QC Tips for Small Wineries

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Goals

- Understanding the concept of quality control
- Understand why we test
- Understand ideologies of testing
- What are confidence limits?
- Review the equipment and analyses

Why Test In Your Winery

- Maintaining wine quality
- Provides information for additions/treatments
- Compliance requirements
- Faster turnaround time
- Cost control???

Random and Systematic Error

- Random error is attributed to events unrelated to the actual chemical reaction
- Systematic error is inherent in the method you have chosen.

Accuracy and Precision

Sample Measurement

- Glassware choices
  - Class A/B pipettes
  - Graduated Cylinders
  - Flasks and Beakers
  - Burettes

Why is laboratory testing important?

- Provides a glimpse of the ‘analytical moment’ in any wine’s life
- It’s the journey as well as the destination!

The Journey Defined

- Grapes/wine don’t read books
- Testing at intervals
  - Checking the gas gauge
- Juice (into wine)
  - Brix, pH, titratable acidity\
    - Refractometer vs hydrometry
- Wine
  - pH, titratable acidity, malic acid, free sulfur dioxide

How do I know my results are “good”??

- See if someone else got the same number?
- Use a method from a book/reference?
- The results seem “right”?
- Get the same result several times?
- Use the same method as someone else?

What is Quality Control?

- A measure of confidence that the result you are working with is within a preset condition
- 95% confidence limits are the norm!
- Standards versus controls!
- Wanting to go pro? These are decisions that cost $$$

Standards and Controls

- Misconceptions that they are the same
- Standard
  - Substance of a stable matrix that is used to calibrate a test or instrument
    - Usually included with Kit
- Control
  - Substance of a similar matrix to the analyte you are testing for
    - Model Wine or known wine

