PALL Food and Beverage

Membrane Systems In The Winery

WineEng 2016
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Filtration. Separation. Solution.SM

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Wine Crossflow – Sustainability driven technology

- Diatomaceous Earth
  - Non-Renewable Resource
  - Disposal Issues
  - Health Implications

Wine Crossflow – Sustainability driven technology

Environmental Benefits of Crossflow:

- Replaces DE throughout the Winery

To reduce:

- DE consumption
- Wine movements
- Disposal costs
- Labour

To improve

- Filtrate Quality (lower downstream filtration costs)
- Oxygen pick up
- Working conditions

Recovery of Wine from Lees – Sustainability driven technology

Environmental Benefit

To replace traditional Diatomaceous Earth based technologies (RVD, chamber press)

To reduce:

- DE consumption with RVD
- Disposal costs
- Labor

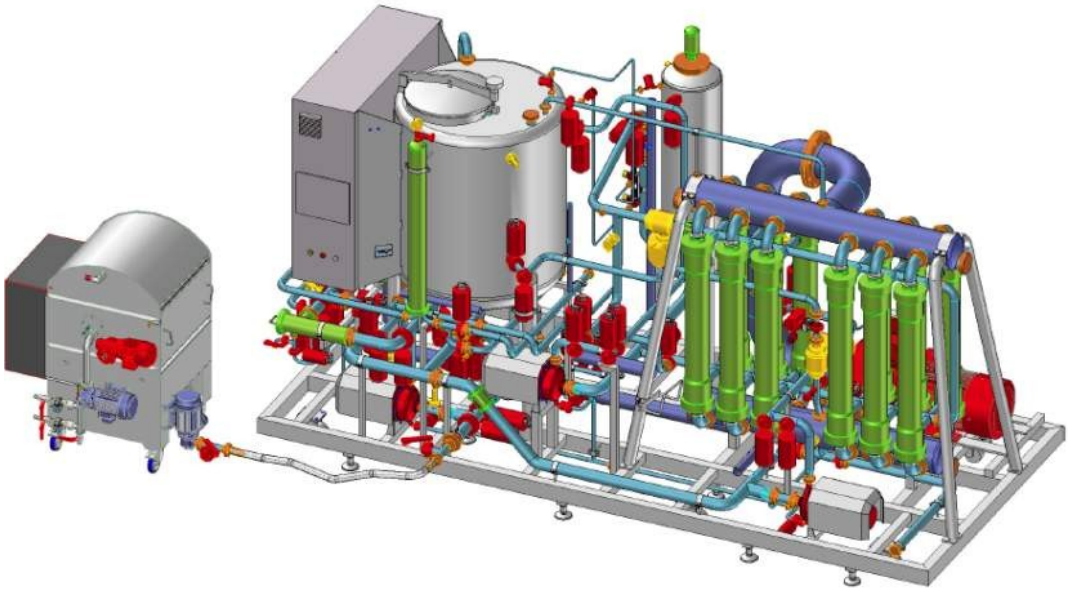
To improve

- Filtrate Quality (higher value in re-covered wine from crossflow)
- Oxygen pick up
- Working conditions

The Oenoflow HS System

1 2 Systems in One

1. Wine clarification
2. Wine lees



How?
Recovery of Wine from Lees

- Hollow Fiber Filtration System
  - Hollow Fibers
  - 0.2 micron
  - 2.6 mm fiber ID
  - System
  - Fully Automated
  - Batch Processing
  - Enclosed system

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Performance

- Performance using Oenoflow™ HS System
- Average flux rate 30-50 LMH with lees
- Up to 70 - 80% solids
- Typical Permeate Turbidity < 1 NTU
- Less oxygen pick up than traditional RVD

Example Results

Trial with white wine lees

Analytical Parameters	Unit of measure	Untreated lees	RVD Filtrate	Oenoflow HS Filtrate	Oenoflow HS Retentate
Free Alcohol	% volume	12.36	10.90	11.95	14.8
Reducing sugars	g/l	1.80	1.30	1.70	2.00
Total alcohol	% volumes	12.47	10.98	12.05	15.02
pH		3.26	3.30	3.31	-
Total acidity	g/l	5.71	4.95	5.48	-
Volatile acidity	g/l	0.23	0.18	0.21	-
Tartaric acid	g/l	2.10	2.00	2.00	-
Malic acid	g/l	2.10	1.70	1.80	-
Lactic acid	g/l	0.50	0.30	0.40	-
Total polyphenols	mg/l	<180	<180	224	240
OD 420nm		0.05	0.051	0.05	-
Oxygen	ppm	1.20	4.30	1.60	1.50
Turbidity	NTU	-	19	0.05	-
Suspended solids	%	32	0	0	80

Comparative figures must be validated on an individual application-specific basis. Variations will occur based on individual conditions.

