



QUALITY CONTROL IN THE SUGARHOUSE

Knowing where things can go wrong,
and making sure that they don't

Maple syrup commands a premium price relative to other sweeteners because of its rich history, its absence of artificial ingredients, the fact that it is minimally processed, and most of all because of its exceptional flavor. That premium price is contingent on the consumer getting the high quality product they expect.



High quality maple syrup is the result of lots of hard work and careful attention to detail. The unique flavor of maple is not only the result of caramelizing of sugars but also the many complex reactions that take place between sugars, amino acids various flavor precursors and heat. How the sugarmaker processes their syrup can impact the quality of the finished product but the greatest influence on what grade of syrup will be produced is the quality of the starting sap. Raw sap is not simply dilute syrup.

The vast majority of maple syrup has excellent quality and consumers are happy. Occasionally however, there can be issues with the processing and/or packaging that causes some sort of defect with the syrup. This could be a simple mistake by the producer such

as not correctly measuring the density, poorly filtering, or not accurately grading the color of the syrup. There are also several naturally occurring (mother nature-induced) off-flavors that can damage the syrups flavor. These are a class of flavors that are the result of natural changes to sap chemistry and not the result of producer mistake. Off-flavors caused during processing can also occur, and are the result of errors made during the collection, storage, concentration, evaporation, filtering, bottling or storage of maple sap or syrup. Sugarmakers must be able to recognize each of these defects before the syrup is put into retail containers, so that it never reaches the consumer.

Syrup grading standards were established to ensure that consumers get a consistent product. To be graded properly, syrup must meet the minimum values in four categories (color, clarity, flavor and density). Most issues

that arise with syrup not meeting these standards could have been avoided. The most helpful advice for producers concerned about damaging otherwise good syrup is the most basic; make sure to grade each batch carefully and don't assume that just because everything went smoothly in the sugarhouse that the syrup doesn't need to be checked. The follow-

ing is a list of problems that can occur with the four primary qualities of syrup, and how to avoid them.

Color

Syrup must be graded by correctly placing the sample into one of four ranges of color. The two most common methods of grading syrup color involve comparing a

sample to a known standard, or by measuring the percent light transmittance (%LT) with an electronic device called a photometer. Syrup will naturally darken over time and producers must anticipate this when assigning syrup that is very close to the lower limit of color for a particular grade.



Keep a separate sample of syrup from each drum to check for quality as the syrup is stored.

- A temporary grade kit is an inexpensive guide to grading syrup color. The kits include a set of glycerin standards tinted to the lower limit of color for Golden, Amber and Dark. The color of these standards will fade when exposed to light, warm temperatures or simply over time. This means that producers will find the color for each grade standard gets lighter over time so much so that it is nearly impossible to make syrup that meets the color of the Golden standard. Purchasing a kit made for the current year season is the best way to ensure that the standards are as accurate as possible.



Sample colors in temporary grading kits fade over time. The sample on the left in this photo is four years older than the one on the right.

- Occasionally producers will grade a batch of syrup to which ever grade standard it is closest to. This is especially tempting when a batch of syrup is very close to the lower limit of a particular grade. Small differences will only get larger as syrup ages.

- A photometer can produce inaccurate readings as well, if not used properly. Syrup samples that have not been well filtered, jars that are scratched or dirty, syrup with air bubbles as well as hot or cold syrup can lead to incorrect measurements of color.

- Remember that color can change after grading and after packing if syrup is not handled properly. Packing hot, newly filled syrup containers into boxes can cause stack burn, which darkens syrup after it is bottled. To avoid this, provide more space around containers while cooling, and don't box up syrup

until it has cooled to room temperature.

- In some cases syrup gradually darkens in the container from top to bottom. This is called layering and the underlying causes are poorly understood. Once the process starts it will darken the entire container of syrup. This represents another reason to keep a separate sample of syrup

(preferably in glass) to periodically check the color grade.

Clarity

Most of the cloudiness found in unfiltered syrup is a naturally occurring calcium precipitate also known as sugar sand or niter. Syrup clarity is a reflection of how well this cloudiness has been removed during filtering. Gravity filtering, while not as effective as pressure filtering with filter aid, can produce acceptable results. More sugar sand can be formed if syrup is allowed to overheat.

- If using gravity filtering methods, remember that damaged cone filters can allow unfiltered syrup to pass. Avoid twisting or wringing the fabric when rinsing.
- More sugar sand can be formed while canning. Avoid this by keeping well-filtered syrup between 180-200F when reheating.
- Sometimes sugar sand is too fine to be caught in a filter



Properly filtered syrup should be as clear as possible. A slight haze, as in the sample on the right, is acceptable, but should not be packaged in glass.

press. The result is syrup with a slight haze. It is generally accepted that filtered syrup that is “practically clear” includes syrup that was filtered through cloth and may not have the polish of filter pressed syrup.

- To make sure no foreign materials have found their way into syrup containers, always visually inspect barrels before filling, especially epoxy-lined barrels. Retire barrels or bungs that have epoxy lining that is chipped or damaged.

Flavor

Maple syrup has a pure, delicate and distinctive flavor that sets it apart from all other sweeteners. The same delicate flavor that makes maple unique does not hide defects well. Make sure to taste EVERY BATCH of syrup before preparing the syrup for distribution or storage. Make sure syrup is only packed into containers (retail or bulk) that have been inspected and deemed

suitable for syrup.

