Maximising the performance and minimising the cost of filtration

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Blue H2O Filtration

BHF TECHNOLOGIES

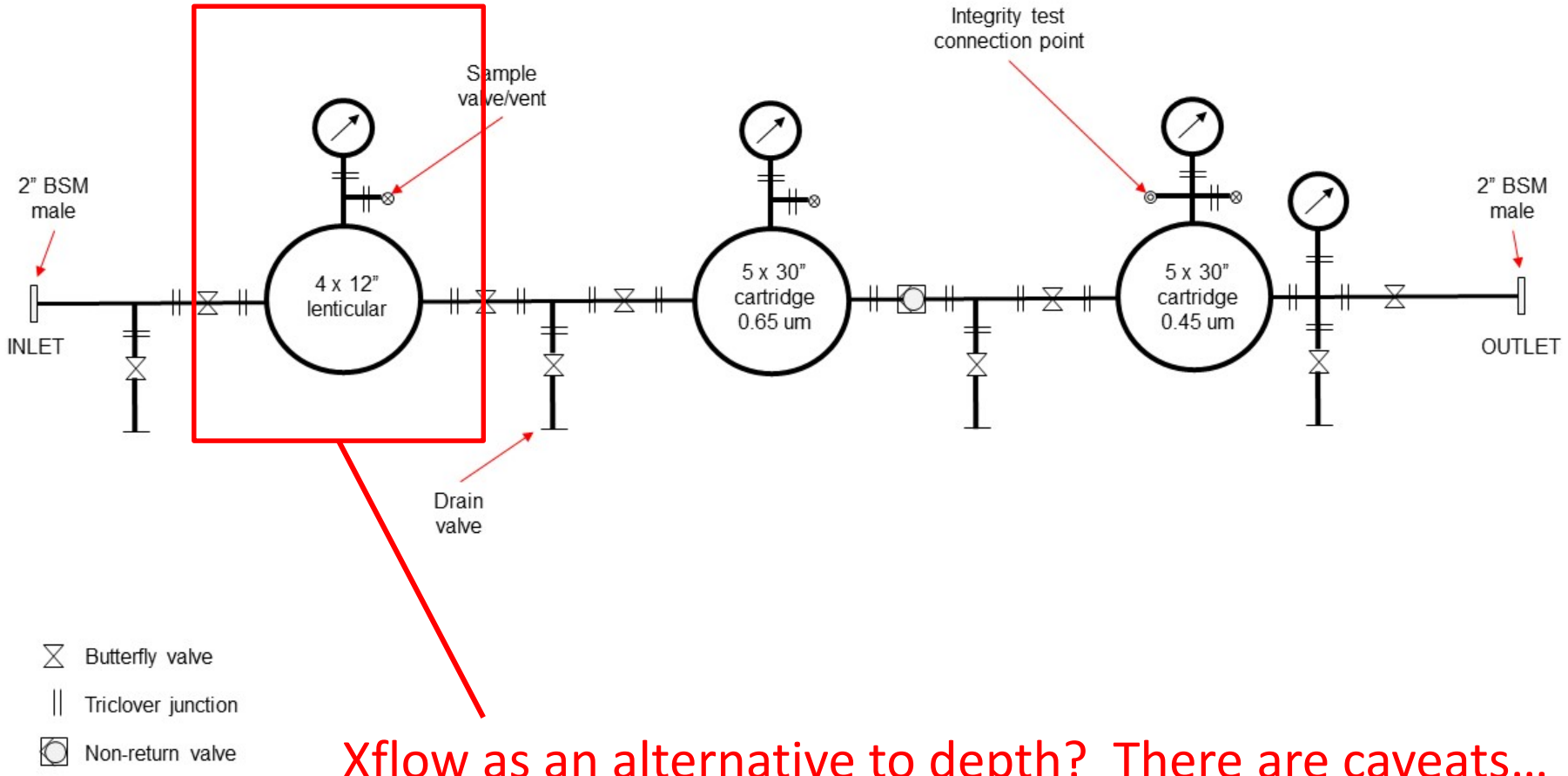
AUS & NZ

VINPAC INTERNATIONAL

TORRESAN

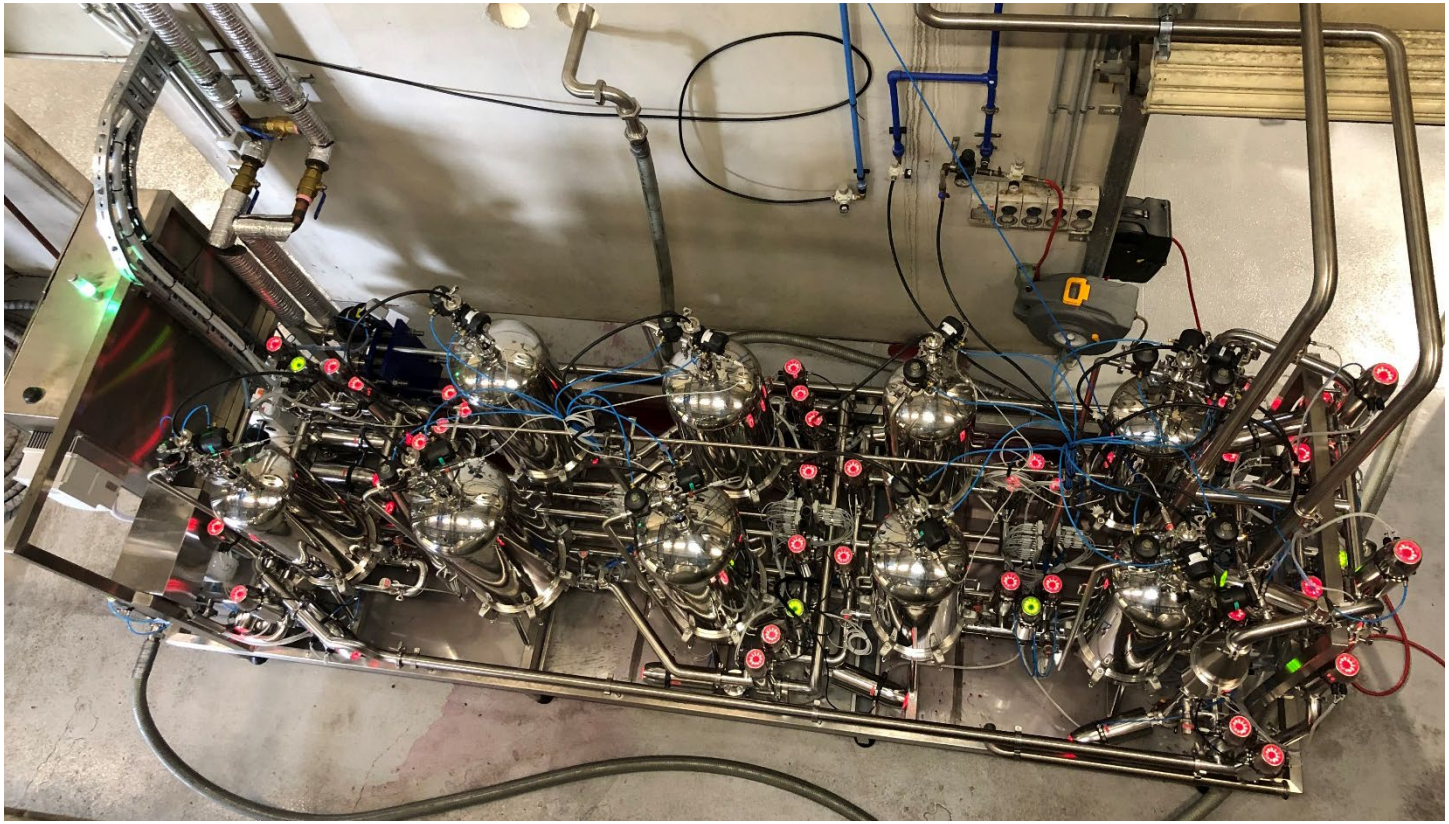
WINERY ENGINEERING ASSOCIATION - LIMITED -

