

BREWING & DISTILLING
ANALYTICAL SERVICES LLC

Overview of Several Quality Considerations for the Production of Distilled Spirits – Old and New Issues and Approaches

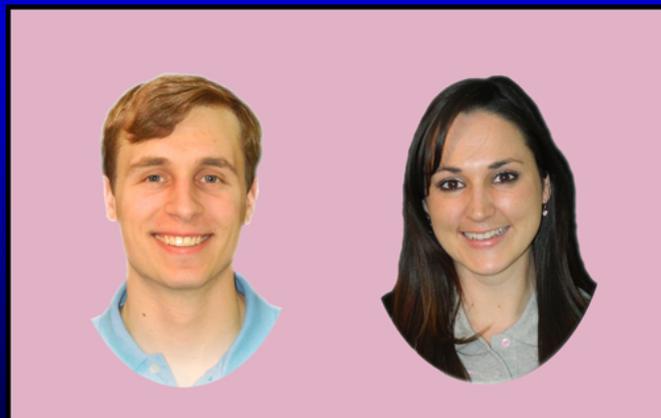
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Brewing and Distilling Analytical Services, LLC

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Acknowledgments/Introductions



Your Questions/Concerns

**What keeps you up at night –
worried about regulations or
quality?**

Quality Quote

“Just as in the craft brewing industry, the craft distilling industry must pay more attention to quality control.

Quality control is not just monitoring fermentation or analyzing the spirit produced or measuring the maturation rates; it is about consistency.

This industry, like any other industry will sink or succeed based on product consistency”

T. Pearse Lyons in Chapter 5. [Whisky: Technology, Production and Marketing](#) [Second Ed.] Elsevier, 2014

What do we see?

Where do odd aromas come from?

**How to Measure alcohol –
Proof/How do I dilute?**

What causes hazes in products?

Shelf-life and Aging studies

To Cover

Issues of Measuring Alcohol

**Some thoughts on future regulations and
test data**

**Product consistency, Shelf-
life/stability and Aging studies**

**Including the interest in rapid aging/scale
of operations**

Measuring Alcohol (& Extracts)



Can You Measure Alcohol?

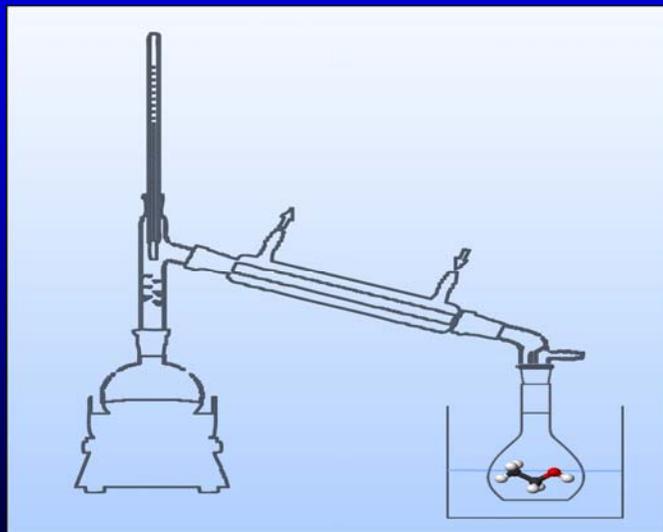
Simply/Accurately? YES and NO

Simply if you are producing traditional (low solids) beverages

More complex – with high sugar, sweetened, cream liqueurs or with highly flavored spirits and cocktails

> Especially so if you want nutritional information

The Lab Still



But What Do You Measure?

Volumetric Distillations

Measure, via Density/SG, the true ABV (Alc. By volume), %

Assuming you recover all the alcohol

Use controls to be sure

From the measured values of SG or Density

Use OIML Tables to obtain ABV at 20 °C

Use AOAC Tables to obtain ABV at 60 °F

If all you need is ABV you are good to go!

Assuming no issues with flavor/oil carryover

Example Distillation & OIML

Volumetric Distillation Gave you Density: 0.94824 (at 20 °C)

OIML Tables (Available on Line) Provide Density vs. ABV and Density vs. ABWt conversions

Take that Density as 948.2 to find 39.90% ABV (may need to interpolate numbers). That is at 20 °C!

For Proof you need at 60 °F [Done via AOAC Tables or algorithms]

But what if you measure SG not Density*?

Use the Formula: $SG \times 0.998201 = \text{Density}$

[e.g., SG 0.94995 converts to the above 0.94824 Density]

Then use the OIML Tables using Density *[\[Note g/mL\]](#)

For 60 °F and Proof – Use AOAC

For 60 °F Values for Proof You can Use AOAC Tables (913.02) “Percentages by volume at 15.56 °C (60 °F) of ethyl alcohol corresponding to apparent specific gravity at various temperatures”

Using such tables (again with interpolation as needed) - look up the ABV from SG value vs. the column marked with the temperature at which you measured the SG of the alcohol (usually 20 °C) and note the ABV

[e.g., SG 0.94995 gives (using interpolation) 39.76% ABV]

Proof is then $2 \times 39.76\% = 79.52$ °P

[\[An unofficially approved though robust algorithm is available to convert from ABV 20 °C to ABV at 60 °F\]](#)

But What If you Need ABWt?