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Example Results

Trial with red wine lees

Analytical Parameters	Unit of measure	Untreated lees	RVD Filtrate	Oenoflow HS Filtrate	Oenoflow HS Retentate
Free Alcohol	% volume	12.38	11.93	12.40	14.2
Reducing sugars	g/l	3.20	3.20	3.30	3.55
Total alcohol	% volume	12.57	12.12	12.60	14.60
pH		3.41	3.45	3.46	-
Total acidity	g/l	5.11	4.86	5.02	-
Volatile acidity	g/l	0.36	0.35	0.38	-
Tartaric acid	g/l	2.00	2.00	2.00	-
Malic acid	g/l	<0.2	<0.2	<0.2	-
Lactic acid	g/l	1.50	1.50	1.60	-
Total polyphenols	mg/l	1496	1527	1552	1850
OD 420nm		2.27	2.52	2.44	-
OD 520		3.00	3.70	3.55	-
Intensity		5.27	6.22	5.99	-
Tonality		0.757	0.68	0.69	
Anthocyans	ppm	335	348	345	
Oxygen	ppm	1.20	4.90	1.25	1.50
Turbidity	NTU	-	18.90	0.60	-
Suspended solids	%	8	0	0	80

Economic Justification

Cost of traditional wine recovery with RVD filter

Existing System: RVD Filter

Basis: 2.6 million L/year (10% of volume)

Factor	Annual Cost ($)
Cost of DE	88,465
Cost of DE disposal	15,611
Labor and Electricity cost	15,000
Total Cost	119,076

Cost of wine recovery with Oenoflow HS System

Factor	Annual Cost ($)
Membrane cost (3years life)	48,000
Labor, Electricity & Chemical cost	12,120
Total Cost	60,120

Comparative figures must be validated on an individual application-specific basis. Variation will occur based on individual conditions.