Typical bottling filtration setup



Xflow as an alternative to depth? There are caveats…

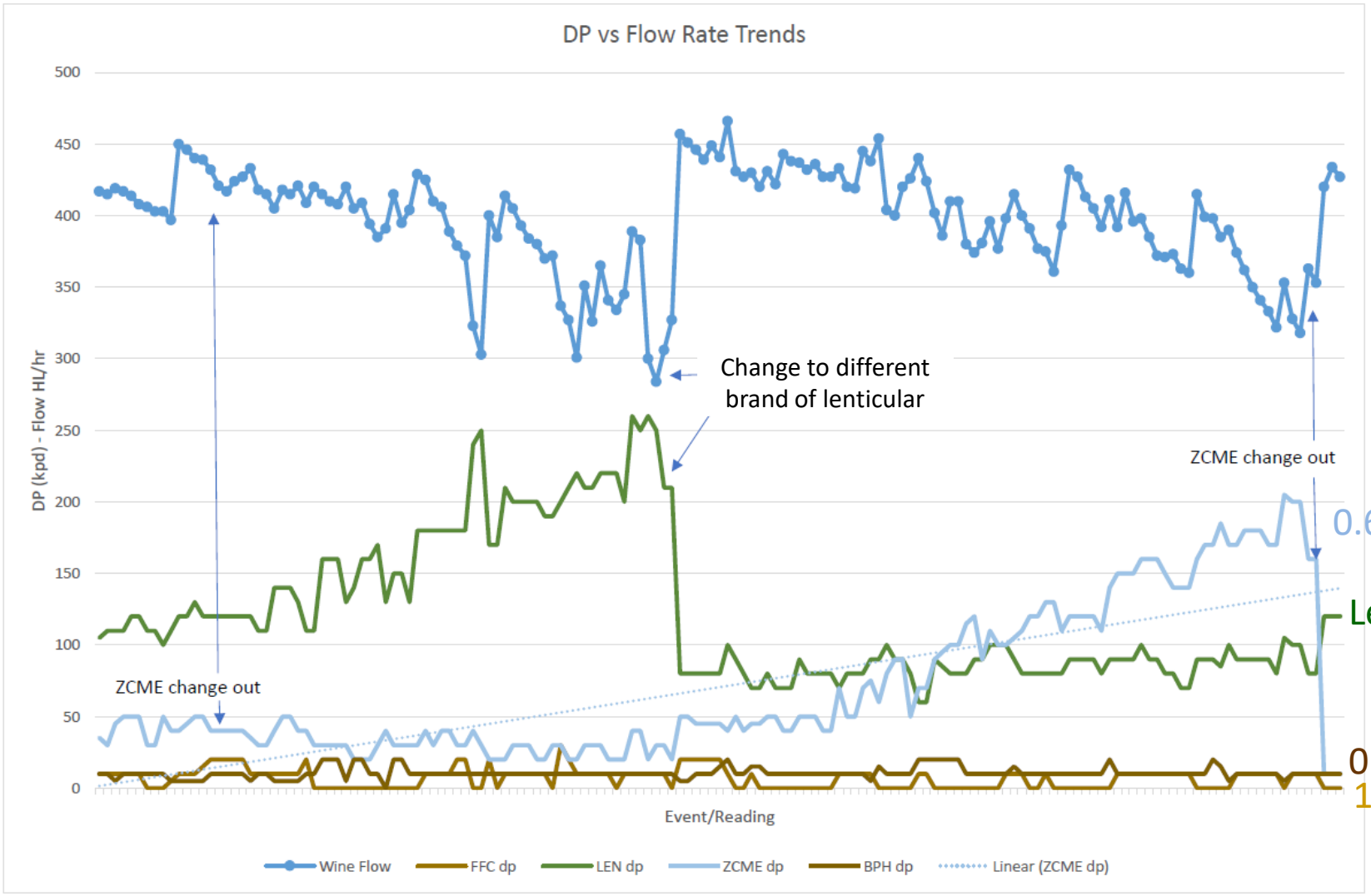
Torresan Estate MV



- No lenticulars – all cartridges for ease of handling
- Minimal operator input required
- Constant data logging: P & DP, T, flow, conductivity
- Used for xflowed wines with FI analysis for maximum benefit
- Maximises filtration $/L through large housings (r^2 law)

The value of monitoring your filtration system performance

DP across bottling filters



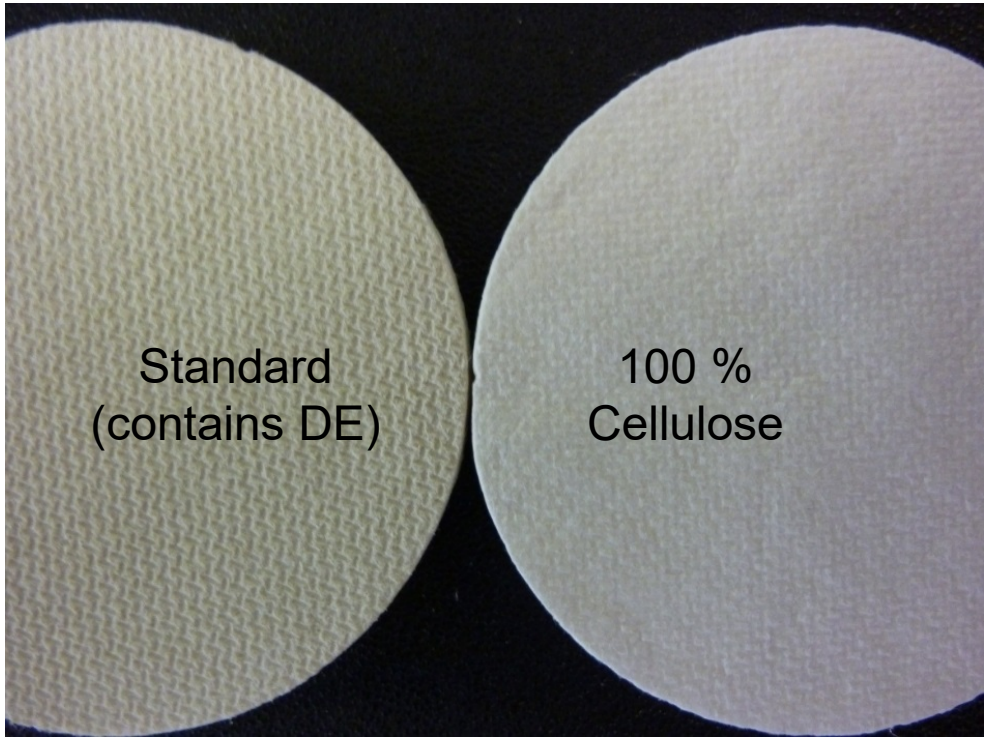
Take home:

Monitor your filtration system

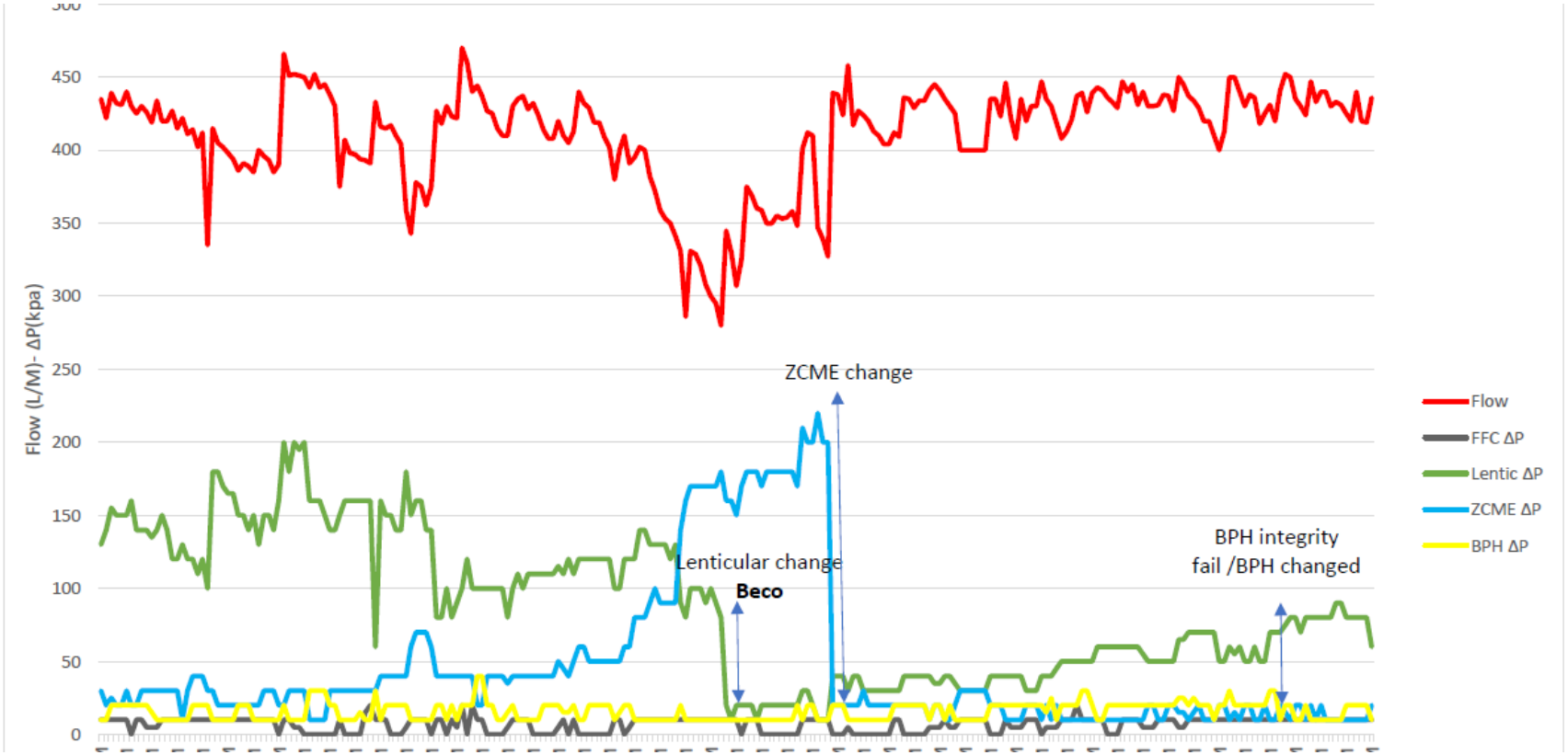
to maximise performance and minimise $/L (not filter cost!)

