Monitoring Fermentation with a Refractometer

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Outline:

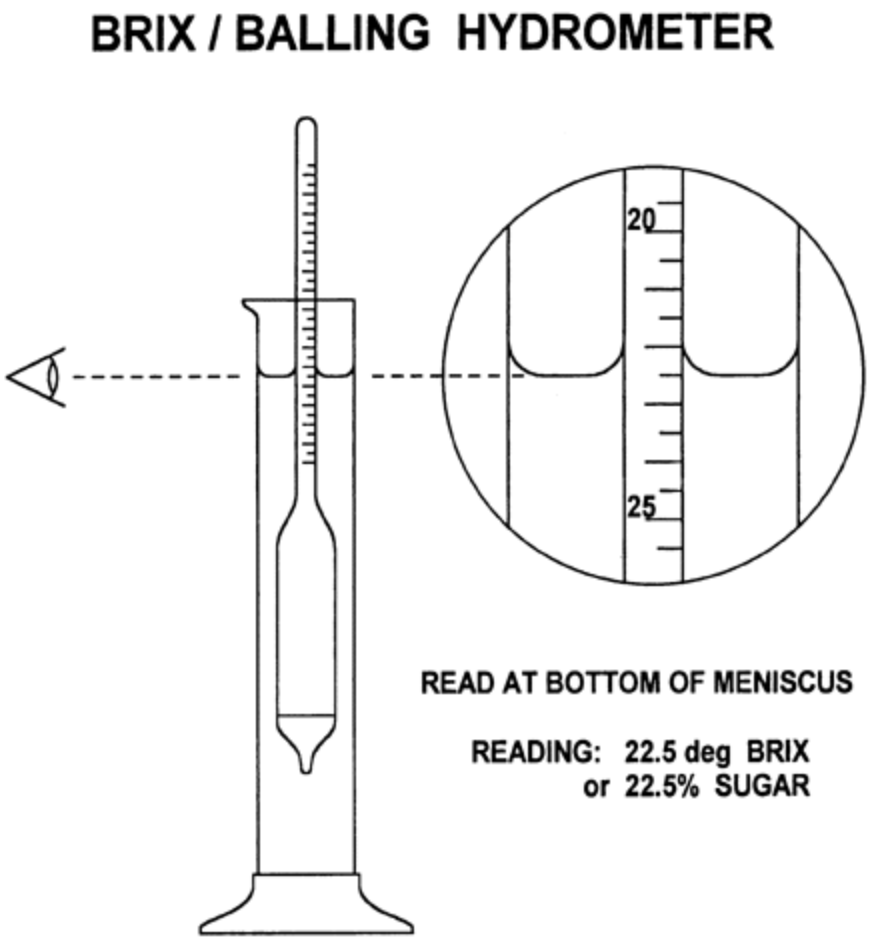
Monitoring Fermentation with a Refractometer (vs. Hydrometer)

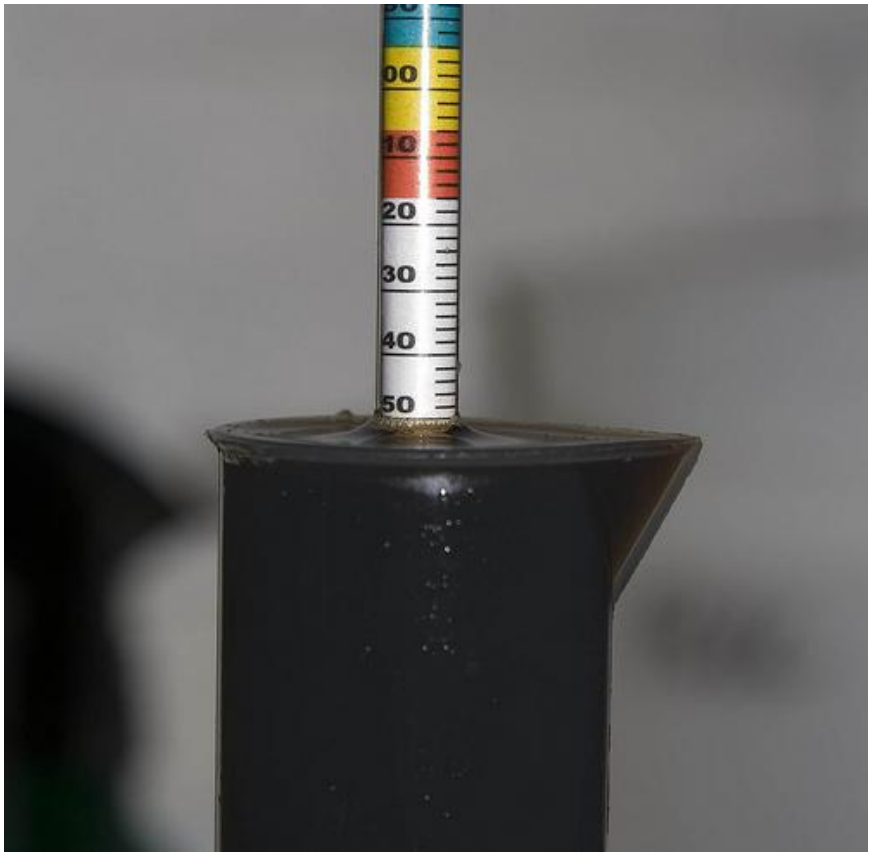
Refractometer approach is faster, just as accurate and more sanitary.
Method, Apparatus, Software versus Tables (www.moundtop.com).