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Economic Justification

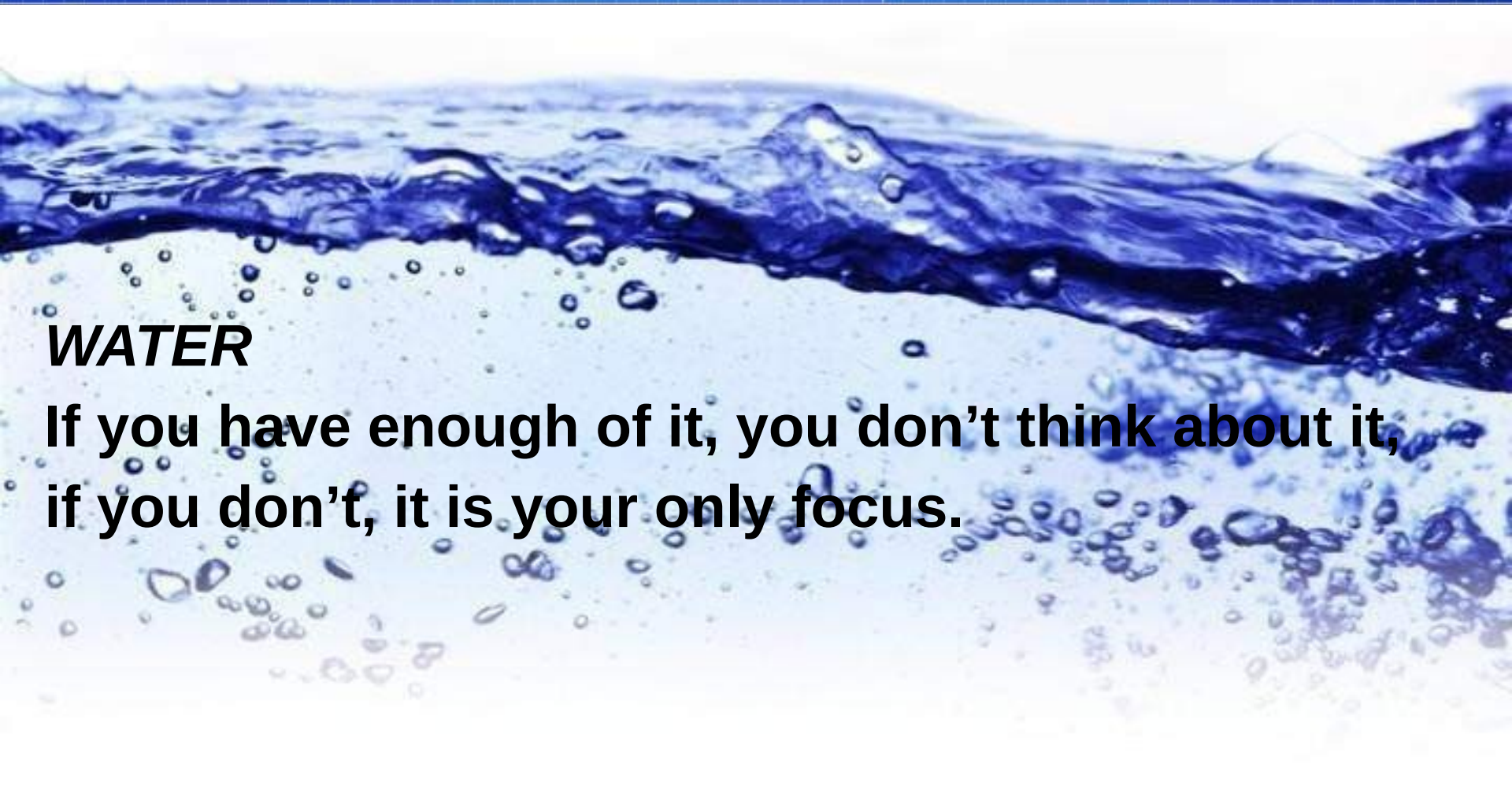
Return on Investment

Value of recovered wine with DE filter (75% recovery at $1.66/L)	$3.237 Million
Value of recovered wine with Oenoflow HS (75% recovery at $1.84/L)	$3.588 Million
Annual recovered wine savings with Oenoflow HS	$351,000
Additional Oenoflow HS savings	$58,956
Total Crossflow savings	$409,956
Oenoflow HS Capital Cost	$405,000
Payback	12 months

Summary

- Recovery of Wine from Lees

Feature	Benefit	Value
No filter aid requirement (DE)	-Less labor and handling -Lower disposal costs	- Lower operating costs - Environmentally friendly -Improved working conditions
Enclosed system design	- Higher quality, higher value wine - Minimal oxygen pick up - Hygienic operation	- Fast return on investment - Brand protection
Low hold-up Volume	- Processing of small batches - Reduced wine losses - Higher wine quality	- Less downtime - Brand protection
Wide bore hollow fibers	- Concentration up to 80% solids - Long module service life - Consistent filtrate quality (low turbidity)	-High wine yield - Lower operating costs -No further processing before bottling/packaging filtration
Fully automated working cycles	- Simple to use - Unattended operation	- Lower operating costs



WATER

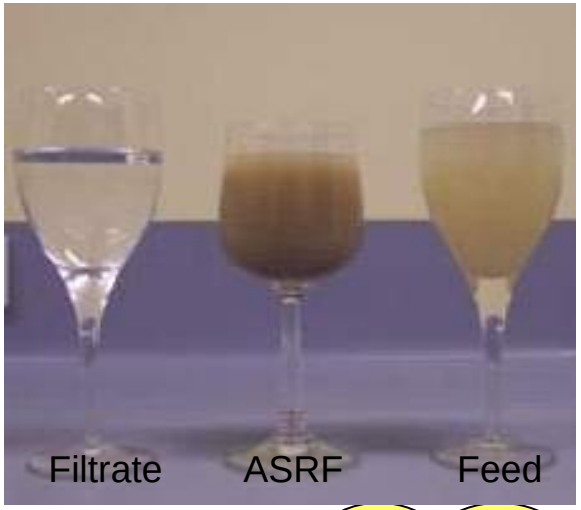
If you have enough of it, you don't think about it, if you don't, it is your only focus.

Typical reduction values in clean water

- I. Turbidity: < 0.1 NTU[1]
- II. TSS: < 0.1 ppm[1]

⟵ Aim of Pall Aria™

- III. *Cryptosporidium* 6 LRR[2]
- IV. *Giardia*: 6 LRR[2]
- V. Total microorganisms: 4 LRR[2,3]
- VI. *E-Coli*: 4 to 5 LRR[2]
- VII. Coli forms: 4 to 5 LRR [2]