Depth media

- 100 % cellulose or cellulose/DE
- Cellulose physically ~ 3 - 4 x stronger
- Compostable
- Cellulose-only is steam-sterilisable (less water wastage)
- Differences in colour/aroma adsorption



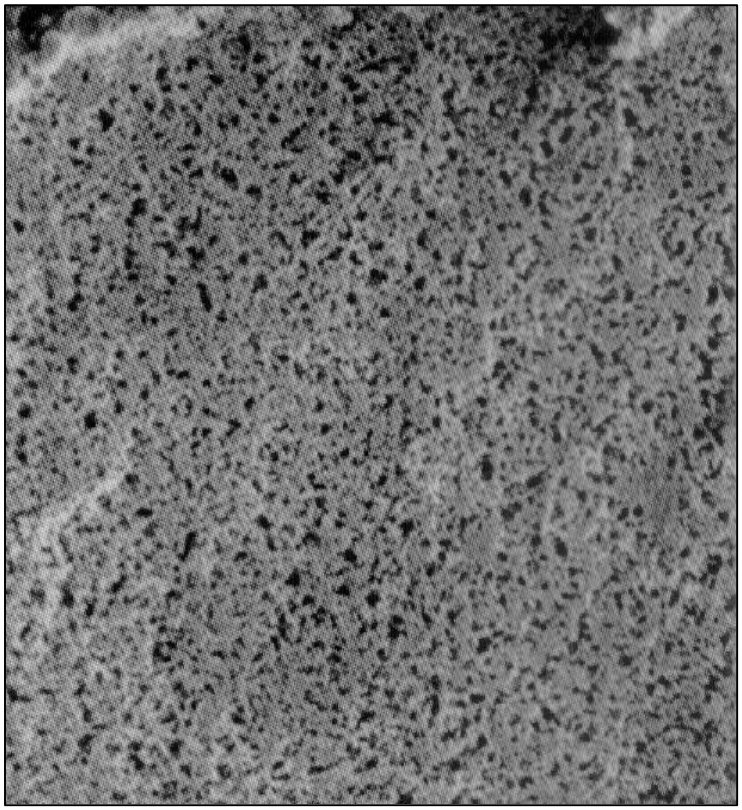
Flow & clean DP between depth media



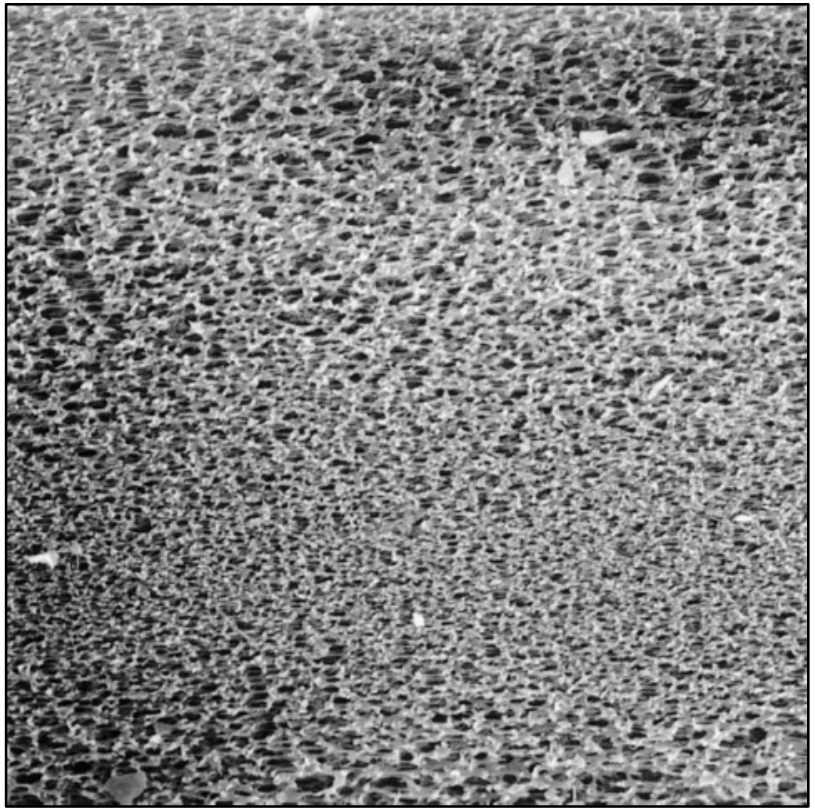
- Flow up to max & DP very low with 100 % cellulose depth medium
- Higher flow and ~60 % longer service life with cellulose-only media