Why Monitor Fermentation?

- Initial Brix predicts potential alcohol
  (and guides chapitalization decisions)
- When to add yeast nutrients (1/3 Brix down)
- Determine rate of fermentation
  (color extraction; "stuck" fermentation risk)
- H_2S intervention (too late for more nutrients?)
- Estimate press date (logistics) and
  MLF inoculation date
- Determine end-of-primary-fermentation
  (Racking decisions)

Classical Hydrometer Approach





Classical Hydrometer Approach

- Measurement based upon relationship between sugar/alcohol concentration and specific gravity (i.e., density) of a solution

- Decreases in %sugar (Brix) and increases in %alcohol BOTH lead to a reduction in the specific gravity of wine (Hence, the hydrometer sinks deeper into the wine as the fermentation process progresses)

Classical Hydrometer Approach

- Apparatus:
  250 ml sampling jar, winemaking hydrometer, thermometer, wine thief, temperature chart

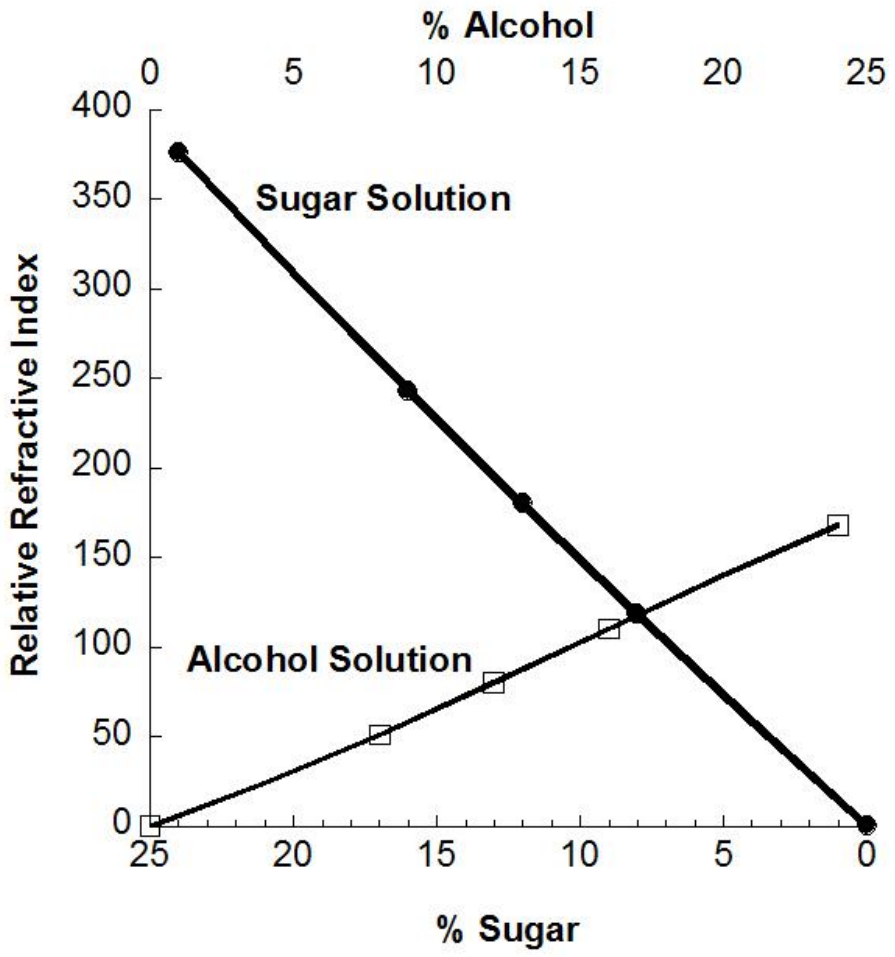
- Problems:
  Wastes a lot of wine; requires manual temperature compensation; messy; difficult to maintain optimal sanitation