[1] below detection limit

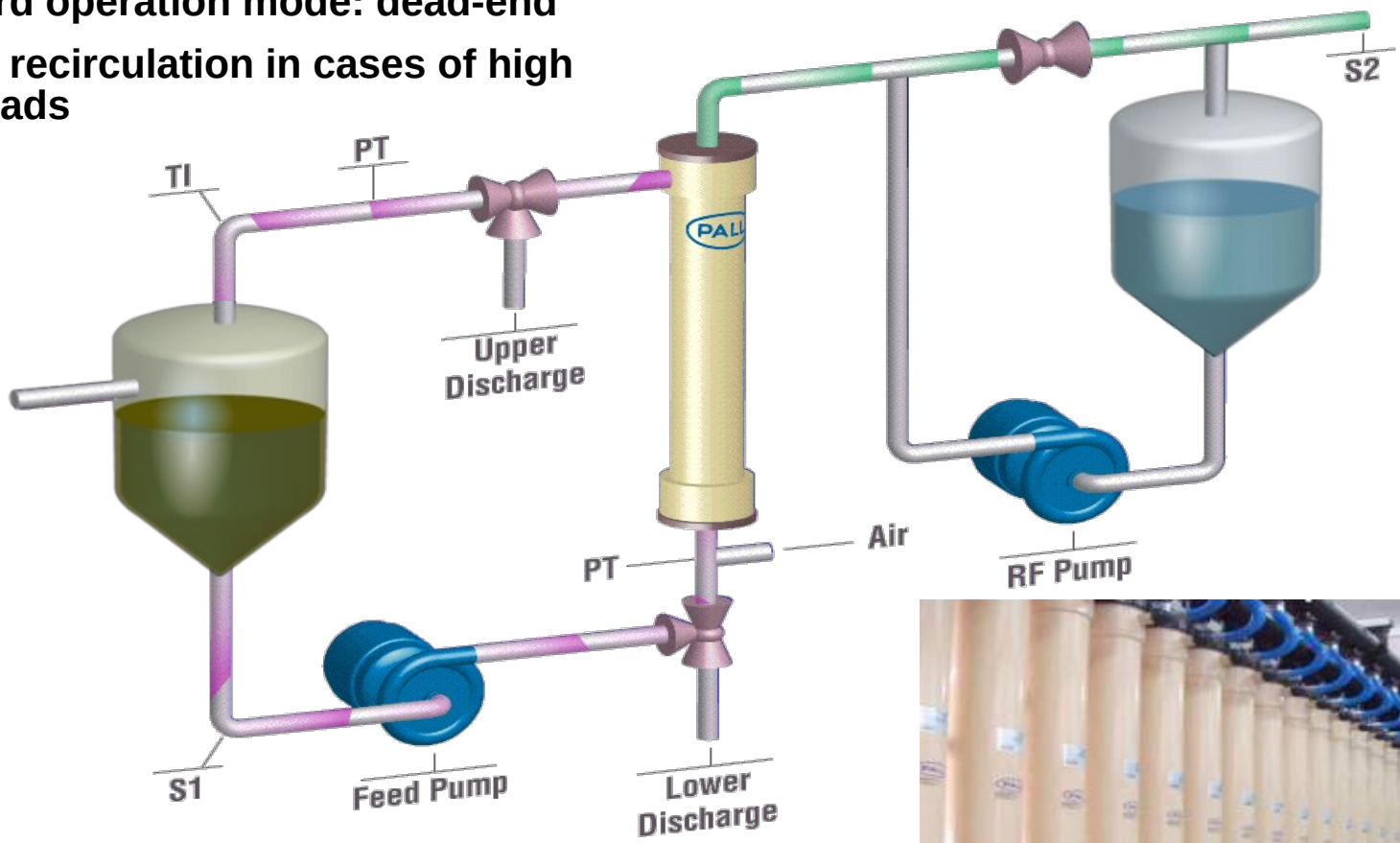
[2] LRR = logarithmic reduction rate

[3] Total microorganisms include several species:
Giardia, *Cryptosporidium* oocysts, MS-2 bacteri
E. Coli, *Bacillus* spores and coliforms.

Filtrate is Ideal for winery water!

Pall Aria™ System Description
- General Operational Mode-

- **Standard operation mode: dead-end**
- **Excess recirculation in cases of high solid loads**