Membranes

- Not a sheet with defined holes in it – it is cast polymer



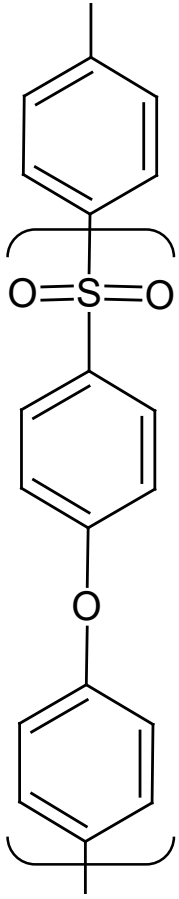
Wine flow direction

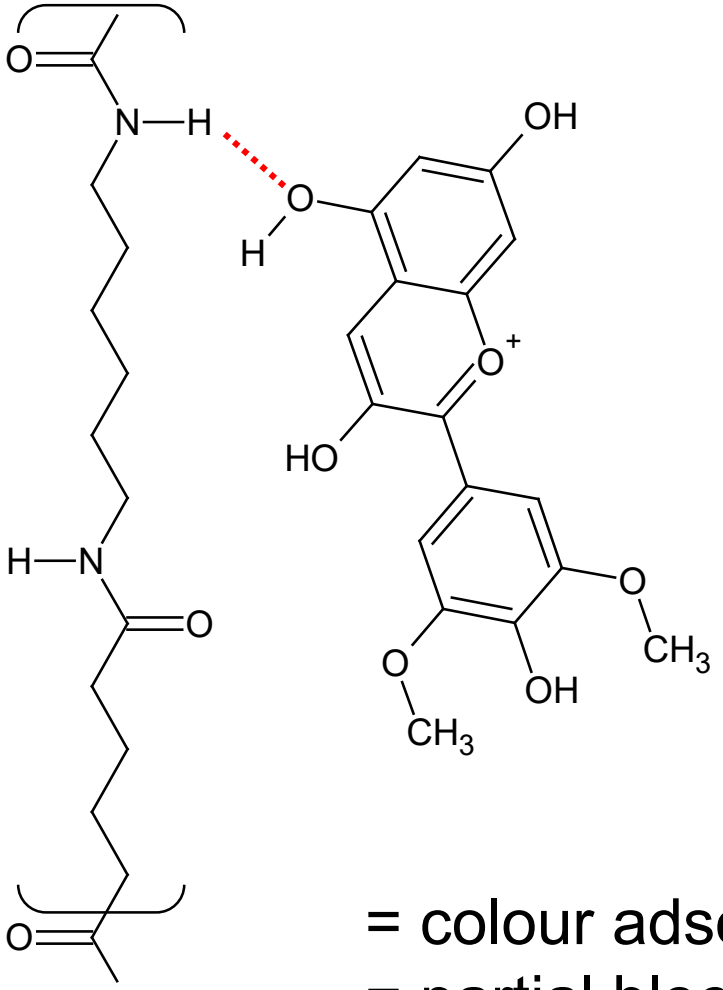


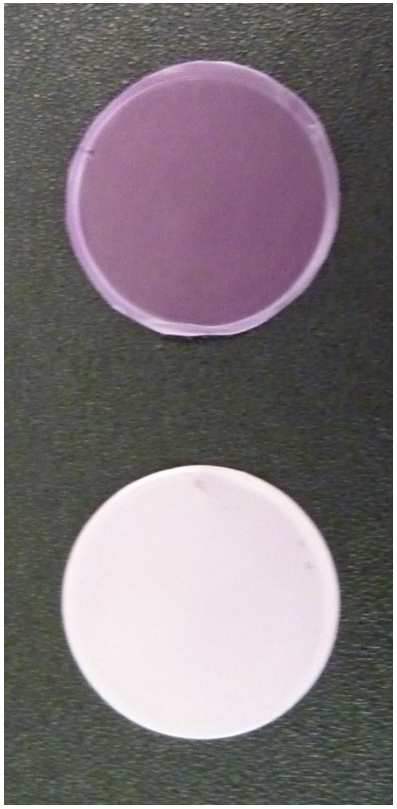
Nylon, symmetrical, 0.45 μm, profile

PES, asymmetric, 0.45 μm, profile

Membranes



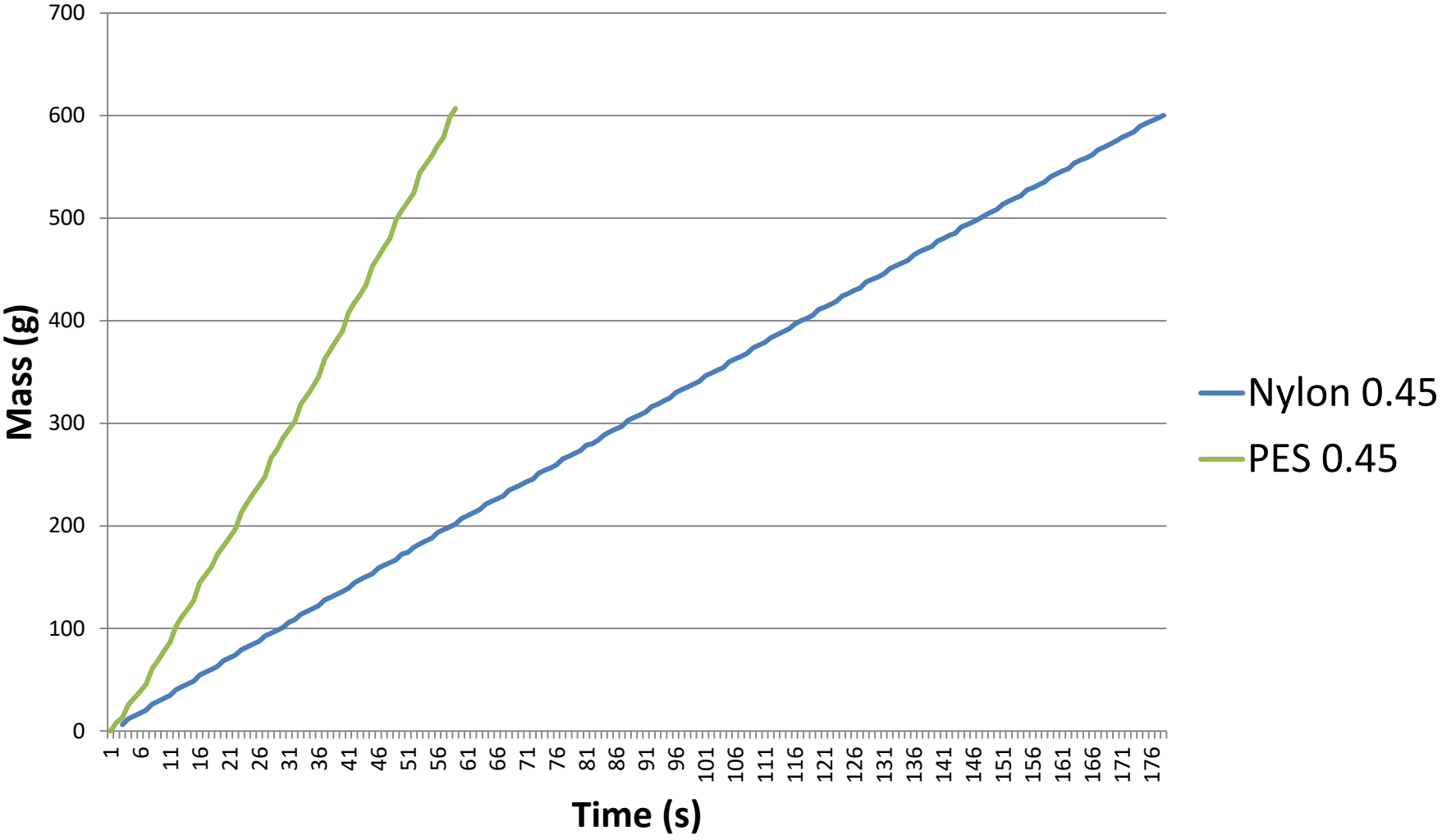




= colour adsorption
= partial blocking

Flow difference PES vs. nylon

RO water



Take home:

Choose your filtration media

to maximise performance and minimise $/L

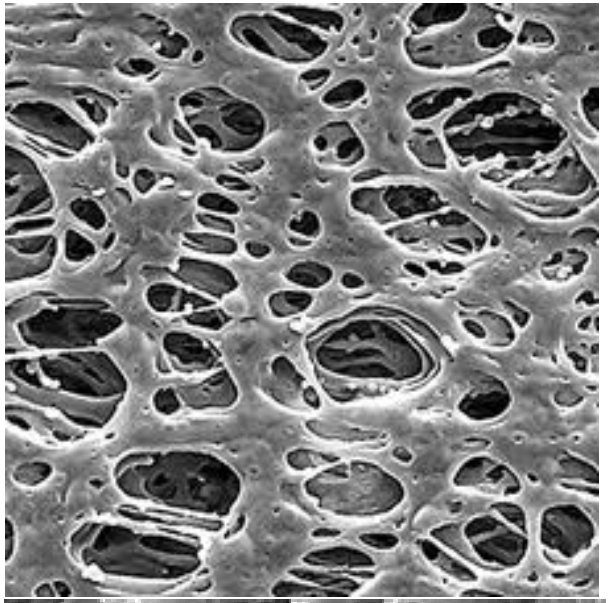
NTU & Filterability index (FI)

NTU

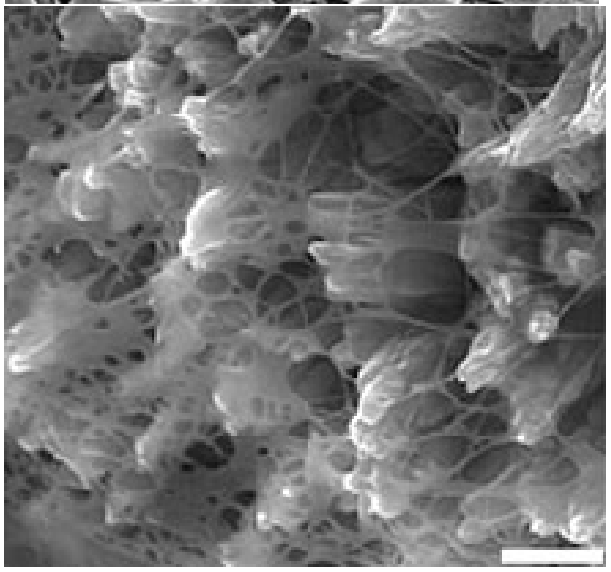
- Wine < 1 NTU = “OK” = “this wine is clean and it is suitable to sterile filter”. Really?
- A measure of light scattering orthogonal to the incident beam.
- Gives an indication of suspended particulates.
- Does not account for reflectance of particulate (e.g. tartrate crystals reflect more than microorganisms).
- Provides no indication of dissolved material. What about the things we can’t see?
- NTU does *not* indicate colloidal status of wine (e.g. glucans, mannoproteins, tannins, protein, gum Arabic, CMC).