Volumetric Distillation Gives you ABV, %

This will be true assuming no components distilling over interfere with the measurement of just the alcohol, all the alcohol is distilled over and the correct tables of data are used

However, this measurement of alcohol is for a pure alcohol:water binary mixture. Cannot use the determined SG or Density with OIML Tables to get the true ABWt if appreciable solids (Extract – sugars, proteins, flavorings) are present. A compensation is needed for this and can be made if the actual sample SG is known

Today we present this as a caution but would need to be accounted for in future needs for Nutritional Information or if you are given GC or HPLC Data on alcohol content

More in Artisan Spirit

See: “Measuring and Calculating Alcohol in Distilled Spirits and Liqueurs: Emphasis on Contemporary High-Extract Containing Spirits” Spring 2015 Issue

Or contact us for further details on this:

info@alcbetesting.com

Overall Quality, Aging, Shelf Life and Rapid Aging – New Test Methods

Quality (and QC) involves:

Flavor and sensory perception

Use of authentic ingredients and additives

Consistent batch production

Removal/prevention of hazes

Understanding shelf-life and changes in characteristics over time

Determining when maturation is complete

This also involves a lot of questions on how to effect rapid aging or how aging proceeds under different conditions – e.g. barrel sizes

New Developments = Spectroscopy

Consistency and authentication through Spectroscopy?

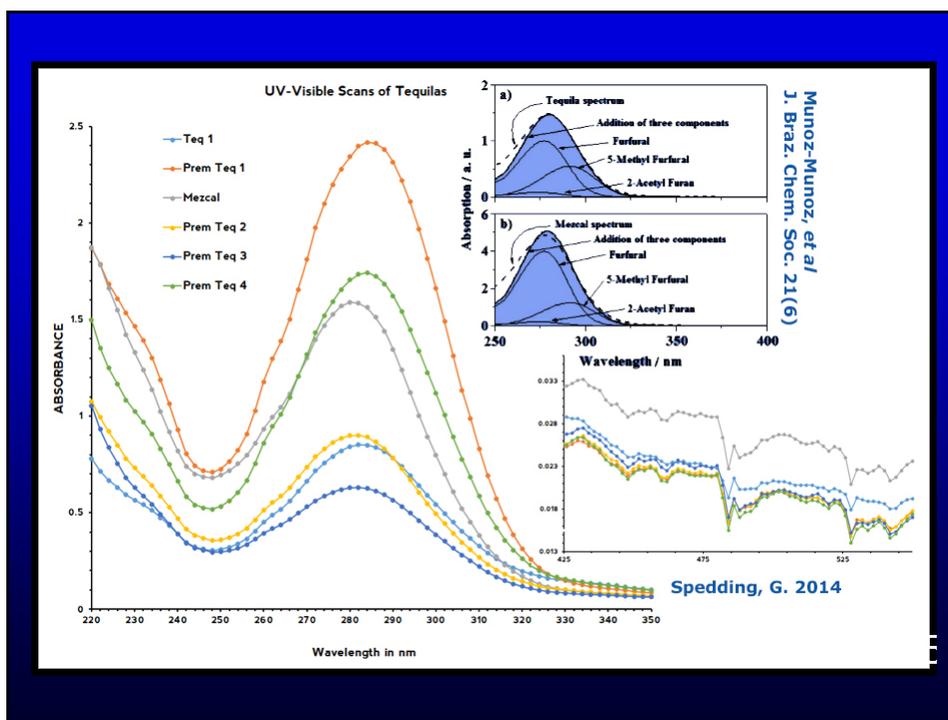
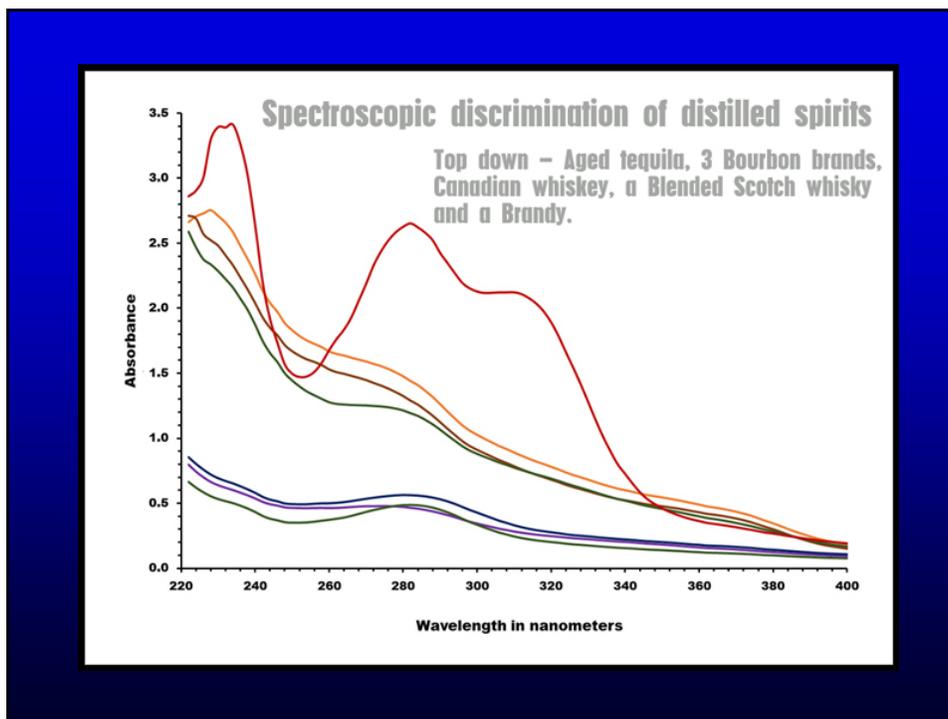
Identity

