

“In a crystal we have clear evidence of the existence of a formative life principle, and though we cannot understand the life of a crystal, it is nonetheless a living being.”

— Nicola Tesla

I told my wife what the title of this month’s article was going to be and she said, “Why don’t you just write it on why paint dries and how to watch it as it does?” She isn’t a beekeeper but normally she’s very supportive. I hope that you, as a beekeeper, will find the information here not only helpful but extremely fascinating, regardless of what Normal People may think.

Why honey granulates

Honey is a supersaturated sugar solution. That basically means that it holds more sugar in liquid form than you would expect it to. Consider regular ol’ sucrose, the sugar we use to make bee syrup. At room temperature, 2,000 grams of sucrose can be dissolved in one liter of water (the classic 2:1 winter feeding formula). That’s 33% water, 66% sugar. If more sugar is added, it won’t stay in solution; it will precipitate out, forming a layer of sugar on the bottom of the container.

But honey is a liquid even with extremely high sugar concentrations. For USDA Grade A, it must be 18.6 percent or less water. So it is no surprise that the sugar in most varieties of honey will eventually precipitate some of that excess sugar. This is called granulation or crystallization.

Making it all better

Honey that has granulated is perfectly good as long as it hasn’t begun to ferment (more on that in a minute). Uninformed consumers often think that it is “spoiled” and throw it out, but that is foolish and a waste of good honey. Warming a jar of honey will cause its contents to return to a liquid state, as good as new if not better. If we warm it thoroughly it should take much longer to granulate again than it did the first time.

The classic way to liquify a jar of honey is to place it in a pan of warm water. Don’t overheat



This granulated honey has been in my basement for at least fifteen years. The liquid portion is 19.4 percent moisture and has a slight sour taste. (See section on Fermentation.)

it (too hot or too long) – that can cause the honey to darken and damage its taste and smell, as well as destroying its enzymes (if enzyme destruction is something that you care about).

Impatient folks achieve similar results by microwaving a jar, with the lid removed, for one minute. Then stir and zap it again at 30-second intervals until it reliquefies. Overheating may be more of a risk with this method but if the honey is for your own consumption, that may not be a big concern.

Note that for the hot water bath or the microwave, only use glass containers. Plastic honey jars will deform in hot water and in the microwave. For proof, I’ve got some that look like they belonged to Salvador Dalí.

For cases of honey jars, I’ve had good luck leaving them in the front seat of my Ford pick-

up truck, parked all day in a sunny spot. For me, this only works during the summer. Experiment with a jar or two to see what make of vehicle, parking lot, angle of parking, etc. works best for you.

Buckets and barrels can be heated with thermostatically-controlled heat bands, available at beekeeping supply stores.

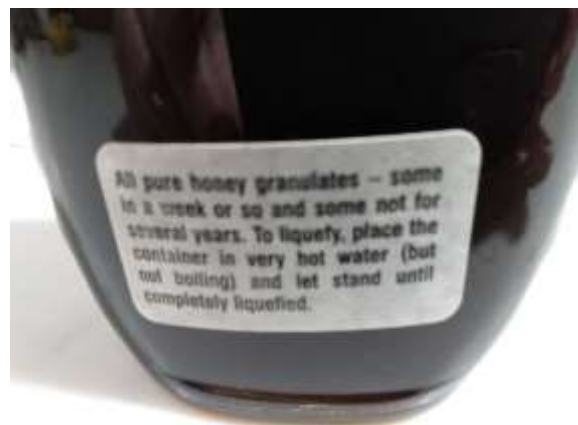
Another effective method is to use a Hot Box. I have an old refrigerator in my basement that I use for this purpose. It holds jars or buckets easily. A lamp with a 100-watt incandescent bulb provides all the heat that is needed. With my setup, plastic containers come out okay as long as they are shielded from the heat source. As with any of these methods, be careful to avoid overheating, and don't heat the honey for longer than is necessary.

More on the interesting bits

I recently had a friend give me a good education on the fact that not all honey granulates (at least not in our lifetime). He gets tupelo honey from Florida and sourwood honey from our NC mountains, and showed me examples from his own historical honey vault. Neither of those, if truly pure, granulate within any reasonable timeline, if ever. Tupelo honey is particularly granulation-resistant. I myself own a jar of purported tupelo honey that is 13 years old; it isn't granulated but it is a little gummy. I attribute that to impurities.

Our own local favorite, tulip poplar honey, is also relatively slow to granulate. At my house, the mostly pure tulip poplar honey takes well over a year to start crystallizing. When it is more of a "wildflower blend", it may start doing so in six months or less.

On the other end of the spectrum, canola, mesquite, goldenrod and cotton honeys are known for granulating very rapidly, sometimes shortly after being extracted.



This commercially-sold sticker says, "All pure honey granulates - some in a week or so and some not for several years." Ironically, it is on a jar of my tulip poplar honey that is at least 10 years old and is still in its original liquid state.

Why the difference?

A key factor in whether and how fast honey granulates is the proportion that is glucose. Nectar is largely sucrose, a disaccharide; it is converted by invertase (an enzyme added by the bees) such that it breaks down into the simple sugars fructose and glucose. Different honeys end up with different concentrations and different proportions of the two. The saturation point of fructose is 79% while for glucose it is only 32%. Therefore, it is glucose that granulates, so the higher the glucose to fructose ratio and the total percentage of glucose, the more rapid and more likely it is that granulation will occur.¹

Another factor in the occurrence and speed of granulation is the presence of starter particles. Crystals build upon solid particles, such as dust, pollen or other sugar crystals. Filtering to remove particles and/or heating honey to melt any sugar crystals will reduce granulation.

Yet another granulation factor is temperature. Cornell's Dr Elton James Dyce found that 57°F is the ideal temperature for honey to granulate. Storing honey at warm or cold/freezing temperatures will retard or arrest

¹ Joe Graham, ed., *The Hive and the Honey Bee*, Dadant & Sons, Hamilton, Illinois, 2015, p. 682, 688.

it. The take-away message is that storing honey in a cool basement is likely to result in more rapid granulation than storage at room temperature (assuming the room is warm!).

Fermentation

Consider this: sugar is dissolved in honey. Granulation occurs when the sugar forms solid crystals which fall out of solution. What does that do to the remaining liquid solution? Obviously it now has a lower sugar concentration than it did originally, since pure sugar crystals have been removed. What do we beekeepers know about honey when the moisture content rises above around 18.6%? It is more likely to ferment. Not guaranteed, but more likely.

Therefore, honey that is naturally allowed to granulate risks fermenting. But the lower the water content of the original honey, the lower the risk of fermentation, even when granulated.

Deliberate granulation

All of this discussion about granulation, fermentation and so on is separate from the situation where we deliberately force our honey to granulate in order to create cremed honey.

(Note it is spelled “cremed” and not “creamed” so that Normal People don’t incorrectly assume that it has dairy products mixed into it.) See “[Honey with a Twist](#)” for instructions on how to make this delicious form of honey. Cremed honey, in its proper state, shouldn’t ferment.

Scratching the surface

The physical properties of honey are a fascinating topic. Honey is magical. I have only scratched the surface in this article and may have even poorly described certain aspects. For the real info, I highly encourage you to look at the relevant chapters of the most recent versions of [The Hive and the Honey Bee](#), [ABC and XYZ of Bee Culture](#) and [The Beekeeper’s Handbook](#). Even if your spouse doesn’t understand what all the fuss is about, I bet you can’t help but say, “Wow!”

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