

Set up a QC/QA Lab on a shoestring Part I

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2018: Microbiology

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2013-2020



Favorite style:
Saison

UCDAVIS
Continuing and
Professional Education

Intro to Beer and Brewing
MBCP: Microbiology

Overview

- Getting Started
- Quality Assurance and Quality Control
- Equipment
 - “Scientific equipment”
 - “non-scientific” equipment
- Lab design (doesn't need to cost a lot of money)

How this Presentation will Work

- \$ - Free or negligible cost
- \$\$ - Might need to think on it for a bit
- \$\$\$ - Need to consult the bean counters first
- \$\$\$\$ - If you're buying this you probably aren't watching this

- Note: Scales may vary depending on equipment type

What does Quality Mean?

Is this the product you intended to make?

Positives: Did you achieve the flavor, color, bitterness, foam/carbonation, clarity you desired

Negatives: is it free from defects, contamination, off-flavors

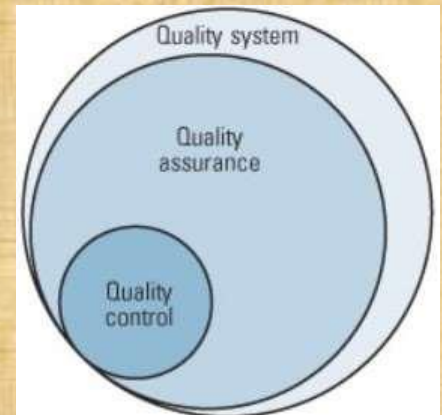
Is it consistent?

Consumer satisfaction

Adherence to laws

Better process control

Know what your changing variables do



Quality Assessment Equipment (\$\$\$\$)



Gas chromatography (GC)
+ Mass spectrometry (GCMS)

Volatile components:
esters, H_2S , VDK,
acetaldehyde



Atomic Absorption Spectrometry

Metals: Zn, Mg, Ca



High Performance
Liquid
Chromatography
(HPLC)

Less volatile
components:
sugars, IAAs

Where to start?

- *At Minimum:*
 - Original gravity/Extract
 - Present gravity (2-3x/wk)
 - Present pH (2-3x/wk)
 - Additions (Dry hop, fruit, etc)
 - Packaging

Gravity



\$50



\$350



DMA 35

\$3,500

pH



\$120



\$12.00

pH probe storage solution
Standard buffers for calibration

Science

- “The difference between screwing around and science is writing it down.”

—Adam Savage



Water

- Taste it!
 - Any strange flavors
- Municipal water sources usually supply reports for free
 - Mineral Content
 - Annual, semiannual
- Analyze in house
 - Simple titration reactions
- Treat water to remove minerals
- Add in minerals if desired



\$250

Water Report

Date	Calcium Hardness	Magnesium Hardness	Sodium	Sulfate	Chloride	Total Hardness	Total Alkalinity	Residual Alkalinity	pH
2/2/2021	80	60	29	20	16	140	160	129	7.67
12/22/2020	44	36	38	20	20	80	116	98	7.96
10/14/2020	60	40	21	20	18	100	100	77	7.48
9/22/20	64	28	28	20	20	92	104	82	7.96
1/24/20	114	44	52	80	34	158	140	101	6.76
12/13/19	102	36	36	50	22	138	132	98	8.3
11/22/19	36	20	54	70	22	56	70	57	7.73
10/25/19	84	48	32	70	20	132	100	69	7.83
9/27/19	64	60	47	70	24	124	120	93	7.95
8/23/19	88	28	49	70	20	116	120	91	7.99
7/19/19	56	16	51	60	20	72	92	74	8.03
6/28/19	44	28	67	80	24	72	100	83	7.76
6/21/19	56	36	67	80	24	92	120	99	7.54
5/17/19	64	68	60	80	24	132	144	116	8.07

Quality Assessment Equipment (\$\$\$\$)