Engineering products to match desired profiles

Shelf Life issues

Rapid Aging and maturation studies

Caramel or other additives?



Spectroscopy = Discrimination

From many tests we see discrimination – broad fingerprints of different styles and brands

Some chemical information under peaks and valleys in spectra are becoming known

These components change with packaged product aging (studies underway)

Additives can be “detected” in fingerprinting scans

What about BBL aging/maturation?

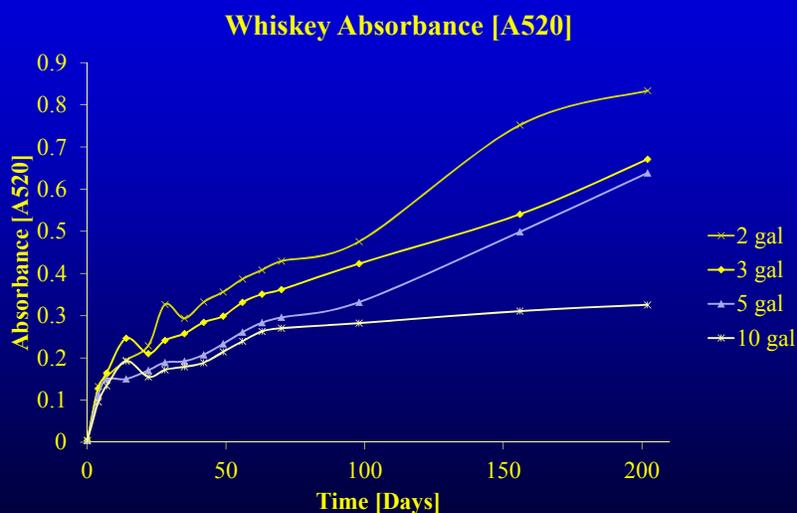
Maturation

“The specific combination of one type of distillate with any one type of cask leading to the development of a flavor (and chemical) profile relative to time”

Maturation

- ❑ Maturation Time, rxns, temperature
- ❑ BBL Size (Surface area to volume)
- ❑ Fill strength-extraction
- ❑ Wood composition and preparation (toast/char)
 - Casks: #Times used/Previous contents!
- ❑ New compounds – flavor congeners in maturing spirit
 - Storage wooden casks gives rise to whisky lactone, vanillin, guaiacol, eugenol, cresols >> migrate from the wood to the spirit
- ❑ Loss of Compounds (e.g., sulfurs lost)
- ❑ Color extraction – imparted to white spirit

Quick and easy Spectrophotometer



Color vs. Flavor

Color is a good marker for the product – consistent color important sensory attribute

However, the overall flavor profile must meet specifications.
Trained taster = Master Distiller

Yet simple measures such as a spectral fingerprint and a color value might be a good tool, along with sensory evaluation, for determining when to package a product and when to pull a product from the shelf

It is being used by those “pioneering” rapid aging/maturation technologies

Spectroscopic Studies Summed Up

UV-visible scans (“fingerprinting”) shows:

Differences in rye, wheat and corn whiskies

Dramatic differences in aged vs. un-aged spirit [possibly signaling end of maturation]

Differences occurring during normal (or forced) shelf-life (e.g. Color changes/bleaching of sample & formation of staling compounds – indirect evidence)

Quality of grain neutral spirit for beverage production

Consistency of product – batch production

Ability to tweak formulations/test vs. other products

Presence of caramel and other food coloring components and additives (adulterants/contaminants?)

Authenticity of your product in the market

Summary & Issues

Alcohol Measurements

Will be a key feature of the distillery laboratory

Will require investigating issues with regard to new types of beverages – Complex topic needing TTB input. Need to start a conversation on this

Aging and Consistency

Interest in smaller barrel sizes and rapid aging.

New fairly inexpensive tools originally for investigating authenticity/adulteration of beverages might be useful as a broad approach to measuring batch consistency and aging of distilled spirits

But wait – There is More Information!

The team at BDAS, LLC is available to answer questions on the topics presented here and other questions of concern regarding alcohol beverage production and analytical measurements

Several papers (peer reviewed and self published) are available upon request on many topics of interest to distillers

Sensory evaluation is an important topic in quality evaluation of beverages and we are ready to address questions or deliver presentations in this area

Contact us: info@alcbvtesting.com

www.alcbvtesting.com 859-278-2533