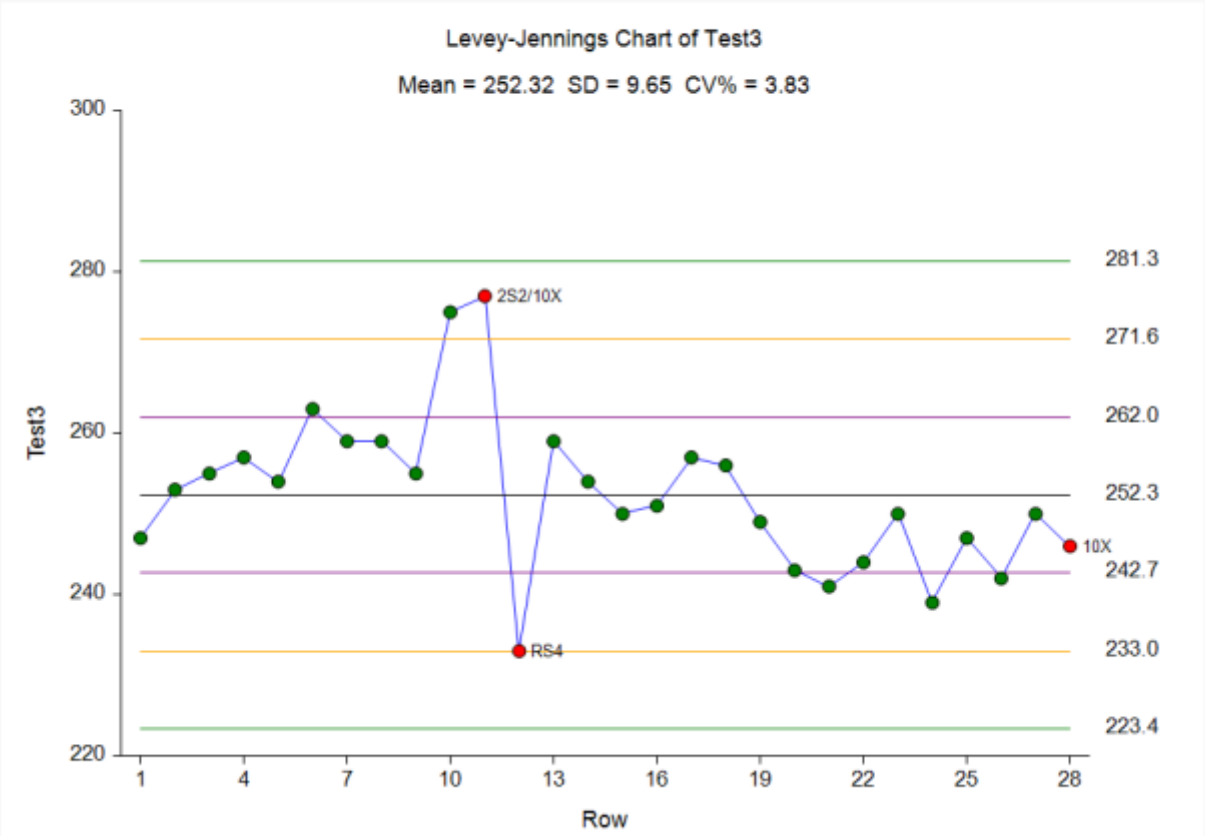
Model Wine

- 10-12% Ethanol
- 4.8 g/L Tartaric Acid
- 1.5 g/L Dextrose (corn sugar)
