Beyond Saccharomyce

cerevisiae

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You thought S, cerevisiae was fun...

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Content:

- Introduction: beer ingredients \rightarrow desert
- Containing microbiology
- Microbiological issues: see notes
- (sources of) other microbiology
- Some existing processes
- Controlling other microbiology 101



Experience Ingredients for beer





Knowledge



Warning:

read this first before digesting this presentation

- We generally recommend that you hold your paintbrush in an angle between 62 and 64 degrees (angle being defined as the angle between the surface of the painting and the straight part of your paint brush. Expressed in degrees with 360 degrees to make a full circle). Although we have painters, who use our paintbrushes with excellent results, in angles between 37 and 82. One of our best painters claims that you have the best results in a 90 degree angle, but in general this does not seem to work very good for most painters. And then you have of course Bill, who nibbles at the end of his paint brush and claims that that actually helps in the flair it gives his brush over his painting.
- There is a discrepancy between what Belgian brewers do and what they tell you they do. The main reason I found to be the cause of this action is actually the question you ask, or maybe more specific the way the question is phrased. I used to have those very specific questions from US brewers when I was working at Rodenbach. The questions were mostly about such a specific detail that it illustrated that the person did not understand the whole forest. He was actually asking what this snail was doing, why we used it, where it was going to go next. But this snail was actually irrelevant to the whole process, you know, I have been trying to get rid of those critters for ages, but they always seems to show up again in cellar 4. I t was most likely an interaction between beer leaking out of wooden casks on almost impossible to clean brick floors. We actually had the most success with leaving out some beakers of beer, because they all seem to crawl or snail (whatever snails do) into those beakers and died, yes because they could not swim. So now this person asked about what this snail was doing, why we used it and where it was going to go next. What do I need to answer? Talk about the forest, the trees to put this snail in perspective? Or should I talk about why they are here (beer leaks and impossible to clean floors). Or about the things I tried to eliminate those snails? I have seen now other Belgian brewers give a non sense answer on this non sense question. I think it's Belgian humor. But all this non sense seems to appear then on website and magazines, and the next thing is the next brewer visiting wants to know more about those snails, since they seem to be key about making Rodenbach, and he wants to be the first to figure out this little Belgian brewers secret. But you know, it's not about the snails it's about the forest and how the trees are doing in the forest. Or maybe it's the languange barrier, who knows
- The warning I wanted to put in this presentation is that when you try the different micro organisms, always be sure that you have a way to control them. I do not want your brewery to be infected, because you heard me talking about an interesting micro-organism.
- When we move from Belgium to the US, my wife and I made it a game to try to find warning labels on the most silly things. Salad, rear view mirrors, bike frames, you name it. We really thought the content of those labels was incredible fun. We grew up having to take up our own responsibilities, but seeing the responsibility moved to the producer was so childish. When my sister, who was living in Mozambique at that time came over, she had the same thing with fat free claims. The best she found was a fat free apple claim, a real high light about non-sense information and conditioning of people. Bring everything that contains fat to Afrika, we will be very happy to have it. When we went a year later to Quilemane, Mozambique, the country just came out of the civil war, that was a product of the cold war. Just before we arrived, a ship had unloaded peanut butter. The talk of the town was that there was peanut butter! Everybody was searching for peanut butter. There was not much else, except for lobster. So lobster in the morning, at lunch and in the evening, and then of course there was peanut butter.







FMEA:

Failure mode and effect analysis

Evaluation of current system Rated on:

Severity when failing (SEV)
Frequency of occurance (OCC)
Ease of detection (DET)
Multiply → ranking (RPN)



Results of Actions Take

	Design Attribute	Potential Failure Mode	Potential Effect(s) of Failure	S E V	Potential Causes	0 C C	Current Controls	D E T	R P N	Recommended Actions	Responsibility and Target Completion Date	Actions Taken	S E V	0 C C	D E T
	propagation in the lab	cross contamination	wort way infection	10	Brett carry over	10	plating	8	800	verify before pitch	QA micro	SOP QA (SA)			Г
ſ										I lab for Brett prop	QA micro/I lab	SOP QA (SA)			
	propagation in the wood cellar	pitching	intection packaging	6	airborn low	2	plating high	8	96			SOP PM/SA			Γ
		no growth	no Bretta							BdM 2004					
		hoses used	Intection packaging	6	airborn low	2	plating low	6	72			SOP PM/SA			Γ
в		wort inbring	wort way infection	10	Brett carry over	10	plating low	6	600	bck ch + hot CIP		SOP AD/GH			
		kegging	Intection packaging	6	airborn low	2	ATP	2	24			spill SOP's	6	2	8
		air venting from	Intection	6	airborn low	2	ATP	2	24						
		cleaning of tanks	infection packaging	6	airborn low	2	ATP	2	24			spill SOP's	6	2	8
	ng fermenter	emptying of hoses	infection cellar	8	airborn low	2	plating high	8	128						Г
22/1		empty kegs	Intection packaging	6	Brett carry over	10	ATP	2	120						
MO			wort way infection	10	Brett carry over	10	plating low	6	600						
		driving gas kegs	infection cellar	8	Brett carry over	10	plating high	8	640	isolate bck chk					
		pressure in keg	explosion	10	Brett carry over	10	plating high	8	800	limit time and # keas		SOP PM/DR/JH			
		stop up	wort way infaction	10	Brott carry over	10	plating high	0	000	bok ob/CIP MW/+T		SOBKO			T