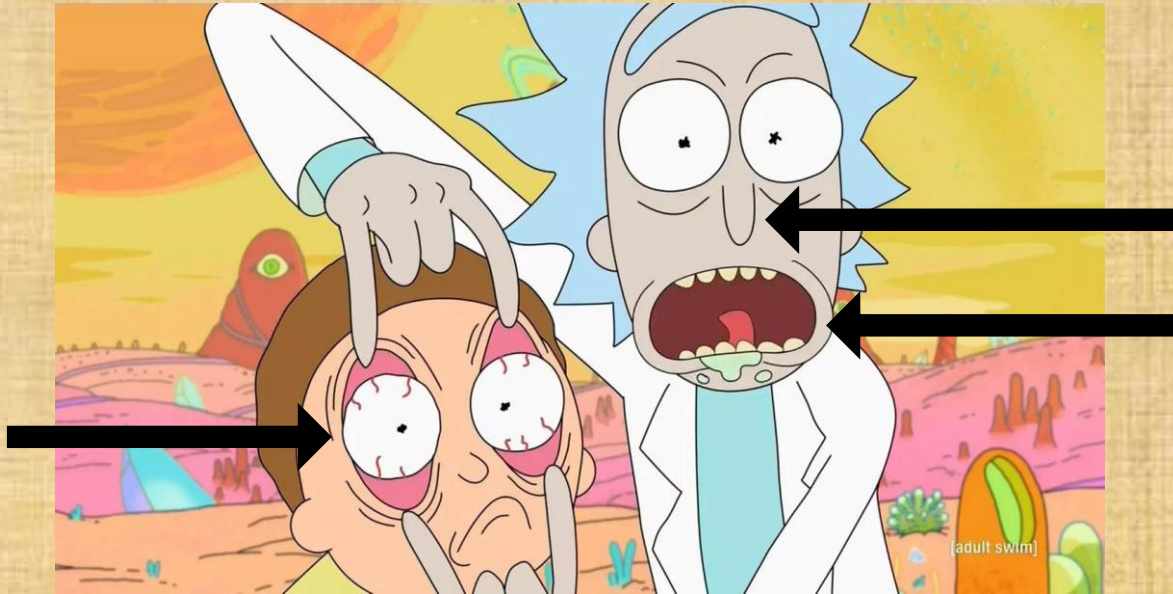
Quantitative data
Very Precise consistency
Early detection



Doesn't always paint a complete Picture
Best to combine sensory analysis with
quantitative analysis



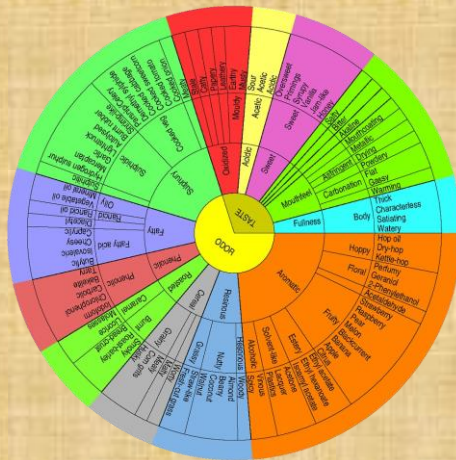
Quality Assessment Equipment (\$)



Sensory Training and Analysis



\$150



All breweries use sensory analysis, many exclusively

Color



Clarity



Clarity (\$)



\$1.00



Clarity Measurement (\$\$)

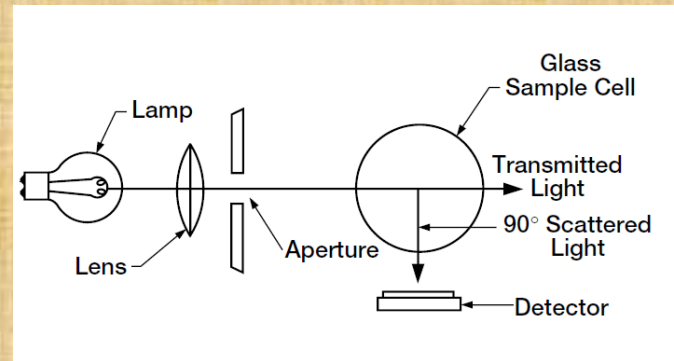
Turbidimeter AKA Nephelometer

Measures scattering of light, independent of color

Used: \$150
New: \$500



Nephelometric Turbidity Unit NTU



Clarity Measurement (\$\$\$*)

- Spectrophotometer
 - More influenced by color
 - Requires centrifugation of a sample to be used as a blank



Used: \$750

New: \$3,000-12,000

Clarity Measurement (\$\$\$*)



$A_{600} = 0.305$



$A_{600} = 0.088$



$A_{600} = 0.022$



$A_{600} = 0.016$

Imhoff Cones



Carbonation

Measured based on pressure and temperature

Low Tech: Seal and shake, measure pressure

Taprite
Zahm & Nagel

Hi Tech: Seal, expand chamber twice, measure pressure difference, lots of fancy math