- 500 mg/L Malic Acid

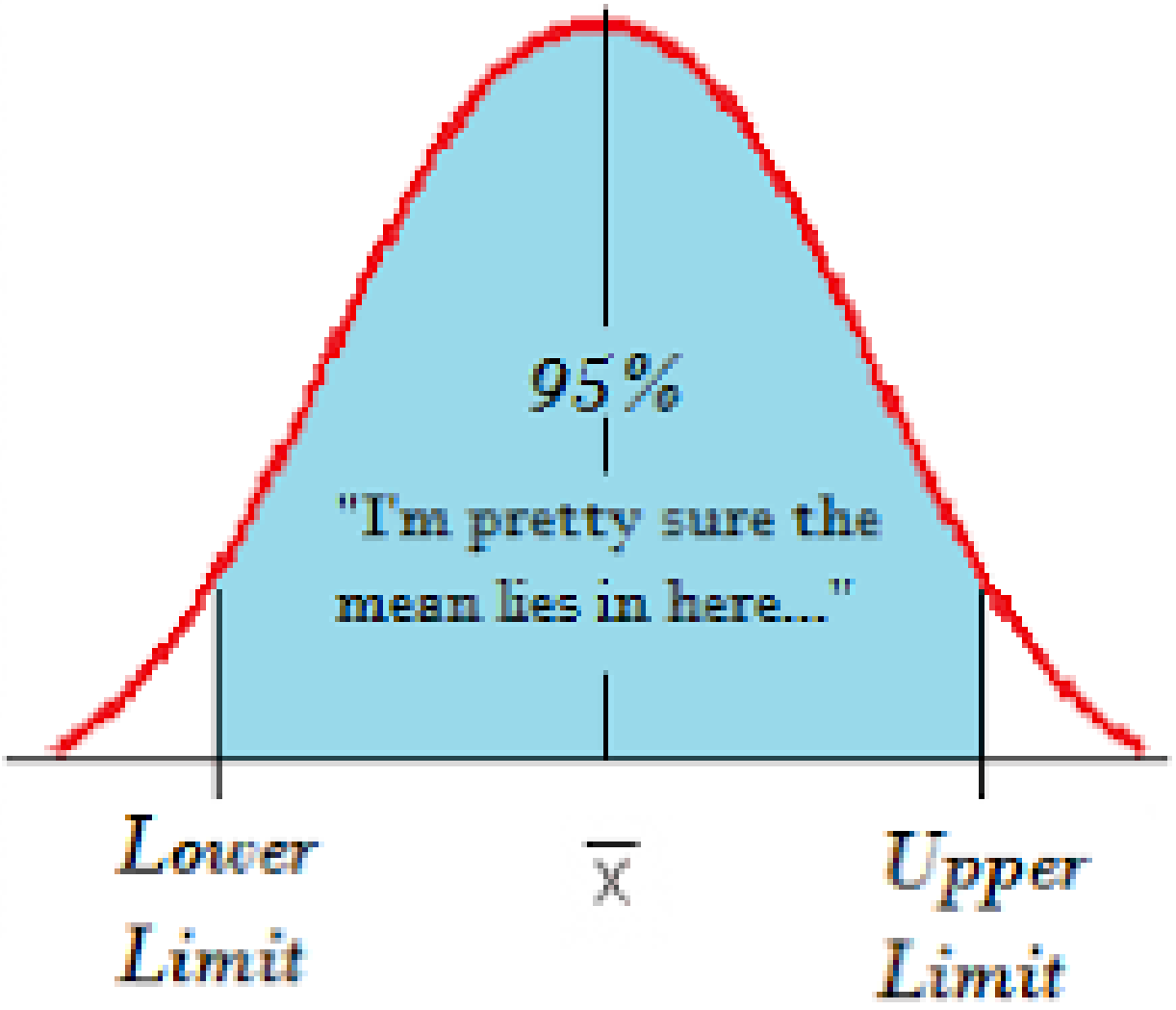
- https://westgard.com/lessons/basic-qc-practices-l/lesson12.html

