“IT HAD BETTER NOT BE MY FAULT”

AN ANALYSIS OF WINE GONE BAD

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WINE QUALITY, GREATNESS, AND FAULTS

Not all of us agree on the definitions of wine quality, as it can either be a personal statement, or it can be the common agreement of a larger group.

We tend to be generous in accepting personal ideas of wine quality, but compromises are necessary to reach a group definition of wine quality.

Groups find it easier to agree upon the most extreme characteristics (or outliers, for the statisticians) of a wine. These are either characteristics that we all find to be exceptionally good, or we all find to be exceptionally bad.

This is the underlying psychology and politics of the terms “great wine” and “faulty wine”. It is socially easier to agree on faults. So what are the wine faults that we all (or almost all) agree upon?

COMMON WINE FAULTS

- Most caused by microorganisms or grape composition
- Color flaws
  - High pH, improper fruit maturity/grape extraction
  - Oxidation & aging
- Clarity flaws
  - Crystal salts (tartrates, etc.)
  - Re-fermentation and microbial hazes
  - Colloidal hazes and sediments
    - Protein/phenolic or glucoside/phenolic or other vs. tartrates
  - Temperature, fining, and aging are clarification tools
- Sensory (aroma and flavor) faults
  - Winemaking origin
  - Microbiological origin

WINE SENSORY FAULTS

- Excess SO_2
- Volatile acidity (Acetobacter, yeast, other microbes)
  - Ethyl acetate and acetic acid
- Oxidation (Excess O_2 or microbiological origin)
  - Acetaldehyde, other aldehydes and pyrazines
- Reduced sulfur aromas (yeast + sulfured grapes, low YAN)
  - H_2S, mercaptans, disulfides
- Assorted microbe-specific compounds
  - Brettanomyces generated
    - Isovalerate, 4-ethyl phenol, 4-ethyl guaiacol
  - Lactic bacteria and pediococcus generated
    - Diacetyl, geraniol, 2-acetyl-3,4,5,6-tetrahydropyridine, acrolein bitters
  - Other yeast, fungi and bacteria
    - Fungal tri-halogenated anisoles (TCA cork taint)
    - Aromatic metabolites not well characterized

Prevention of Wine Faults

- Grapes of proper maturity and free of spoilage; avoid high pH, if possible
- Clean premises and equipment
- Clean water for washing
- Proper use of SO_2 at crush, cellar, bottling
- Control oxygen and microbial entry into wine through surface or aerosol
  - Closed vessels
  - Argon or nitrogen cover

Prevention of Wine Faults (cont.)

- Prevention of bio-films on surfaces of building, equipment, tanks, barrels, hoses
  - Steam pressure washer + scrub as needed and practical
  - Soda cleansers + scrub as needed and practical
  - Peroxyacetic acid cleansers + scrub as needed and practical
  - Phosphate cleansers + scrub as needed and practical
  - Hose balls
  - Emergency use of chlorinated cleansers (no permeable contact)
- Sanitation of cleaned surfaces
  - Steam, hot water, ozone, SO_2 /citrate
- Test materials that enter winery for microbes, and keep in separate space, for quarantine period or permanently

Curing Wine Faults

- Prevention always trumps a cure
- Not all faults can be cured
- Pre-fermentation cures (most effective)
  - Well-designed, clean building and equipment
  - Good grapes, must nutrient adjustment, and SO_2 use
  - Rough settling of white musts
- Fermentation cures (generally effective)
  - Proper yeast and fermentation conditions
    - Nutrient conditioning, temperature control, clean premises
  - Additives to remove proteins, enhance grape component release
- Post-fermentation cures (somewhat effective)
  - Sanitation, SO_2 filtration (generally effective)
  - Additives and fining (limited effects)
- Marketing cures (last resort)

Generation of Volatile Acidity

- Includes acetic acid, ethyl acetate
- Often co-exists with acetaldehyde (oxidation)
- *Acetobacter* main culprit,
  - Grows aerobically
  - Fermentation cap susceptible to infection
- Yeast & ML contribute to volatile acidity
  - Usually not problem amounts
- Fruit flies carry on proboscis and legs to infect
- Ullage in tanks and barrels
  - Lets *Acetobacter* grow aerobically

Prevention of Volatile Acidity

- Sound grapes at harvest
- SO_2 at crush, racking (if no malolactic), cellaring, bottling
  - Adjust to grape damage
- Kill and keep out fruit flies, etc.
- Sanitation of building, equipment, tanks
- Microbial monitoring of all inputs
  - SO_2 and filter, if necessary