Glucans

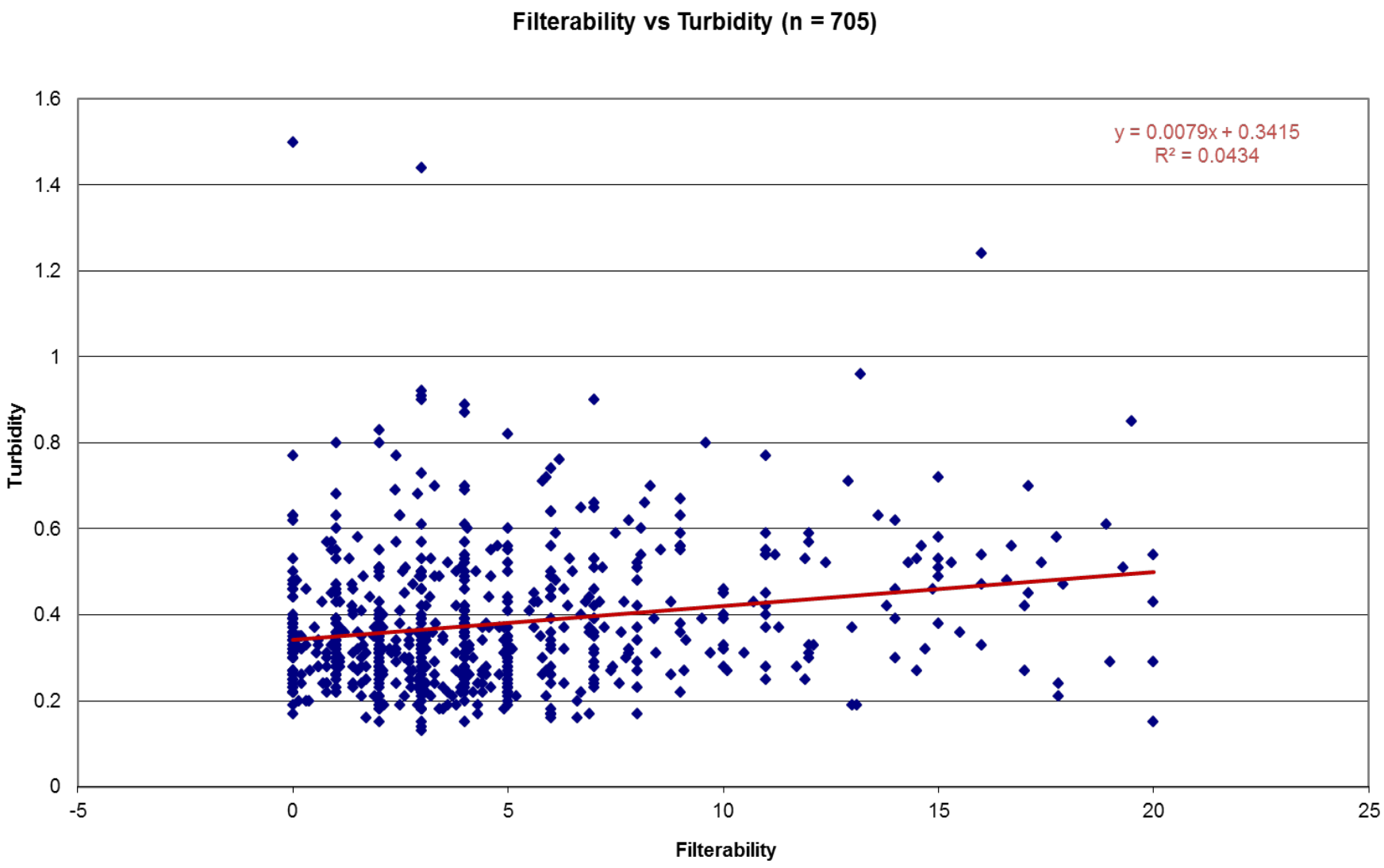
Clean PES membrane



PES membrane fouled with glucans from *Botrytis*



NTU vs. FI: Correlation? No.



Filterability measurement

- Many winemakers have little awareness of FI.
- Several methods in use to measure "FI".
- All require a technician to monitor the analysis from start to finish – a big disadvantage, especially if the wine sample being run is not greatly filterable (ie high FI = long analysis).
- Some labs use 0.45 um, some 0.65 um, regardless of final wine membranes (porosity & medium) being used in bottling.
- Often cellulose acetate (lab cell counting) membranes are used to measure FI. Cellulose nitrate often used in NZ (!).
- Vast performance differences between membrane types and therefore data obtained.
- FI measurement is not a replication of bottling filtration. It is a method for flagging potentially problematic wines. In reality bottling depth and 0.65 prefiltration *should* be doing little work.
- No standard exists for a 0.45 um wine membrane…

Filterability measurement

BHF filterability measurement

Measures **time** for a given volume.

- 25 mm 0.45 um disc identical to bottling membrane.
- Push wine through at 2 bar constant pressure.
- Record time to pass 200 mL & 400 mL.
- Index:

$$FI = T_{400} - 2T_{200}$$

- **Bottling: FI ≤ 20**

Note:

- Useful as a guide to bottling performance.
- Reflects wine colloidal and particulate loading.
- Reliable data + works with any membrane test disc.
- Can never run out of wine.
- Results must be evaluated in conjunction with other data – e.g. wine volume, condition of filters etc.

Gen I-III report

BHF Technologies
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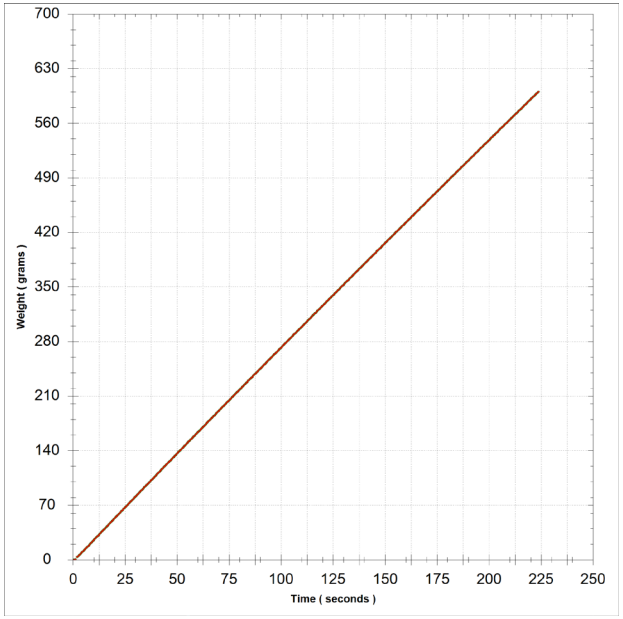
0401 446 119
bhftechnologies.com.au

TYPE : Step Rd 802 Boronia
STOCK :
BASIN :
MEASURE DATE : 6/17/2014 1:33:55 PM

	WEIGHT (gr)	TIME (sec)
START POINT	10	4.540
POINT NR. 1	200	73.446
POINT NR. 2	400	147.952
POINT NR. 3	600	223.768

FILTERABILITY INDEX	**IF** = T2 – 2 * T1	**5.599**
MODIFIED FILT.INDEX	**IFm** = (T3 – T1) – 2 * (T2 – T1)	**1.310**
MAX VOLUME	**Vmax** = 400 + ((400 * T1) / IF)	**5322.399**



NOTES :
NTU 0.52

Gen IV: Water blank

Filtrability Index v2.1:

1800 gr	1800 ml
1600 gr	1600 ml
1400 gr	1400 ml
1200 gr	1200 ml
1000 gr	1000 ml
800 gr	800 ml
600 gr	600 ml
400 gr	400 ml
200 gr	200 ml
0 gr	0 ml