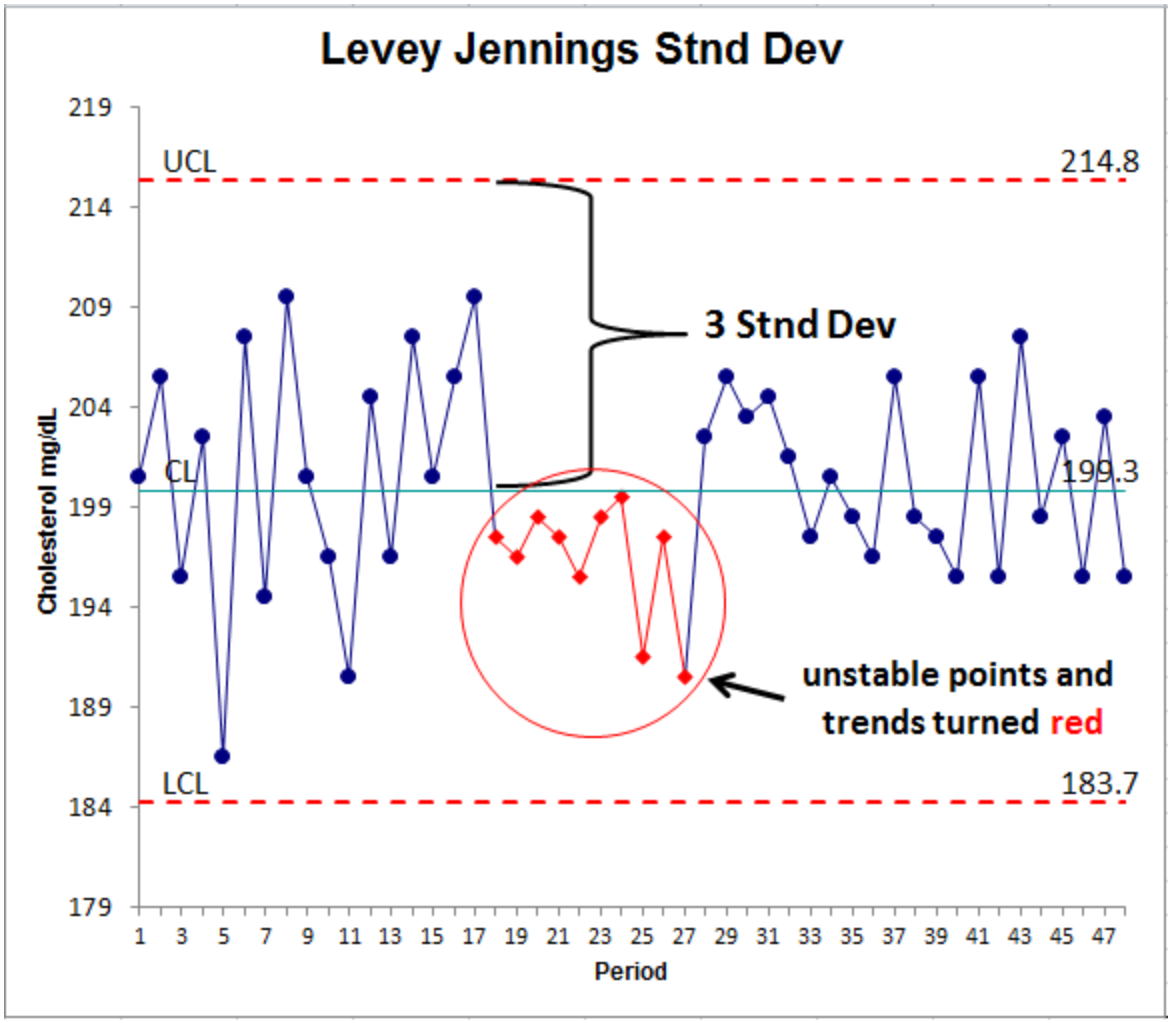
Levey-Jennings Control Chart

Levey-Jennings Control Chart for Rows 1 - 28



CONFIDENCE INTERVAL




Levey Jennings Stnd Dev
Cholesterol mg/dL
219
214
209
204
199
194
189
184
179
UCL
214.8
CL
199.3
LCL
183.7
3 Stnd Dev
unstable points and
trends turned red
1 3 5 7 9 11 13 15 17 19 21 23 25 27 29 31 33 35 37 39 41 43 45 47
Period

Confidence in Results

- How do you develop confidence?
  - Occasional comparison with commercial lab
  - Results follow a logical pattern of cellar activities

Essential Testing

Basic

- Brix (°B)
- Temperature
- pH
- Titratable Acidity (TA)
- Malic Acid (HMa)
- Residual Sugar (RS)

Advanced

- Alcohol (EtOH)
- Volatile Acidity (VA)
- Sulfur Dioxide (SO_2)

Chemicals/Kits

- Don’t over purchase
- Pool Resources if you are in a wine club
- Maintain integrity of the content in the original container
- Refer to manufacturer’s requirements for storage (Iodine, H_2O_2)
- Reagents are standardized and ready to go if…

Equipment and Glassware

Hydrometer/Refractometer	$15 -130
pH Meter	$50 and up
Pipettes	Depends
Burette	Depends
Flasks	Depends
Beakers	Depends
Test Tubes	Depends
Analytical Balance	$250
Ebulliometer	$600
Cash Still	$600

Common Issues

- Sampling
- Sample prep
  - Interferences with CO_2
- Analytical Technique
- Headspace after sampling
- Test Choice
  - Interferences, Level of detection (LOD)
- Result Interpretation/Comparison

Techniques

- Results are only as good as the sample received
  - Something well mixed and representative of the entire lot
- Good Reagents
- Good (rather consistent) technique
  - Comparing apples to apples