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Wort and beer microbiology

Beer spoilers

- wild yeast (non production yeast)
- Saccharomyces cerevisiae, S. pastorius, Hansenula anomala (forms a layer on top of the beer), Pichia membranaefaciens, Candida krusei, Toruloposis, Dekkera (sexual and spore former) or Brettanomyces, Kloeckera (dies of at 4Vol% alcohol), Rhodototula
- Gram+ Bacteria:
- Lactobacilli (L. brevis, L casei), Pediococci,
- Streptococcus, Leuconostoc, Kocuria (ex Micrococcus) when < 20 IBU (bitterness measurement)
- Bacillus and Clostridium: eventually in spores
- Gram- Bacteria:
 - *Enterobacteriaceae* (easy growth upto pH 4.4 and ethanol >4.2%): *Escherichia, Klebsiella, Enterobacteria, Obesumbacterium proteus* (ex *Hafnia protea* or *Flavobacterium proteus*), *Serratia* and *Pseudomonaceae* (infection risk minimal) as

Pseudomonas, Xanthomonas, Achromobacteriaceae.

- Megasphaera cerevisiae
- Pectinatus, Zymomonas
- Acetobacter and Gluconobacter

Interesting MO

- S. cerevisiae
- yeast:
- Brettanomyces
- Kloeckera apiculata
- (Pichia, Candida, Torulopsis, Rhodototula)
- Gram+ Bacteria:
- Lactobacilli (L. brevis, L casei), Pediococci,
- Leuconostoc or other malo-lactate MO
- Gram-Bacteria:
- (Enterobacteriaceae)
- Acetobacter, Gluconobacter

Sources for micro-organisms

- Vendors: White labs, Wyeast, ATCC,...
- Equipment: tap lines, return kegs, beer savers, infections in the brewery, wood barrels.
- Ingredients: malt flora
- Other brewers.
- Bottles of beer.



momyces bruxeliensis eseudomycelium sy: High Power Ultrasentca

Next steps:

- Initially: cultivate variety
 - Try to find as many sources as possible
 - Add them to different vessels
- Improve through selection
 - Eliminate: dump and clean, ritual burning
 - Taste
 - blend



a Folie The birth of







2000

1997

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Different existing beers







Different brewing processes





Rodenbach: the process

• brewing 11°Plato

demho

- fermenting (1 week)
- lagering (4-5 weeks)

- brewing 13.5°Plato
- fermenting (1 week)
- lagering (5-8 weeks)

aging (2 years)

🕷 Rodenbach 🕷

Classic Rodenbach

blending

Rodenbach Grand Cru Alexander Rodenbach



Identification of the Yeast



Z BELCE

Identification of Bacteria



Biochemistry

	ferment	tation	lagering	aging	
Attenuation	83.93	79.17	87.79	83.18	100
Ethanol	5.21	5.19	5.97	5.73	7.84
pН	3.81	3.69	3.60	3.60	3.20
lactic acid	139	119	1162	792	5372
acetic acid	145	148	719	683	1280
ethyllactate			50	50	350
ethylacetate			20	20	90

BE.

Acids and Derivated Esters





Bottled Ales

	Blended	old sour	Geuze	Flavour
	sour ales	ales		threshold
Propanol	26-28	23-30	2,62-3,89	800
iso-Butanol	3,0-4,6	4,0-6,0	16,3-21,0	200
Amyl alcohol	51-64	40-56	44-59	70
2,3-Butanediol	57-125	84-107	167-318	500
iso-Amylacetate	1.8	0.2	0.5	2
Diacetyl	0.036	0.02	0.104	0,08-0,15
2,3-Pentanedion	0.002	0.007	0.069	1





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Questions?