3	gr
3	ml
133	sec

T1 200 ml: 431
T2 400 ml: 876
T3 600 ml: 1338

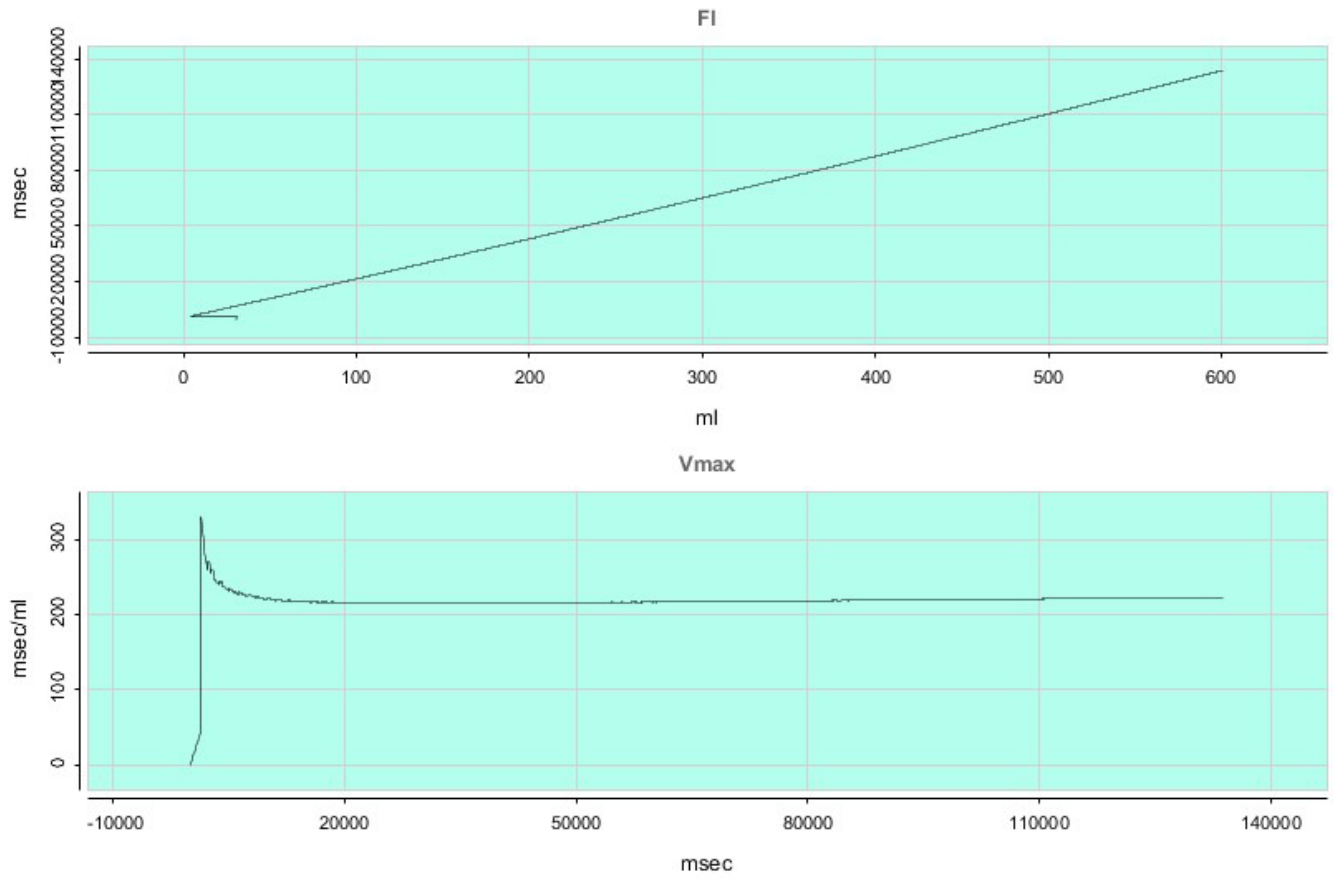
START

TARE

STOP

Gas Release | Gas Open

SAVE



Fluid:	Water blank	
Density:	1.0	Kg/L
Filter type:		
Lot n.:		
Sample size:	25	mm ø
Pore size:	0.45	µm
Pressure:	2	bar
Temperature:	0	°c

FI:	1.342	*FI ~ MFI < = 20*
MFI:	1.752	*Vmax > = 4000*
Vmax:	13256	L/m²
Date/Time: (g-m-y/h-m-s)	7. 11. 2018. 12. 53. 3	
sign:		

Gen IV: Red wine

Filtrability Index v2.1:

__1800 gr	1800 ml__
__1600 gr	1600 ml__
__1400 gr	1400 ml__
__1200 gr	1200 ml__
__1000 gr	1000 ml__
__800 gr	800 ml__
__600 gr	600 ml__
__400 gr	400 ml__
__200 gr	200 ml__
__0 gr	0 ml__