Sampling & Sample Preparation

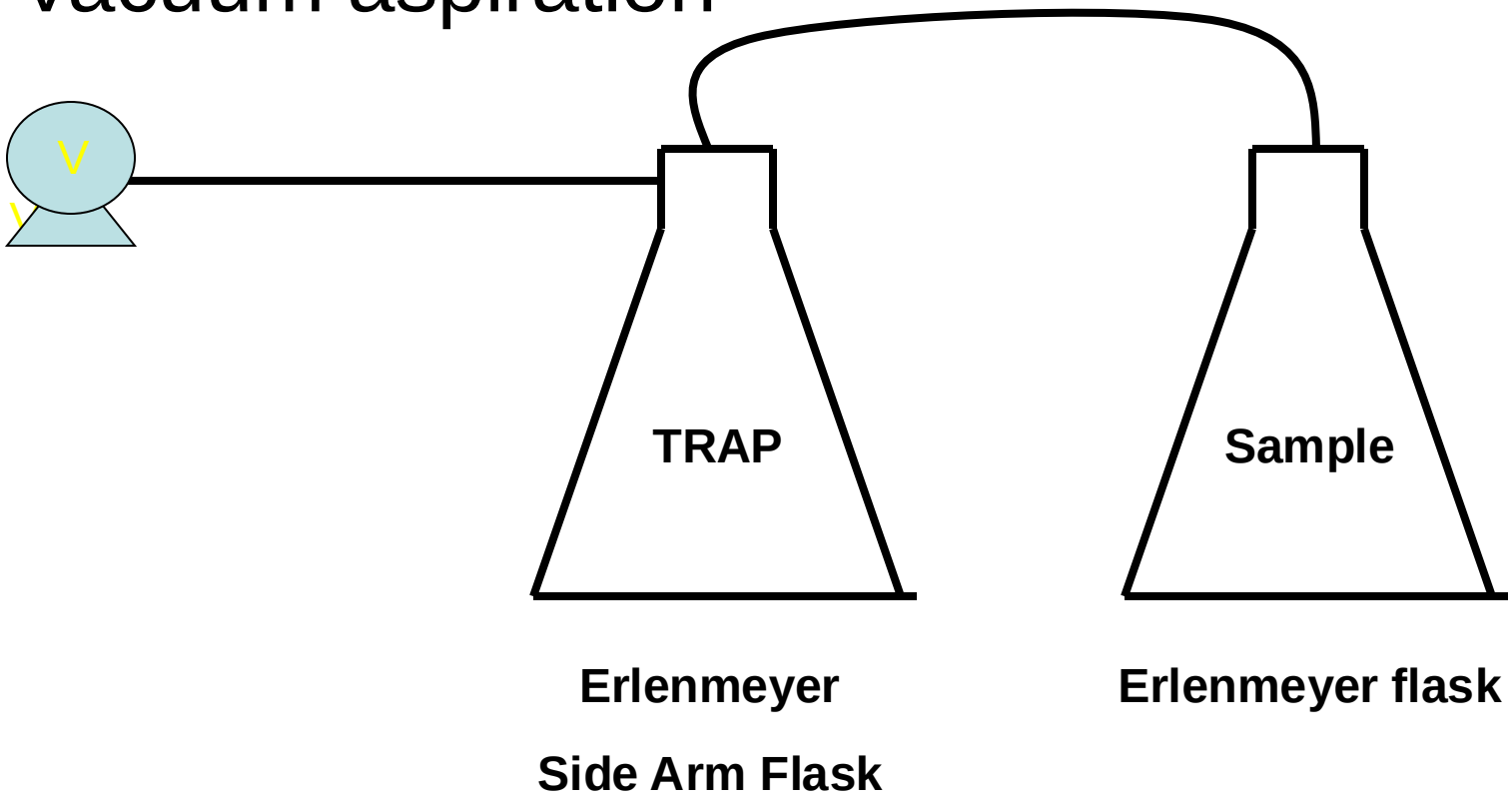
- Be Consistent and sample at appropriate times
- Make sure headspace is not compromised after sampling
- Keep conditions sanitary
- Most samples should be clear
- Degassing to reduce the effects of CO2

Sampling

- Consistency
  - Mixed, reflective of entire batch
  - Time intervals
    - E.g. Sulfur dioxide (SO_2)

Sample de-Gassing

- Vigorous Shaking
- Vacuum aspiration



Brix

- Refractometer
  - Samples should be free of bubbles
  - Temperature compensated
  - Check Zero and with a known standard.
- Hydrometer
  - Brix and Temperature are directly related
  - Samples should be clear and free of bubbles

pH

- Levels dependent on varietal/style
- Simple yet complex
- Calibration
- Buffers
- Result interpretation

Titratable Acidity

- Sample preparation
- Endpoint choice
- Interferences
- Interpretation

Malic Acid

- Paper Chromatography ~$100/Kit
- LOD of ~100 mg/L
- Controlled spotting
- Organic waste
- Enzymatic method is complex and require more advanced equipment

Residual Sugar

- Sugar Pill (Clinitest)
- Based on an old alkaline copper reduction method.
- Better for whites than for reds
- Gold Coast and enzymatic methods are complex and require more advanced equipment.