- To ensure that off-flavors don't go undetected, have more than one person taste each batch of syrup. This is best done at one time and not when actively boiling.
- New cloth filters can have residue from the manufacturing process that can impart an off-flavor to syrup. Make sure to rinse new filters with lots of hot, clean water.
- Use only the amount of defoamer needed to control foam

while boiling. Using too much defoamer can result in an off-flavor or unpleasant mouthfeel. Buy new defoamer each season since old defoamer can impart a rancid off-flavor to syrup. Be extremely cautious about how defoamer is added to the evaporator. Simple oil drippers are popular but can add excessive amounts of defoamer if not adjusted properly. Additionally, some sugar makers

use spray bottles for defoaming mistakenly believing that the fine spray does not contribute a great amount of defoamer.

- Sap that has been stored for a prolonged period of time or in warm conditions will likely produce "sour" off-flavor to the syrup. Make sure to process sap as quickly as possible after gathering.



Store and handle diatomaceous earth (DE) carefully. If this filter aid gets damp or musty, it can impart a musty flavor to your syrup. The safe handling of DE includes taking precautions to avoid inhaling the DE particles.

- Even the small amount of moisture that remains in the barrel from steam cleaning can grow mold over the summer and contaminate an entire batch of

syrup with a musty off-flavor. Wash and inspect barrels before filling.

- The inexpensive plastic bung gaskets provide an airtight seal for barrels and should be inspected every time a barrel is opened or sealed. Replace if they look damaged in any way.
- Some producers use cloth filter material to strain sap before further processing. These filters

should be thoroughly cleaned and replaced regularly before they can contaminate sap and impact syrup quality.

- Syrup is best graded for flavor at room temperature. When syrup is too hot it can be difficult to detect off-flavors.
- Don't attempt to grade syrup flavor when you are tired, have a cold, just had a meal with strong flavors or have been boiling for hours. All these can all diminish your ability to detect off-flavors.
- If good-tasting syrup takes on a musty off-flavor after being run through the filter press, the problem could be with your diatomaceous earth (DE). If bags of DE are exposed to moisture while in storage they can become contaminated with mold. The DE may not show any signs of damage but can impart a musty flavor to syrup when used with a filter press.



Syrup cools rapidly in a hydrometer cup. Take the density measurement immediately after reading the syrup's temperature and then apply the proper correction depending on the value.

- Do not use non-food grade containers or repurposed food grade containers that have a residual smell. Plastic containers that do not have a food grade rating are relatively inexpensive and therefore appealing to some sugar makers despite the fact that the plastic is of unknown quality and has the potential to leach chemicals into otherwise high quality syrup. Likewise, food-grade containers reused from other industries can impart off-flavors, significantly reducing syrup quality.
- Don't assume all debris (metal filings, tooling oil, grease) from manufacturing was removed before delivery. Wash ALL new pieces of equipment (evaporator, sap tanks, filter tanks, filter press, pumps, etc.) very well before using.
- Set aside a sample of each barrel and have a tasting day after the season has finished so you can accurately compare between batches and plan how

each batch will be marketed.

- Do not “skim and reheat” moldy syrup. Fungi are made up of more than just the visible material floating on the surface. Various species can grow in correct density maple syrup. Attention to keeping all items that contact syrup clean can limit contamination. Make sure customers know to refrigerate open syrup in order to slow or prevent the growth of mold.
- Syrup with a fermented off-flavor has been described as “sickening sweet” and “fruity.” It can be the result of below density syrup or syrup stored in barrels that do not have an effective oxygen barrier. Porous or incompletely filled plastic barrels are sometimes associated with this defect.
- The sugaring season is often long and exhausting and the end of the season is when several off-flavors are more likely



Syrup boiled beyond the proper temperature will become supersaturated, causing crystals to form. Such syrup should not be packed in retail containers.

to appear. It can be difficult to separate very strong late season syrup flavor from off-flavor.

- Beware of the phrase “it’s not ‘that’ bad.” Presenting consumers with anything other than the best-tasting syrup can damage the market for pure maple products. Even slight off-flavors should not be sold at retail.

Density

Measuring density involves taking precise measurements with multiple instruments. The process can easily produce incorrect values if one or more of the steps is skipped. Syrup that is above the standard for density is supersaturated and will precipitate sugar crystals in order to regain equilibrium.

Syrup that is below standard density has a greater chance of becoming contaminated with mold or becoming fermented.

- Be sure to draw off at the proper temperature. Weather can cause dramatic changes to the barometric pressure, which

affects boiling points. Make sure to check the boiling point of water EACH day that you boil and adjust the draw off temperature accordingly.

- When using a hydrometer, be sure to know the temperature of the syrup. Although many producers use the “hot test line” to check syrup density, syrup that has cooled below 211F can be accurately determined with a hydrometer if the syrup temperature is measured and the right correction applied. The syrup, hydrometer and hydrometer cup should all be the same temperature for the most accurate reading.
- When syrup exceeds the legal limit for density it must be adjusted to bring the batch into range. Adjustments must be done with clean, hot, potable water. Even though water easily dissolves into hot syrup the two must be well mixed before checking density. Be sure to

adequately mix syrup when adjusting overly-dense syrup.

- Whenever syrup is reheated for canning there is the chance that density will increase. This can be especially true of the last containers filled in a given batch. Check one or two of those containers before sealing to ensure syrup is correct density. Adjust canning procedure if density is out of range.

Finally, sugarmakers must know the laws and regulations that impact the sale of their product, and must have a plan to address any issues that do occur if poor quality syrup does find its way to retail. Make sure all syrup that is placed in retail containers receives a unique batch code. This will help if a syrup quality issue arises and will assist in determining the extent of the problem while limiting the amount of syrup that must be taken off sale.

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