0 *gr*

0 *ml*

442 *sec*

T1 200 ml: 1077
T2 400 ml: 2844
T3 600 ml: 0

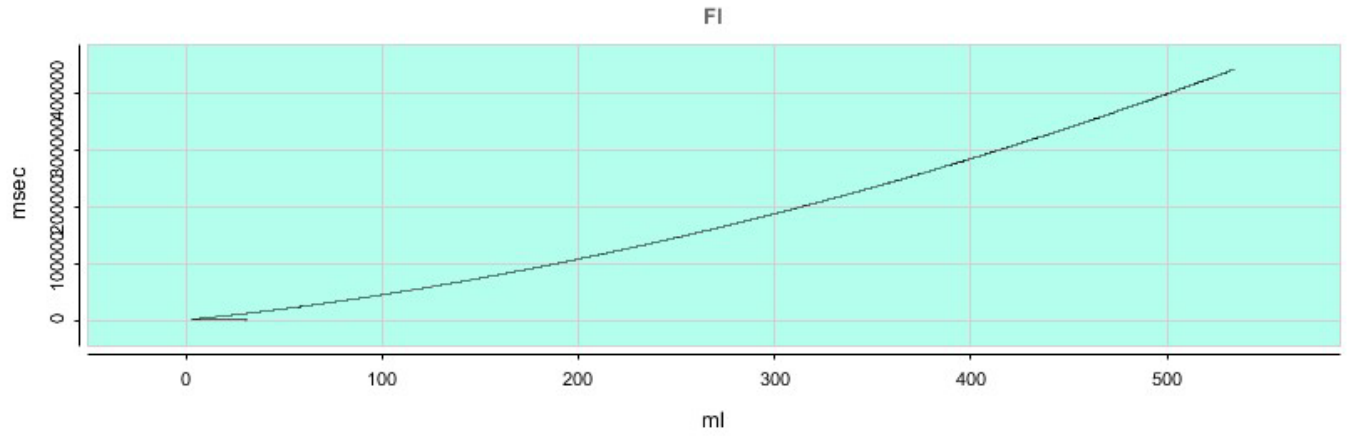
START

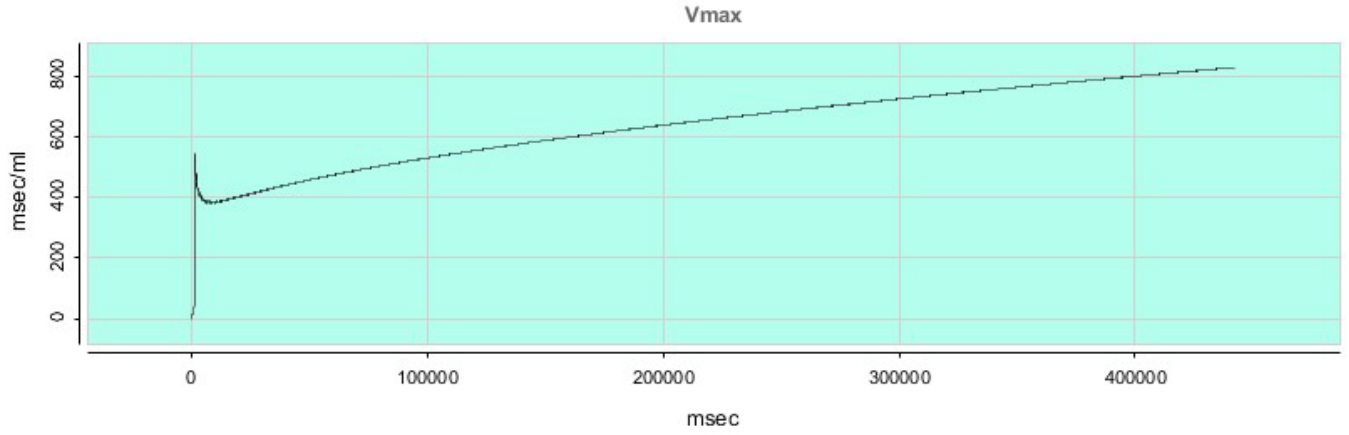
TARE

STOP

Gas Release | Gas Open

SAVE





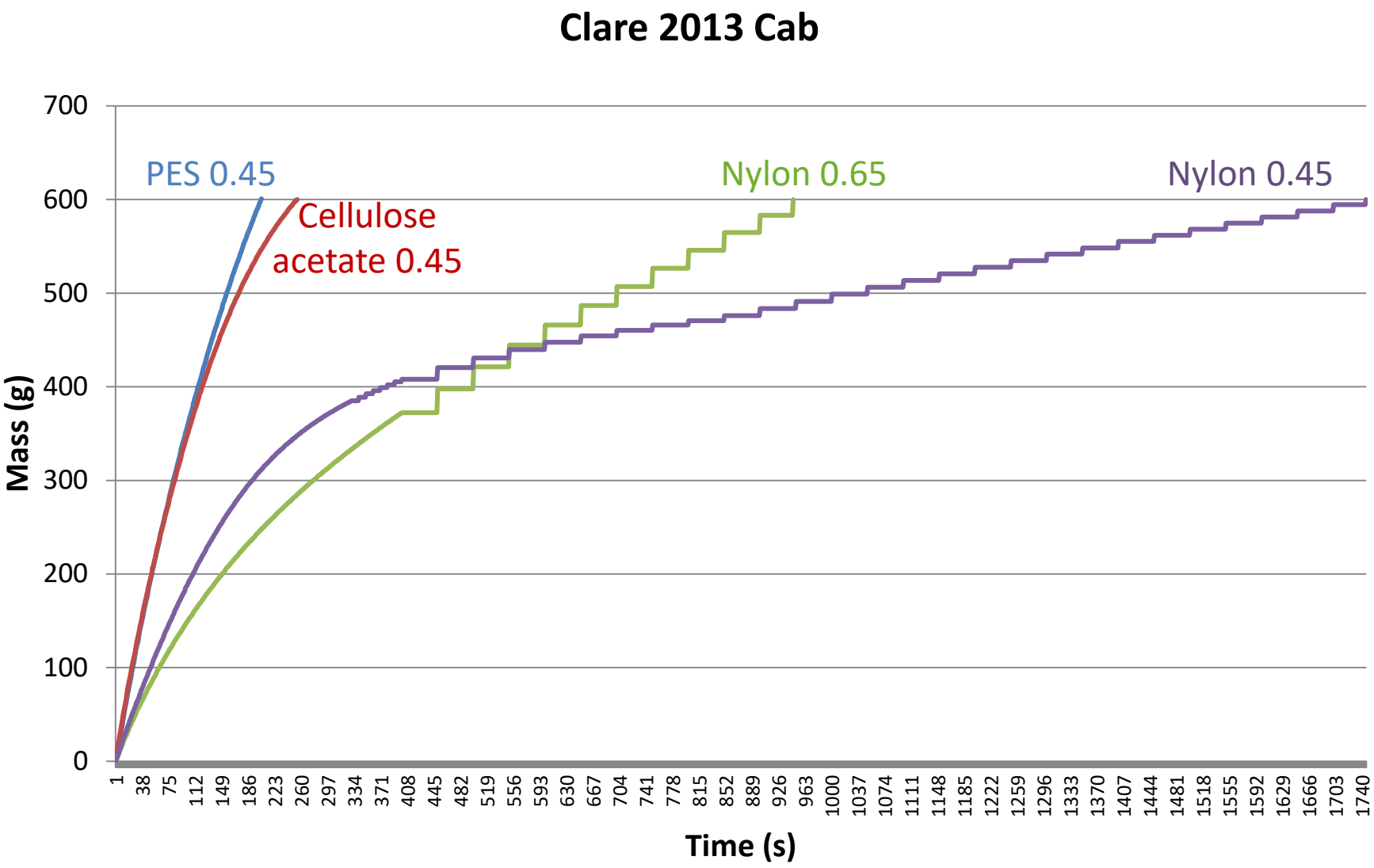
Fluid:	Cake red trial 30 filtration at bottling	
Density:	1.0	Kg/L
Filter type:		
Lot n.:		
Sample size:	25	mm ø
Pore size:	0.45	µm
Pressure:	2	bar
Temperature:	0	°c

FI:	69.031 *	*FI ~ MFI < = 20*
MFI:	0.000	*Vmax > = 4000*
Vmax:	1024	L/m²
Date/Time: (g-m-y/h-m-s)	7. 11. 2018. 13. 11. 53	
sign:		

Some filtration suppliers contend that the membrane disc type makes no difference to the FI analysis result.

Let’s examine that.

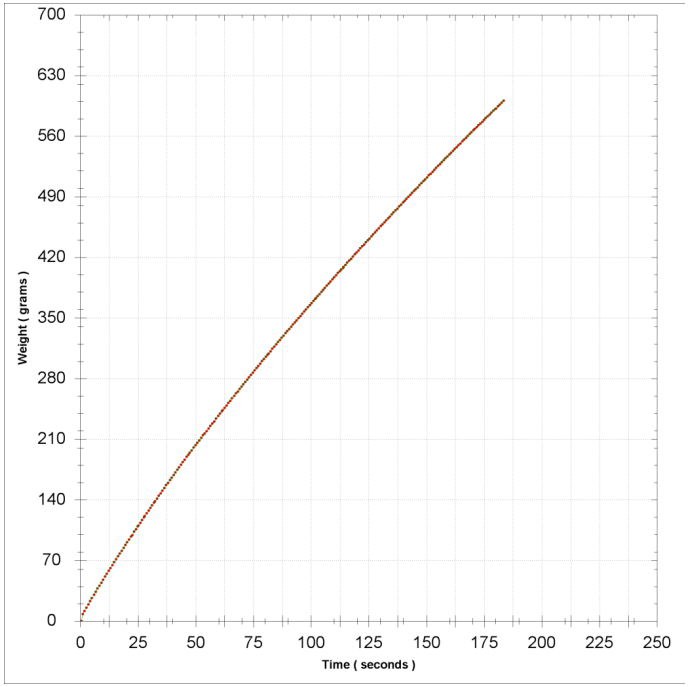
Membrane comparison 0.45 um



Additive influence on FI and process efficiency

Tannin

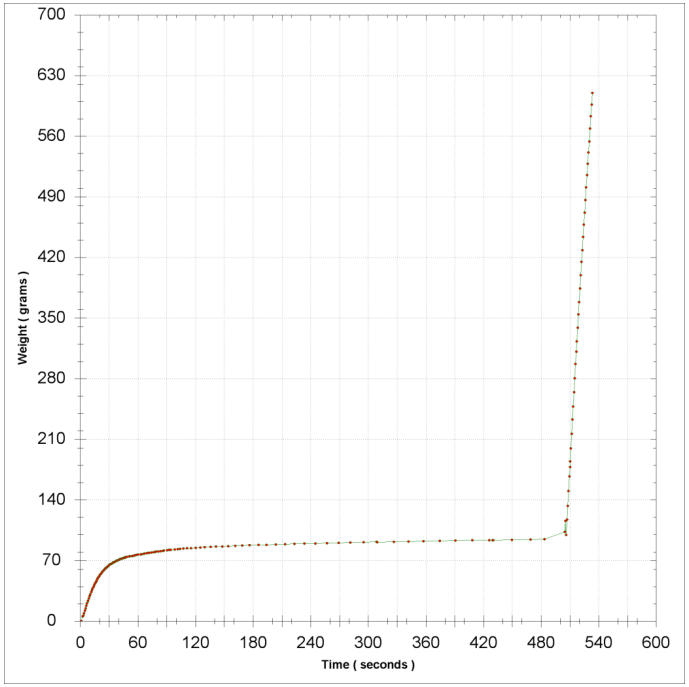
- 2011 Cab post x-flow



FI	FIm
15.2	9.2

Tannin

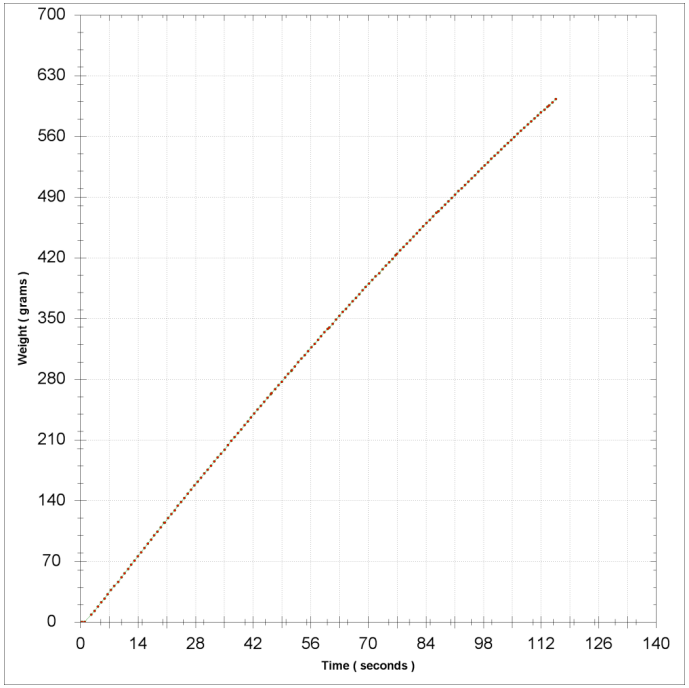
- 2011 Cab post x-flow + 1 mL/L red liquid tannin



