

Ask Proctor: Why do I sometimes make light-colored syrup at the very end of the season?

Timothy D. Perkins, University of Vermont, Proctor Maple Research Center, Underhill, Vermont

The typical trend over a sugaring season is for syrup to start out light in color and get progressively darker, eventually ending up with very dark (and strong or off-tasting) syrup at the end. While there can be some temporary excursions up and down in syrup light transmittance, the natural progression is from light syrup early on to dark syrup near the finish. However, occasionally a syrup producer finds that right as the season is concluding the syrup color goes up dramatically and wonder why this happens.

The explanation has to do with syrup chemistry during boiling. Sap is naturally slightly acidic (pH below 7.0). As it boils, minerals and organic acids in the liquid are concentrated and quickly reach the saturation point. As this happens, the pH of the boiling sap rises rapidly to the point where the liquid becomes fairly alkaline (Figure 1), often well above pH 7.0. The material in solution precipitates out to form niter (scale) and sugar sand in the pans, which gradually reduces the pH of the liquid throughout the remainder of the boil. Several chemical browning reactions occur during the time the pH is above 7.0. These reactions cause the breakdown of invert sugars (glucose and fructose) and the formation of color and flavor compounds. Because microbes are more active and produce more invert sugar with warmer temperatures as the season progresses, syrup tends to get darker later in the season as a result of these alkaline degradation reactions during boiling. This also explains why scale/sugar sand

formation can be more problematic later in the season.

Very late in the season, when sap flows are low and temperatures are high, there can be substantial fermentation of sap in the tubing system or during storage. Fermentation causes the acidity of the sap to rise to very high levels (low pH). When this spoiled sap is boiled, the pH rises as it normally does, but because the sap started out so strongly acidic, the pH of the liquid never rises above 7.0 before it achieves syrup density. Since the boiling sap pH never gets above neutral, the alkaline degradation reactions do not take occur, color formation is impeded, and the syrup never darkens.

However, nature is not being gentle to maple producers. Instead, the cosmos is playing a paradoxical joke on us because the syrup made at this time, while appearing very light, has a sour taste due to the excessive amount of fermentation. The overall effect is that you make some of the most beautiful-looking light syrup of the season but it tastes terrible. So even though the syrup may look great...this is one sign that the season is over and it's time to stop.

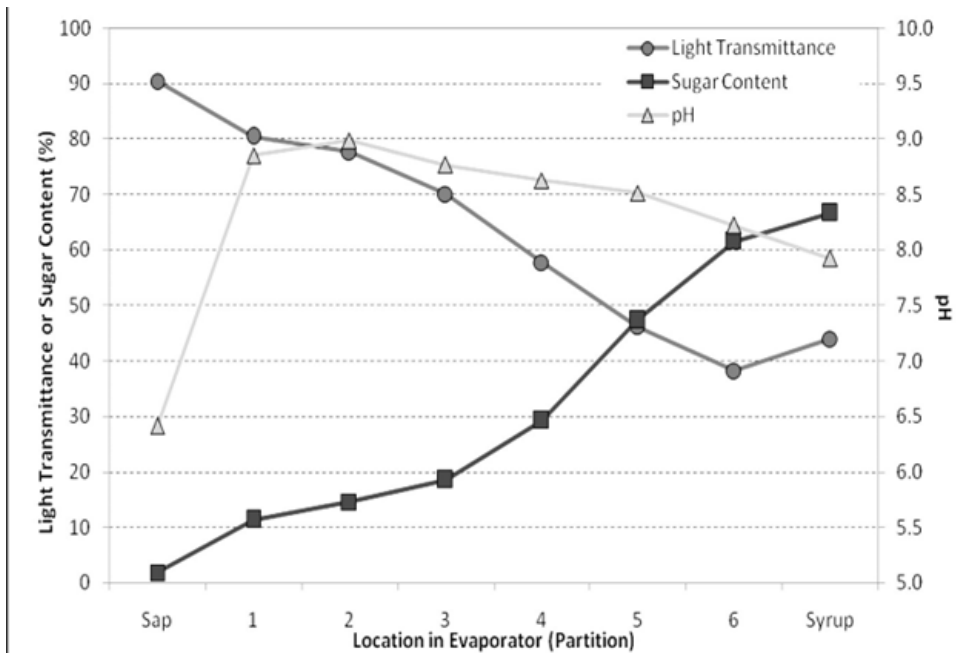


Figure 1. Changes in sugar content(density), light transmittance (color) and pH during boiling from sap to syrup during boiling in an evaporator.