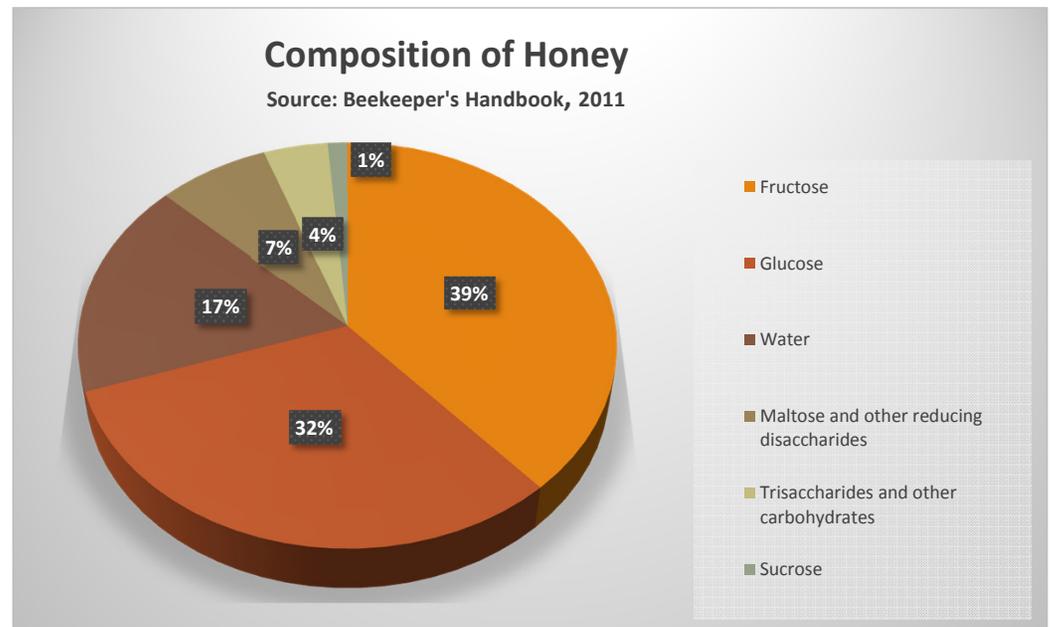


First, What is Honey?

Honey is a **supersaturated** sugar solution containing ~180 identified substances

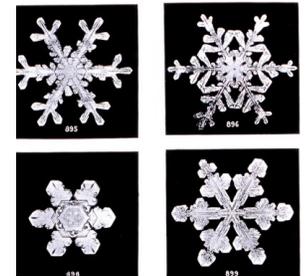
- Composition*:
 - Water: 17.2%
 - Fructose (fruit sugar): 38.2%
 - Glucose (grape sugar): 31.3% (aka dextrose)
 - Sucrose (cane/beet sugar): 1.3%
 - Maltose and other reducing disaccharides: 7.3%
 - Trisaccharides and other carbohydrates: 4.2%
 - Plus enzymes:
 - Invertase, Glucose Oxidase, Amylase, Catalase
 - Aroma constituents, pollen, and wax
 - Trace minerals and vitamins

Note: these percentages are not fixed



What is Supersaturation?

- Supersaturation is a state of a solution that contains more of the dissolved material than could be dissolved by the solvent under normal circumstances.*
- Crystallization is the process of formation of solid crystals *precipitating* from a solution*
- Occurs when **very small particles** (seeds) trigger the separation of the dissolved material (**solute**) from the containing substance (**solvent**)*
- In honey, what is the solute and solvent?
 - **Glucose, fructose, sucrose, other sugars** dissolved in water
- Supersaturation results from changing the conditions of the solution:
 - Temperature
 - Volume of the solvent
 - Increasing pressure



Pop Quiz: Name the Solute/Solvent

Solution	Solute	Solvent
Honey	Glucose, Fructose, etc.	Water
Pop/Soda/Coke	Carbon dioxide, sugar	Water
Sea Water	Sodium Chloride	Water
Steel	Carbon	Iron
Air	Oxygen	Nitrogen

A Badge of Quality?

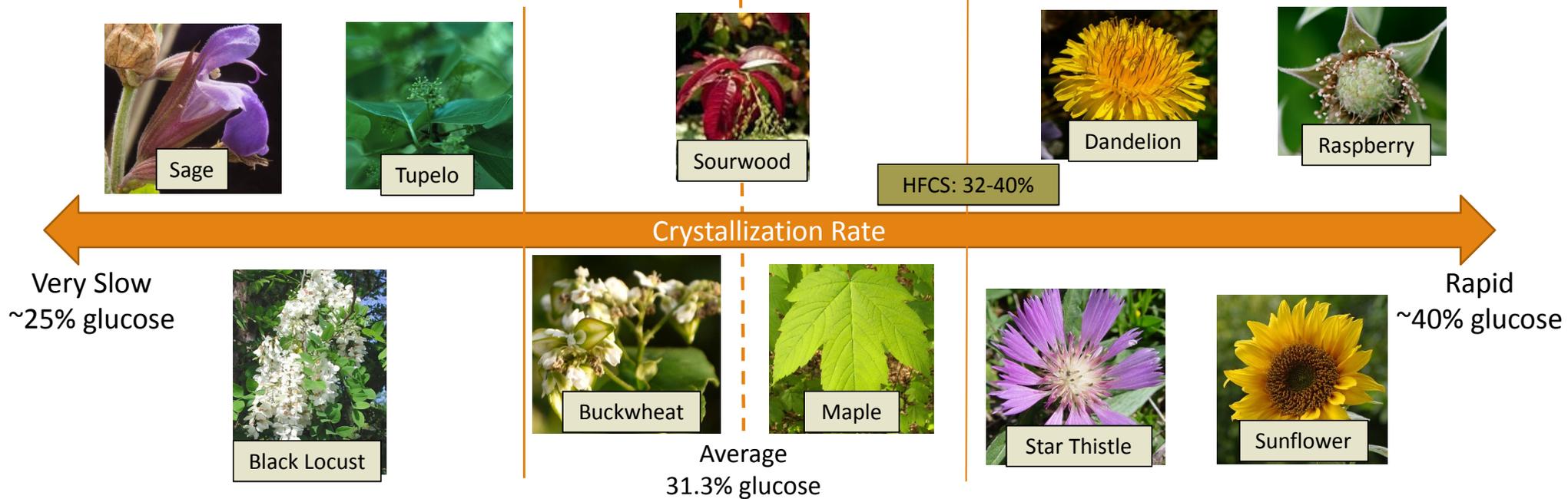
Crystallization indicates:

- Presence of seed material
 - Pollen
 - Wax
- Likely not pasteurized/heat processed
 - Enzymes can still be intact
- Not diluted with cutting agent (i.e. corn syrup)?
 - Corn syrup contains about the same amount of glucose as honey
 - Corn syrup presumably is free of particulate



Why Do Some honeys Crystallize Faster?

- Glucose content in the honey differs with nectar source
- Honey containing less than 30% glucose can stay liquid for years



How to Prevent Crystallization

Why Bother?

- Presentation quality, customer needs
- Increased chance of fermentation
 - Increased water content when glucose forms glucose monohydrate crystals
 - Honey ferments when water content is above 18.6%

Consumers

- Ideally, store honey below 50° F*
- Proper storage – air-tight, moisture-resistant containers

Producers

- Don't store wet supers – remaining honey crystallizes, providing seed crystals for the next harvest
- Consider avoiding plastic - storage in low-density polyethylene containers can allow moisture to escape, contributing to crystallization
- Cream the honey – crystallize it yourself!
 - Raspberry honey
- Heat honey to 145° F for 30 minutes, and filter out particulate (“processing”) – *(but no longer raw...)*

How to Resolve Crystallization

The “Ok” Method

Method:

- Heat the honey to melt glucose crystals

Cautions:

- High heat kills enzymes, caramelizes (at 158° F) and darkens honey

Microwave Method

- Heat for a few seconds, stir, repeat until crystals are melted
- Advantages:
 - fastest!
- Disadvantages:
 - Will melts plastic fast, plastic may leach chemicals into honey
 - High heat harms beneficial enzymes
- Not the best option unless you need speed and don't care about enzymes



This plastic bottle use to stand upright...

How to Resolve Crystallization

The “Better” Method

In Water with Heat Added

- Bring a pan of water to 104°F
- Place the honey container in the water with cap open
- Keep heat on low, monitor temperature
- Check for decrystallization progress

Advantages:

- Faster

Disadvantages:

- Still must watch and regulate temperature
- Temperature above 104°F damages honey
- Need a thermometer
- Not good for plastic
- Are the labels waterproof?



How to Resolve Crystallization

The “Best” Method

In Heated Water

- Bring a pan of water to a boil, turn off the heat
- Place the honey container in the water with cap open
- Leave until both have cooled
- Repeat as needed

Advantages:

- Can walk away, no thermometer needed!

Disadvantages:

- Slower, are your labels water-resistant?
- Does the high heat (212° F) of the bath overheat some of the honey?



Resolving Crystallization for the Producer - Warming Box

- Warming large amounts of honey, either pre- or post-bottling
- 6 pieces of R4 ½ inch insulation
- Light bulb fixture, 25-40W light bulb
- Duct tape
- Thermometer recommended



Resolving Crystallization for the Producer - Warming Box

- Temperature was just right for decrystallization
- Able to fit large quantities or multiple jars/bottles
- Breaks down easily for Spring/Summer storage
- Don't let the light bulb touch the sides!



Time	Temp
3:30pm	room
8:12pm	100°F
11:45pm	104°F
1:05am	100°F
7:35am	106°F



Other Warming Approaches



Tillman Bucket Heater Plans

Build a Better Box

- Steve Tillman's plans and videos are online
- <http://www.michiganbees.org/beekeeping/in-the-beekeepers-workshop/>

Hot car method

Hot water in the tub

Bucket warmers



\$43 from Brushy Mountain



Purposeful Crystallization

Why?

- Texture – spreadable, very fine texture, nice feel on the tongue
- Preemptive crystallization – If you can't beat 'em, join 'em

The Dyce Method* of creaming honey

1. Heat honey to 120°F
2. Strain with two-ply cheesecloth
3. Heat honey to 150°F, stirring continuously
4. Strain again with two-ply cheesecloth
5. Cool honey rapidly in an ice bath. Stir gently, cool to 75°F
6. Add finely crystallized honey as seed crystals (10% by weight) (can food process granulated honey)
7. Place mixture in a cool room (57°F) (what's special about this temperature?)
8. After 1 week, process mixture in a food processor to break up large crystals
9. Bottle and store in a cool place



Purposeful Crystallization

Other examples in food

- Ice cream
- Creamed maple syrup!



Questions

References

- Honey Bee Biology and Beekeeping, Dewey Caron, 2013.
- The Beekeeper's Handbook, Diana Sammataro and Alphonse Avitabile, 2011.
- Bee Culture Magazine, October 2014.
- The Honey Hotline Fact Sheet, Honey Crystallization, National Honey Board
<http://www.honey.com/images/downloads/crystallization.pdf>
- Wikipedia entry on Supersaturation <http://en.wikipedia.org/wiki/Supersaturation>
- Wikipedia entry on Crystallization <http://en.wikipedia.org/wiki/Crystallization>
- Beekeeping for Dummies, Howland Blackiston, 2009.