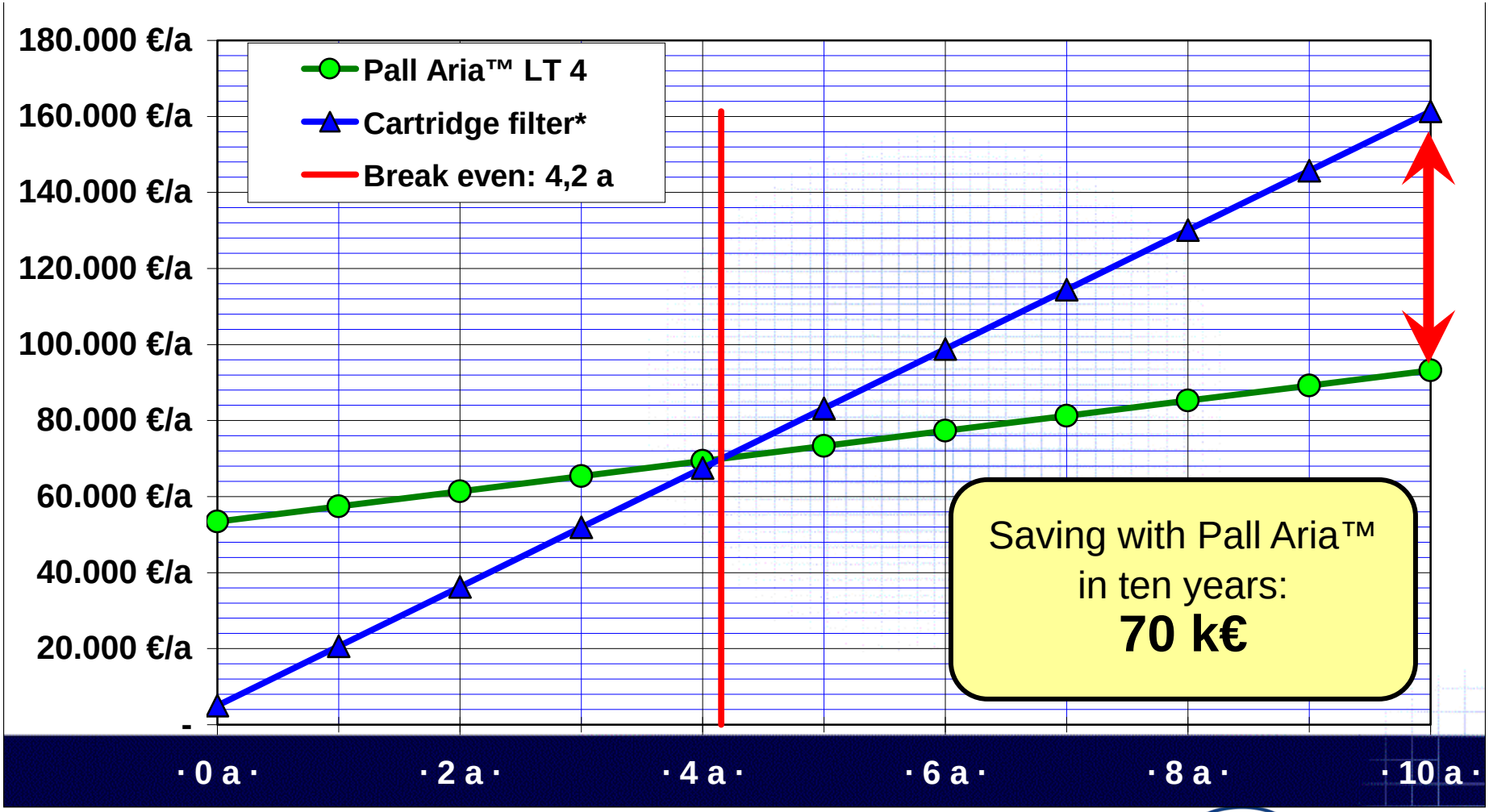
Out-in Filtration

High quality water at low cost!

Stainless steel
Hygienic design
FB 2 – up to 10 m³/h
FB 4 – up to 20 m³/h
FB 6 – up to 30 m³/h
FB 8 – up to 40 m³/h
FB 10 – up to 50 m³/h
FB 12 – up to 60 m³/h

ROIC – result

After four years+ we have the return on investment!



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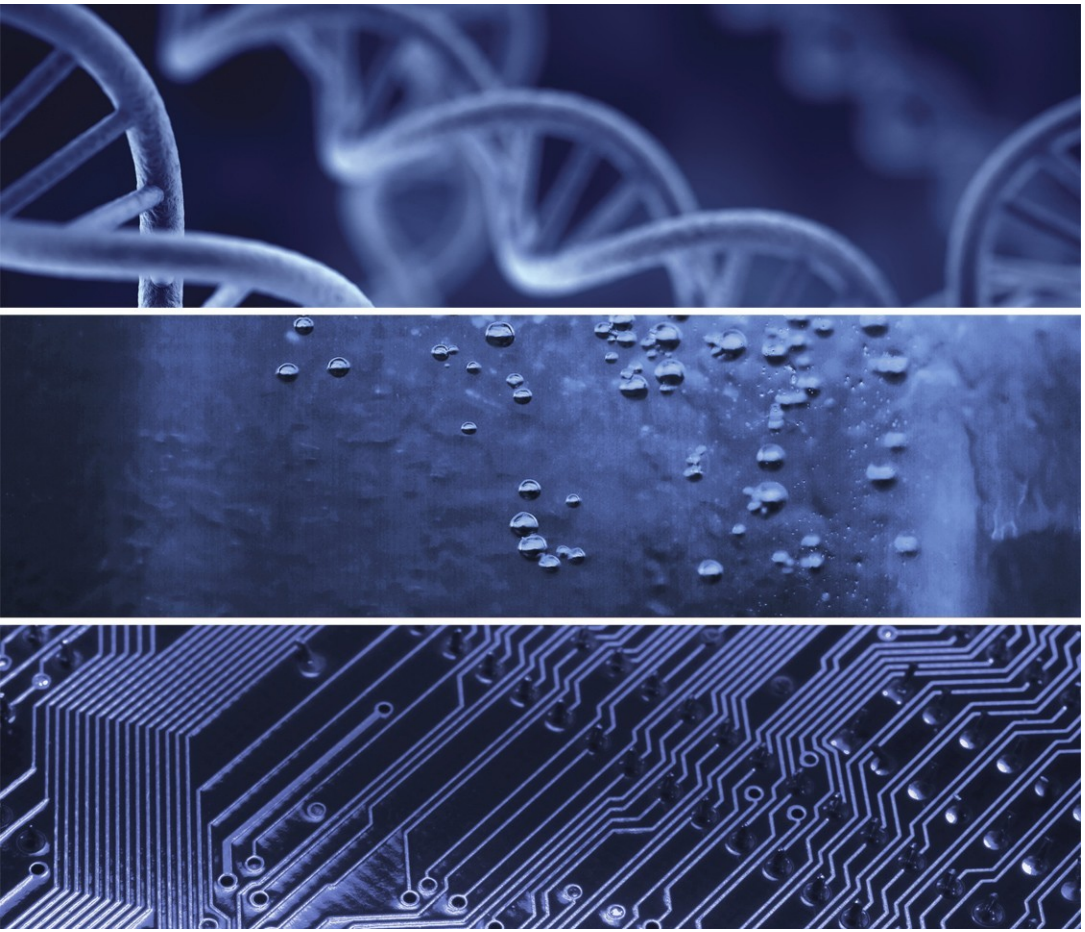
*Better Lives. Better Planet.*SM