Cure for Volatile Acidity

- Small amount
  - Tolerate, up to 0.5 g/liter (500 ppm)
  - Filter and blend to acceptable level
- Large amount
  - Reverse osmosis filtration (expensive)
  - Filter and refermentation (desperate option)
  - Sell to vinegar maker or dump

Oxidation and Nutty Odors

- Often co-exists with volatile acidity
  - Oxygen and exposure often co-incident
- Primarily acetaldehyde
  - Suppresses freshness and fruitiness
  - Naturally produced by yeasts as alcohol intermediate, especially *Candida* (surface yeast)
  - Produced by auto-oxidation during aging
  - Efficiently binds SO_2
- Some substituted pyrazines
  - Product of breakdown of amino acids

Prevention of Acetaldehyde

- Prevent exposure of wine to oxygen, higher temperatures, and surface yeasts
  - Keep argon or nitrogen covering wine
  - Prevent ullage and high storage temperatures

Cure for Acetaldehyde

- Small amount
  - Bind w/ SO_2
- Larger amount
  - Fine w/ potassium caseinate
  - Refermentation

Generation of Sulfur Off-Odors

- Improper nitrogen and yeast nutrients in must
- Improper yeast conditioning before pitching
- Use of certain strains of yeast
- Sulfur from bordeaux mix or other fungicide
- Reduced sulfur from storage on anaerobic lees
- Volatile sulfur compounds
  - "Reduced sulfurs"
    - H_2S
    - Mercaptans
    - Di-sulfides
  - May include some positive compounds (Ex: tropical or passion fruit, cat urine)
    - 4-mercapto-4-methylpentan-2-one (4MMP)
    - 3-mercaptohexan-1-ol (3MH)
    - 3-mercaptohexyl acetate (3MHA)

Prevention of Sulfur Off-Odors

- Ensure 150-300 ppm YAN in must
- Proper yeast conditioning before pitching
- Use certain strains of yeast w/low H_2S production
- Ensure no sulfur applied to grapes several weeks before harvest
- Do not store wine for long on anaerobic lees
- Volatile sulfur compounds
  - "Reduced sulfurs"
    - H_2S
    - Mercaptans
    - Di-sulfides
  - May include some positive compounds (Ex: tropical or passion fruit, cat urine)
    - 4-mercapto-4-methylpentan-2-one (4MMP)
    - 3-mercaptohexan-1-ol (3MH)
    - 3-mercaptohexyl acetate (3MHA)

Cures for Sulfur Off-Odors

- Low H_2S cure, rack & add SO_2 to freshen
  - O_2 & SO_2 converts H_2S to HSO_3 and H_2SO_4
  - May appear again when anaerobic again
- Higher H_2S and mercaptans, add $CuSO_4$
  - Acidify first with ascorbic acid
  - May appear again when anaerobic again
  - Copper difficult to clear from wine
- More stable di-sulfides
  - Even acidification and Cu may not be effective

AVOIDING UNDESIRABLE SULFUR COMPOUNDS, Menke

http://wineserver.ucdavis.edu/av/AV9704.html

Faults Generated by Lactic Acid Bacteria

- Excess volatile acidity and/or diacetyl
  - Selected *Oenococcus oeni* (volatile acidity)
  - Unselected *Oenococcus oeni* (vol. acid. & diacetyl)
  - *Lactobacillus brevis* (volatile acidity)
  - *Lactobacillus hilgardii* (volatile acidity)
  - *Lactobacillus kunkeei* (vol. acid. & competes w/yeast)
- Off odors (mousy, sauerkraut, etc.)
  - Unselected *Oenococcus oeni*
  - *Lactobacillus brevis*
  - *Lactobacillus hilgardii*
  - *http://www.lallemandwine.us/pdf/article_state_of_art_ml.pdf*

Cures for *Lactobacillus* Off Odors

- Prevention is the only acceptable cure
  - Use and maintain SO_2 at crush, cellar, bottle
    - Can also add lysozyme to high pH musts (Gram+ only)
  - Sanitize or sterilize surfaces, barrels, tanks
  - Filter before bottling
- Refermentation may or may not solve problem
- Employ microbial monitoring
  - Test all barrels and tanks initially and periodically
  - SO_2 and filter, if necessary
    - Much more effective than lysozyme, unless pH high

Brettanomyces Spoilage

- Once established, hard to eradicate totally
- Band-aid, burnt wood, or mousy flavors
- *Brettanomyces* spoilage yeast difficult to identify quickly and with certainty
  - Tests for 4-ethyl phenol, 4-ethyl guaiacol, isovalerate are confirming of past infection
- Happens under low SO_2, high pH, and elevated temperatures
  - Malolactic fermentations vulnerable