Alcohol

- Specific gravity
  - Alcohol (%v/v) = (SG1-SG2)/0.0074
- Distillation
- Vinometer
- Ebulliometer

Ebulliometry

- No sample treatment unless RS>2%
- Based on the boiling point of wine versus that of water.
- Use cold water in the condenser
- Clean out chamber periodically

Volatile Acidity

- Sample/Still Prep/Vent
- Distillation than titration of the distillate
- SO_2 will also interfere

The Cash Still

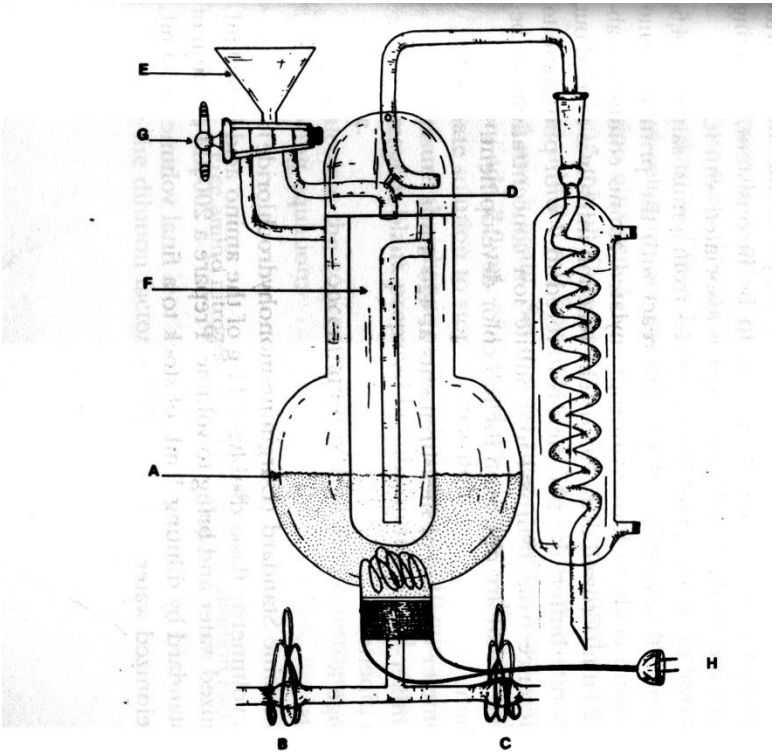


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Fig. 20–2. Cash and Markham Volatile Still Assemblies for Volatile
Procedure.

Sulfur Dioxide (SO_2)

- Ripper Method
- Aeration Oxidation

Ripper

- Volatile – Test first!
- Whites versus Reds
- Free and Total
- Re-dox reaction – Endpoint is dynamic
- Can’t use if you have used ascorbate
- Platinum electrode option
- Results interpretation

Aeration Oxidation

- Advanced
- Sample
- Free and total require different methods
- Aspiration rate and condenser temperatures are critical

Equipment and Glassware

- Hydrometer/Refractometer
- pH Meter
- Pipettes
- Burette
- Flasks, Beakers
- Analytical Balance
- Ebulliometer
- Cash Still

- $15 -130
- $50 and up
- Depends
- $50 ish
- $5-10 ish
- $250
- $1500-$3000
- $1000

Commercially Available Equipment

- Vinmetrica ~$Varies
  - pH, TA, SO_2
- Hanna F/T SO_2

Kits

- Quick and Dirty
- Limitations
  - Single Use
  - Assume reactions are finite
  - Costs
- Chemistry Background Helps A lot!

Recommended Reading

- **Wine Analysis and Production, Zoeklein, et.al. Chapman and Hall (Aspen)**
- **Techniques for Accurate Chemical Analysis of Grape Juice and Wine, Illand**

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