Refractometer Approach

- Refractometry is an alternative approach to measuring both the %sugar and %alcohol in a solution

- Problem:
  As fermentation progresses, the drop in %sugar causes a decrease in the refractive index of wine; while the accumulation of alcohol causes an increase (Ambiguity)

Refractometer Approach



As fermentation progresses, the depletion of sugar and the accumulation of alcohol “push” the refractive index of wine in opposite directions.

If this process could be accurately “modeled”, then a refractometer could be used in lieu of a hydrometer to monitor the progress of fermentation.

Refractometer Approach

(The Model Equations)

```
%estimate SG using current (rbrix) and original brix (obrix) readings
sg=1.001843-(0.002318474*obrix)-(0.000007775*(obrix^2))
    - (0.000000034*(obrix^3))+(0.00574*(rbrix))+(0.00003344*(rbrix^2))
    + (0.000000086*(rbrix^3));

%compute and apply temperature correction to SG estimate
tcorr=1.313454-(0.132674*tempf)+0.002057793*(tempf^2)
        -(0.000002627634*(tempf^3));
sgc=sg+(tcorr*0.001);

%estimate true brix using temperature corrected SG value
tbrix=-676.67+(1286.4*sgc)-(800.47*(sgc^2))+(190.74*(sgc^3));
```

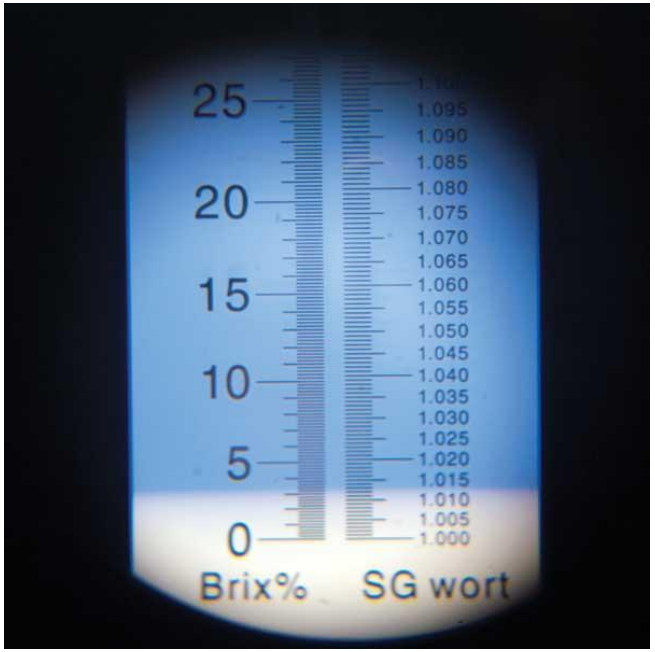
Notes

These equations are used in the spreadsheet implemented by ValleyVintner.com and can also be found at http://www.primetab.com/formulas.