Detection and Identification of Wine Spoilage Yeast Using qPCR WEA NZ 2016

Pall GeneDisc Technologies

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GeneDisc Method for Yeast

PCR is user friendly Microbiology Testing for Engineers

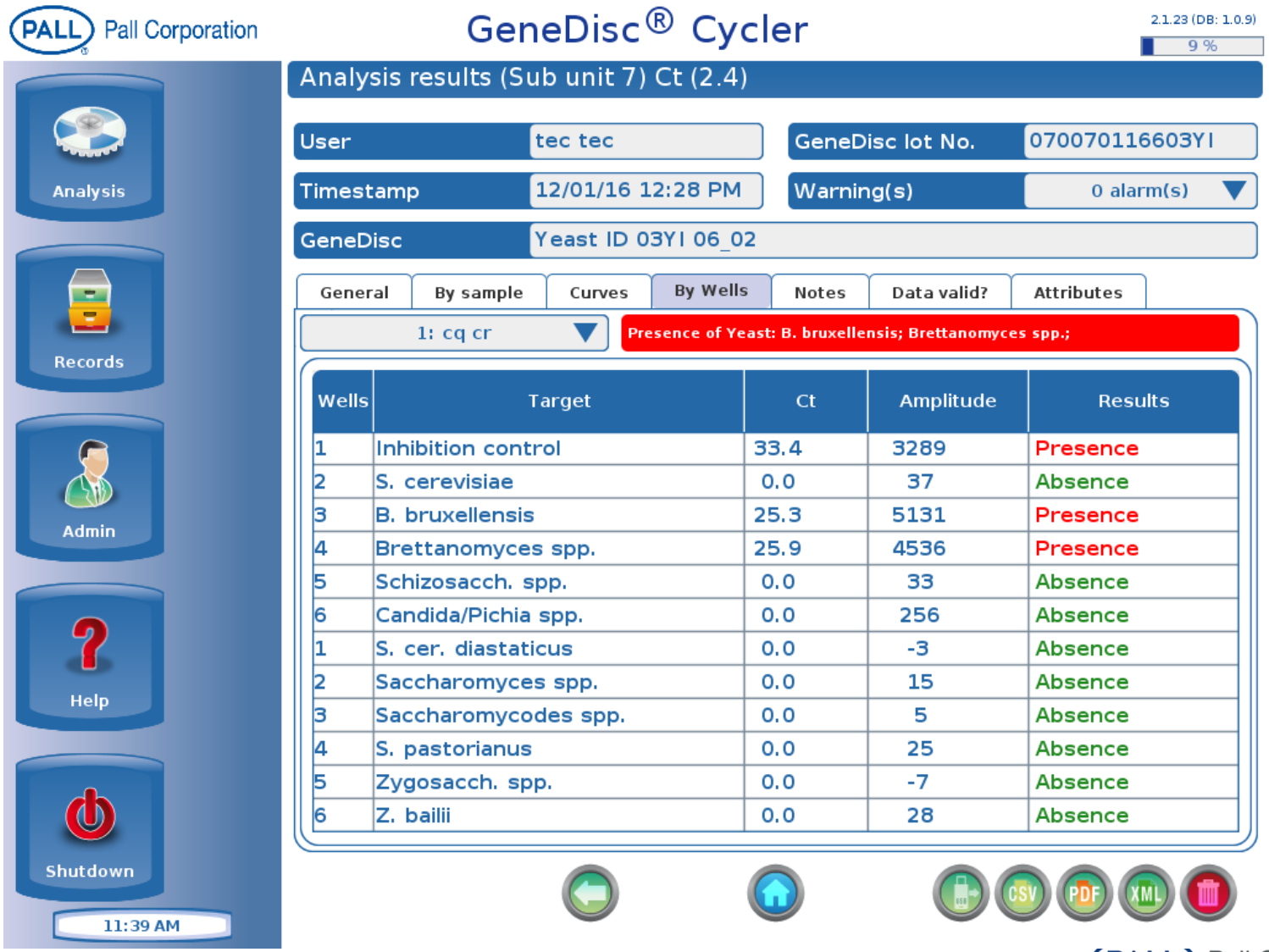
- Yeast detection and identification using PCR
- Short time to result: critical for time constrained steps
- Easy to use: no need to be a microbiologist
- Reducing storage cost
- Improving logistic flow
- For Wine need a 10 mL to 750 mL sample

