Analytical Tricks and Tips (#2)

This second test tip also arises as a result of numerous client requests (including one from Tibet!) for a simple way to test the alcohol levels of their productions. IT MUST BE NOTED THAT THIS IS NOT AN OFFICIAL METHOD: It is only a quick, though very useful, check for alcohol content. The method described is applicable to beer and to wine. [Note; as for all lab methods there are some dangers involved in carrying out even this simple assay. It should be attempted by qualified personnel only. We cannot be held responsible for any actions taken or for accidents occurring or for any results obtained. Use appropriate, authentic and intact laboratory glassware and equipment at all times].

Beer: Indirect Measurement of Alcohol:

- **Measure exactly 250 mL of beer (use a volumetric flask) and place into a large beaker (e.g., use a 500 mL or 1000 mL graduated beaker). Rinse the volumetric flask out with about 100 mL of distilled water and add to the beaker.**

- **Slowly boil the beer (avoid splashing and losses) until about 2/3rds of the volume has been lost to evaporation.**
  [A heated mantle would work best for this - with even heating- but a Bunsen burner set-up could also be used.]

- **Cool the beer to about room temperature (if necessary use an ice-water bath to help speed cooling - but CAUTION! - only do this with partially cooled Pyrex or other Lab-spec. glassware). When cooled, return the beer to the volumetric flask and bring the volume back to 250 mL with water. [Use water that has been used to rinse out the beaker for this; you then get a quantitative transfer of all the extract minus alcohol.]**

- **Use a very clean (and appropriate) Plato hydrometer to measure the extract content of the sample; this will be the real extract of the beer (RE). [Make any necessary temperature-dependent adjustments to the readings using correction tables.]**

- **While the beer is boiling (step 2) take a hydrometer and measure the apparent extract (AE) on a portion of the same beer that has been degassed (pass back and forth, several times, between two containers to degas or pass it through filter paper). [Again make appropriate adjustments to readings based on the actual temperature at which the measurement is made.]**

  Calculate alcohol by weight from the formula:

  Alcohol (weight) = 2.22 (RE - AE) [Use 2.23 for beers

  above 13 ^{O}Plato]

  If done carefully this method will give fairly accurate values, though they will not be applicable to BATF (TTB) standards and should not be used for official purposes. [TTB/official values are critically dependent upon temperature as well as on the use of much more sophisticated equipment/instrumentation in order to get truly accurate values. At Brewing and Distilling we use only the best and latest equipment from Anton Paar USA.]

Please call us if you would rather express your values in alcohol by volume terms and we can help you there. ***[As a starting point for you here see the wine method below and use that equation for a rough volume estimate using a factor of 1.42.]***

Use these methods as a rough guide in your own laboratories for alcohol contents and for process-change evaluations. Then Get A Qualified Lab to run samples for confirmation and for "certified" labeling purposes. {Brewing and Distilling Analytical Services comes to mind here!}

Wine: Indirect Measurement of Alcohol:

A similar procedure to the one given above for beer has been presented that is applicable to wine (see www.monashscientific.com.au/BoilingMethod.htm for complete original details). However, we have found the need to modify a factor in the calculation supplied by Monash Scientific in order to get reliable accurate results.

- **Follow the procedure outlined above for beer with the following modifications and suggested changes.**

Wine samples may need a more careful attention to the boiling step (possibly using a few boiling chips/granules).

The Monash method calls for the use of distillation apparatus which is fine though more expensive to set up. Adapt the boiling procedure above.

Use an appropriate Specific Gravity Hydrometer. Chart values for temperature compensation of hydrometer readings can be found at the Monash site.

- **Calculations: The Specific Gravity value obtained from the unboiled wine sample is given the term SG1. The value for the boiled sample (alcohol depleted), SG2.**

Calculations;

The Equation to use here (for volume alcohol) is:

Alcohol (% v/v EtOH) = SG2-SG1/ Factor* x 1000

*** Factor given at Monash is 2.11. However, in careful determinations in our own laboratory, we have found the factor value that should be used is 1.29 at least for wines in the 10-15% alcohol by volume range. [REPEAT, WE USE THE VALUE 1.29!]**

[Winemakers usually express wine alcohol content by volume but if you wish to convert to alcohol by weight please call us and we will show you how to convert your volume values.]

Using this method, and the "correct factor" (1.29) in the equation we have estimated a wine (of true - by official methods - value at 13.38% by volume) to give a value of 13.41% alc. by volume at 20 ^{0}C. [Note: we used a density meter rather than a hydrometer for our gravity determinations so our values will be more accurate than if using a hydrometer.]

Winemakers: We recommend that you approach this assay with a bit more caution (than brewers) and verify for yourselves the factor value needed in the equation. [Study the method carefully also at the Monash Scientific website: www.monashscientific.com.au/BoilingMethod.htm.] It should however, with careful preparation and attention to detail, work well for you. Check out the method by using a reputable lab for confirmation of results and always for Officially Reliable Values.

Method for Distilled Spirits/Higher Alcohol Containing Beverages: Indirect

Measurement of Alcohol: CAUTION! For higher alcohol containing beverages a word of caution is necessary here. DO NOT USE OPEN FLAMES FOR SUCH WORK! Use, instead, a heating mantle (appropriately grounded), and a water bath (boiling on the mantle) with the sample placed above the boiling water to effect evaporation of the alcohol in the sample. This will, naturally, take a long time to attain the required 2/3rd volume reduction.

The method should work (as described above for beer and wine) with use of appropriate hydrometers and with the establishment of an appropriate factor for the equation. Some experimentation will be necessary on your part to establish the best conditions for this assay. Please let us know how you get along if you do try this method.

UPDATE: 8/21/05. The factor for distilled spirits will vary dependent upon the sugar (carbohydrate) content of the spirit. The value is also alcohol-strength dependent and rises with increasing alcohol (volume) content. For approx 40% by volume spirits (without any carbohydrate) we are finding factor values of 1.240 to 1.257 - depending upon the type of spirit. [Vodka is around the 1.240 mark.] A value of 1.25 would be a good compromise for most other spirits at or about 40% by volume content (with very little to no carbohydrates) - though we AGAIN stress that these are only for non-official rough estimates for alcohol content. Experiment and work out the factors for your favorite spirit and get values checked by officially accepted methods for appropriate labeling and usage purposes. We cannot be held responsible for your reporting alcohol contents to any persons or bodies and authorities based on our factors presented here.

As discussed above this method will only give unofficial values for alcohol content.