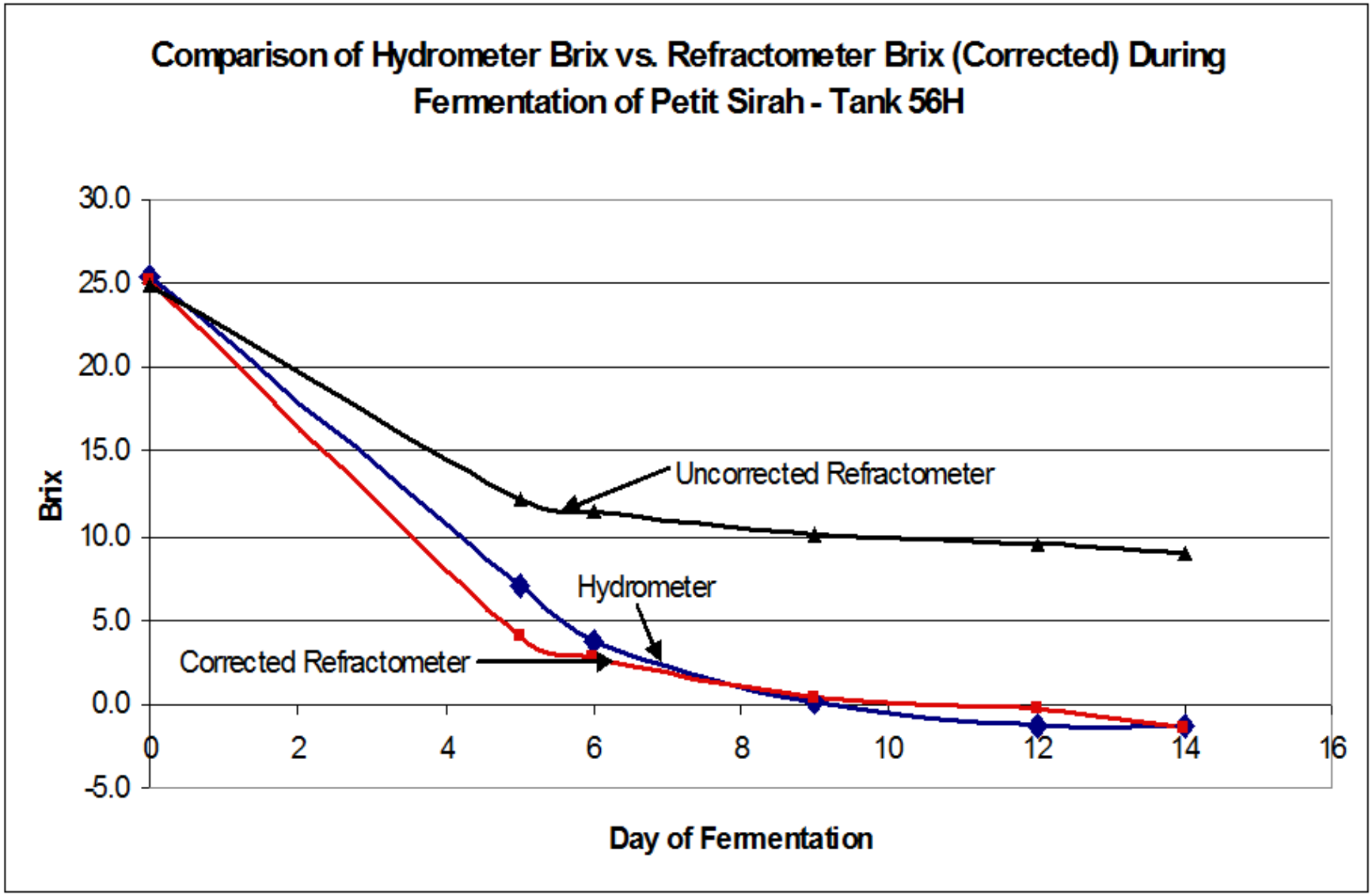
Refractometer Approach

- Record Initial Brix
  (Prior to pitching yeast)

- Draw a few drops of wine using sanitized pipette
- Read Refractometer Brix
- Enter reading into computer spreadsheet.
- Computer model estimates true Brix & S.G.



Refractometer Approach



Source: Barry Gump, “Tips for Small Winery Labs”

Refractometer Approach

- Accurate
- Fast
- Less clean-up
- Optimal sanitation can be maintained
- Verify finish with residual sugar test
  (Just like with hydrometry)

Spreadsheet available from:
http://valleyvintner.com/Refrac_Hydro/Refract_Hydro.htm

Refractometer Fermentation Tables available from:
http://www.moundtop.com/fermentation/RBRIX-Fermentation-Tables.pdf
(No computer/spreadsheet needed if Tables are used)