PCR Analysis with GeneDisc Plate

- GeneDisc Plate for Yeast ID
  - 6 or 3 sectors plates

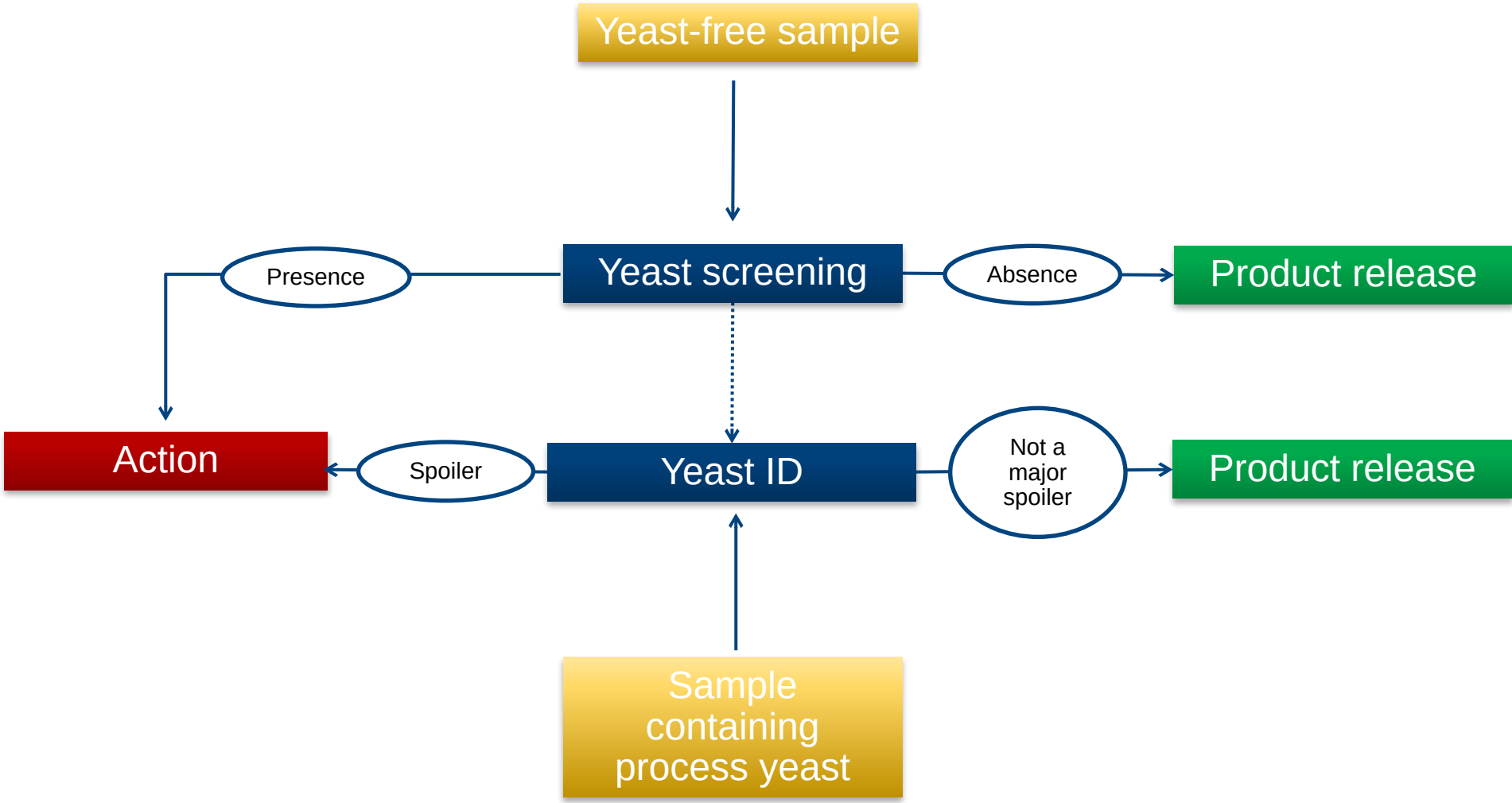
Well	Target 1	Target 2
1	Inhibition control	*Saccharomyces cere. diastaticus*
2	*Saccharomyces cerevisiae*	*Saccharomyces* spp.
3	*Brettanomyces bruxellensis*	*Saccharomycodes* spp.
4	*Brettanomyces* spp.	*Saccharomyces pastorianus*
5	*Schizosaccharomyces* spp.	*Zygosaccharomyces* spp.
6	*Candida-Pichia* spp.	*Zygosaccharomyces bailii*