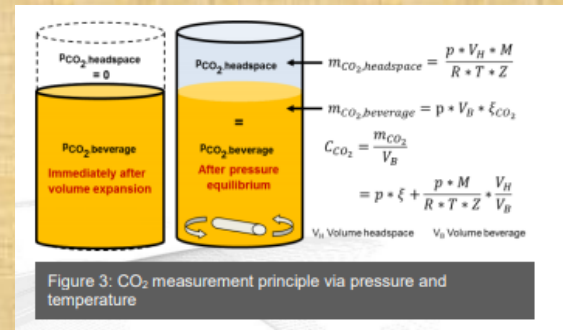
\$300



\$1,500



\$25,000



Packaged Beer

- Bottles, Cans
- Check for dissolved oxygen (DO) and CO₂ levels



Refurbished
€10.900,00



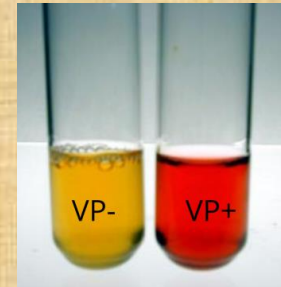
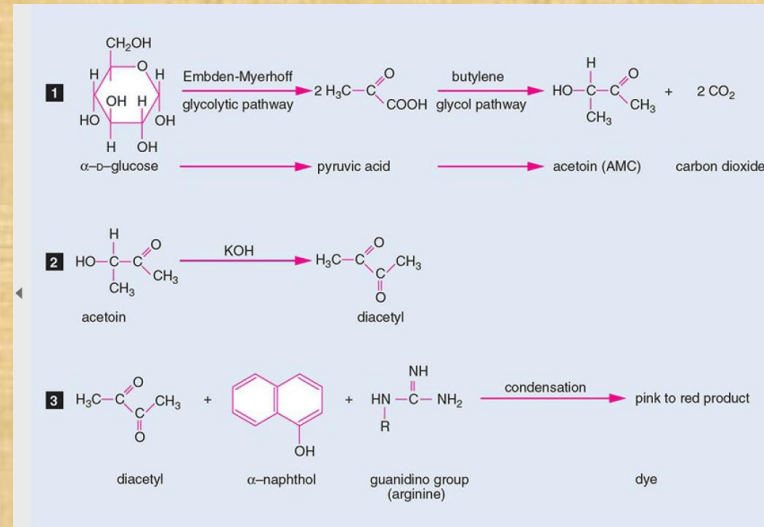
\$25,000



\$5,000

VDKs

- \$ Organoleptic
 - Water bath 70°C
 - 20 minutes
- \$\$\$ Colorimetric
- \$\$\$\$ GC

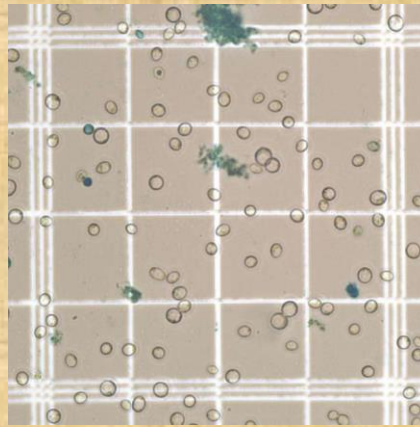


Cell Counts

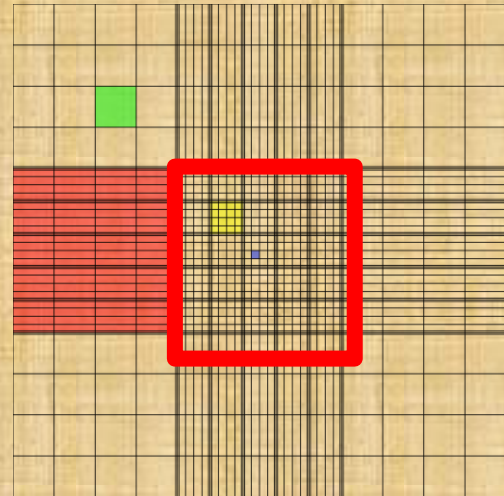
- Hemocytometer

Each square holds 10^{-4} mL

Count cells and multiply by 10^4 to get cells/mL



\$20-120



\$5.00



\$250



Testing:

Microbiological testing (WLD, LCSM and HLP selective medias)

Alcohol by volume and weight

Extract values

Attenuation

Specific gravity

Calories

pH

Color

IBU

Diacetyl and 2-3 pentanedione (VDK)

\$304

Big QC DAY: \$159/ 2 samples