Results with GeneDisc Plate for Yeast ID



Wells	Target	Ct	Amplitude	Results
1	Inhibition control	33.4	3289	Presence
2	S. cerevisiae	0.0	37	Absence
3	B. bruxellensis	25.3	5131	Presence
4	Brettanomyces spp.	25.9	4536	Presence
5	Schizosacch. spp.	0.0	33	Absence
6	Candida/Pichia spp.	0.0	256	Absence
1	S. cer. diastaticus	0.0	-3	Absence
2	Saccharomyces spp.	0.0	15	Absence
3	Saccharomycodes spp.	0.0	5	Absence
4	S. pastorianus	0.0	25	Absence
5	Zygosacch. spp.	0.0	-7	Absence
6	Z. bailii	0.0	28	Absence

Decision Workflow



Yeast Method Performances: Wine Samples

- Comparison with culture on artificially spiked (WLN agar at 25 °C)

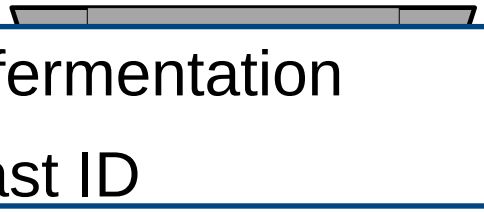
Wine Market		GeneDisc method		
		28 H	72 H	Not detected
Culture method	2 days	*S'codes. ludwigii* *S. cerevisiae*		
	3 days	*P. fermentans* (high level) *S. eubayanus* *S. pastorianus* *C. stellata* (high level) *Schizo. japonicus* (high level)		
	4-7 days			*B. custersianus* (1 CFU)
	Not detected	*P. fermentans* (low level) *Schizo. japonicus* (low level)	*C. stellata* (low level) *B. bruxellensis* *Z. bisporus*	*B. custersianus* (low level)

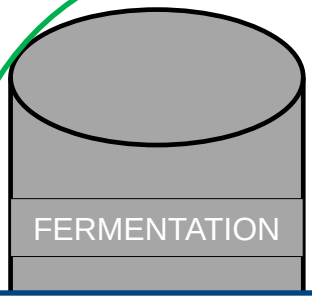
Legend: *Saccharomyces* (*S.*). *Saccharomycodes* (*S'codes*). *Pichia* (*P.*). *Candida* (*C.*). *Zygosaccharomyces* (*Z.*). *Schizosaccharomyces* (*Schizo.*). *Brettanomyces* (*B.*)

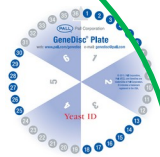
- Informative results
- Faster results
- Higher sensitivity (*B. custersianus* result likely related to the separate samples spikings for the two methods at a very low quantity of yeast)

Exemple of Implementation in Winery

HARVEST





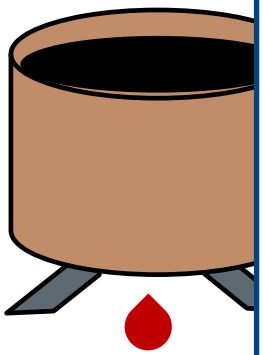


Monitor fermentation

With Yeast ID

During investigation, after spoilage detection, additonal checking points can be implemented throughout the process to identify its origin.

Investigation facilitated/possible with Yeast ID.



filling (*e.g.* filler head)

- Critical control (time) if release depends on it

With Yeast Screening and/or ID

ck if spoilage yeast
grown
east ID

In Conclusion

- **Accelerated decision-making**

Early preventive controls (*e.g.* yeast slurry control) to reduce risk of product spoilage and speed up batch release

- **Fast corrective actions implementation**

Reduce negative financial impact of spoilage with rapid root cause analysis

- **Tailor-made informative method for beverage industries**

Two GeneDisc options for various testing strategies

- **Reduced hands-on cost**

Ease of use simplifies testing workflows and on-site implementation

Questions?

Thank You for your Attention!

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