FI	FIm
Fail	Fail

Tannin

- 2011 Cab post x-flow + 1 mL/L red liquid tannin – post xflow (again)

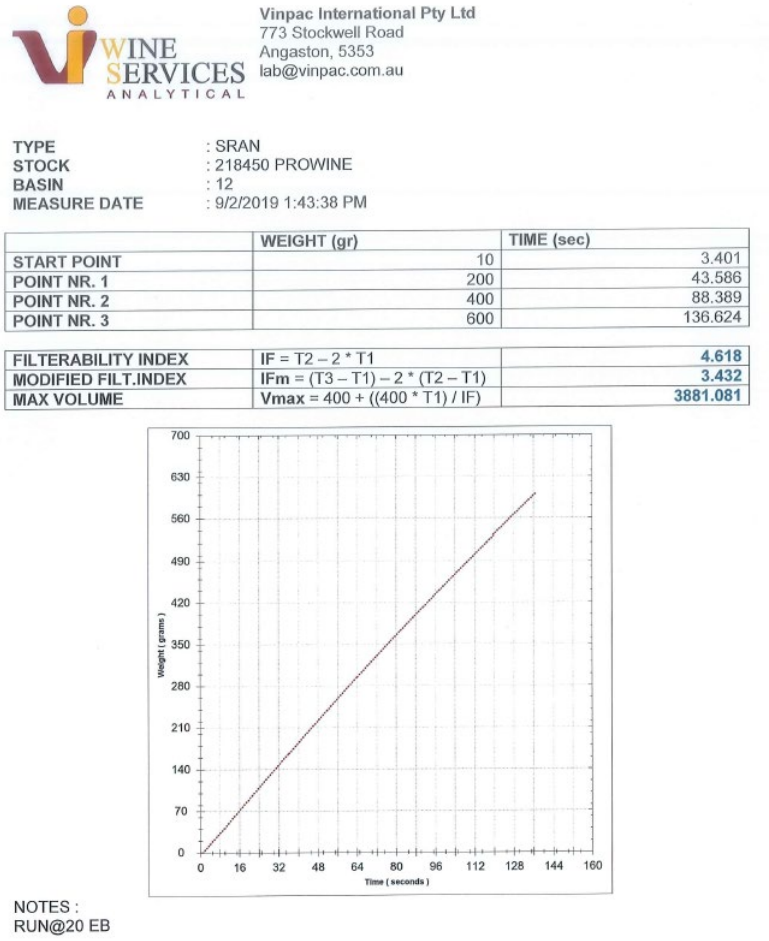


FI	FIm
4.3	6.2

Media choice and process efficiency outcomes

- Train 1: standard lenticular, nylon 0.45 um prefilter, PES 0.45 um final
- Train 2: Beco cellulose lenticular, Parker PES 0.65 prefilter, Parker PES 0.45 final.

- 2018 SHZ 45 kL
- Blocked all 3 filters on train 1 after processing 9 kL.
- Train 2 job completed (36 kL – no DP increases.
- Choice of filtration media can play a big role in processing efficiency.
- Not all filters are the same…



WINE SERVICES ANALYTICAL

Vinpac International Pty Ltd
773 Stockwell Road
Angaston, 5353
lab@vinpac.com.au

TYPE : SRAN
STOCK : 218450 PROWINE
BASIN : 12
MEASURE DATE : 9/2/2019 1:43:38 PM

	WEIGHT (gr)	TIME (sec)
START POINT	10	3.401
POINT NR. 1	200	43.586
POINT NR. 2	400	88.389
POINT NR. 3	600	136.624

FILTERABILITY INDEX	IF = T2 – 2 * T1	4.618
MODIFIED FILT.INDEX	IFm = (T3 – T1) – 2 * (T2 – T1)	3.432
MAX VOLUME	Vmax = 400 + ((400 * T1) / IF)	3881.081

NOTES :
RUN@20 EB

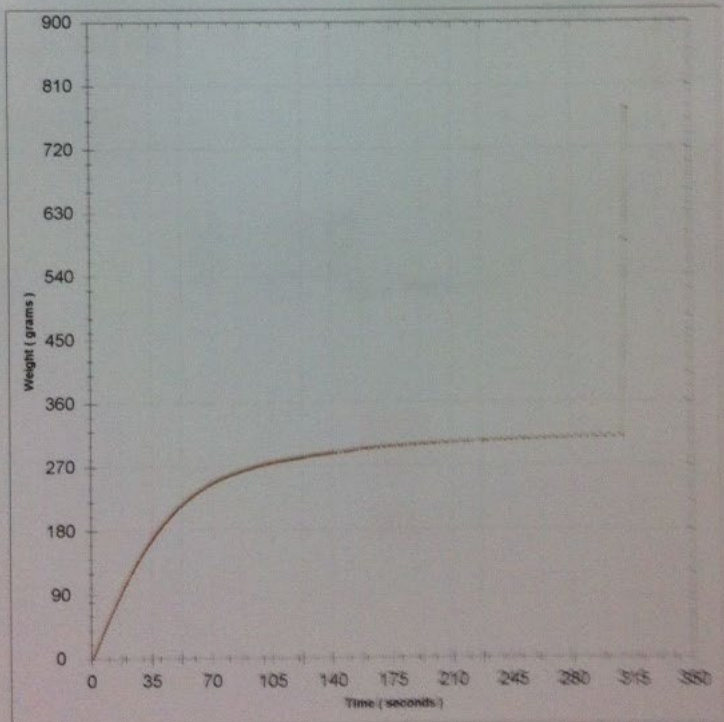
Take home:

Beware of additives, choose filtration media carefully and measure FI to maximise performance and minimise $/L

Xflow performance and process efficiency – the caveats

Xflow influence on FI

FILTERABILITY INDEX	IF = T2 – 2 * T1	221.682
MODIFIED FILT.INDEX	IFm = (T3 – T1) – 2 * (T2 – T1)	-264.681
MAX VOLUME	Vmax = 400 + ((400 * T1) / IF)	479.053



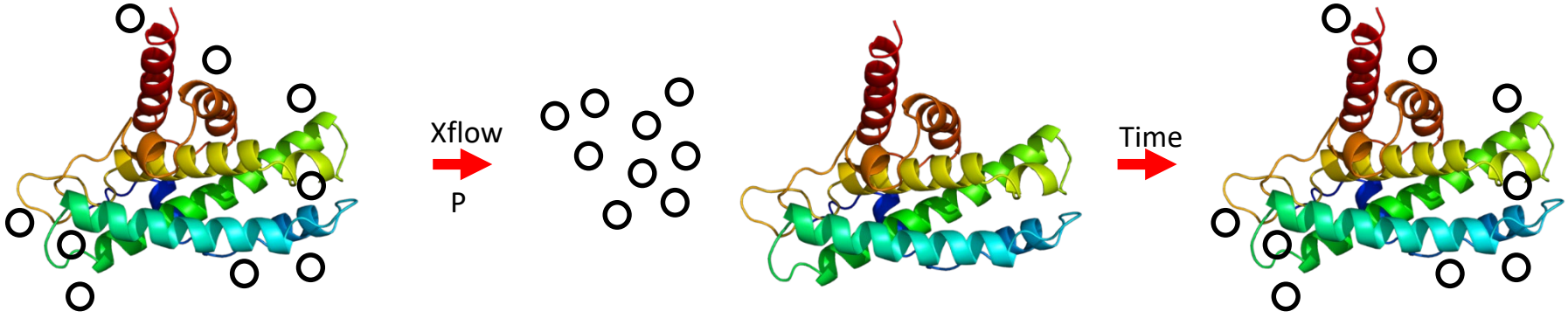
NOTES :

0.55 NTU

Xflow influence on FI

Colloids

- Macromolecular (eg mannoprotein, CMC, gum Arabic)
- Association (eg protein-tannin)



High FI

Low FI

High FI

Monitoring xflow performance

Monitoring xflow performance

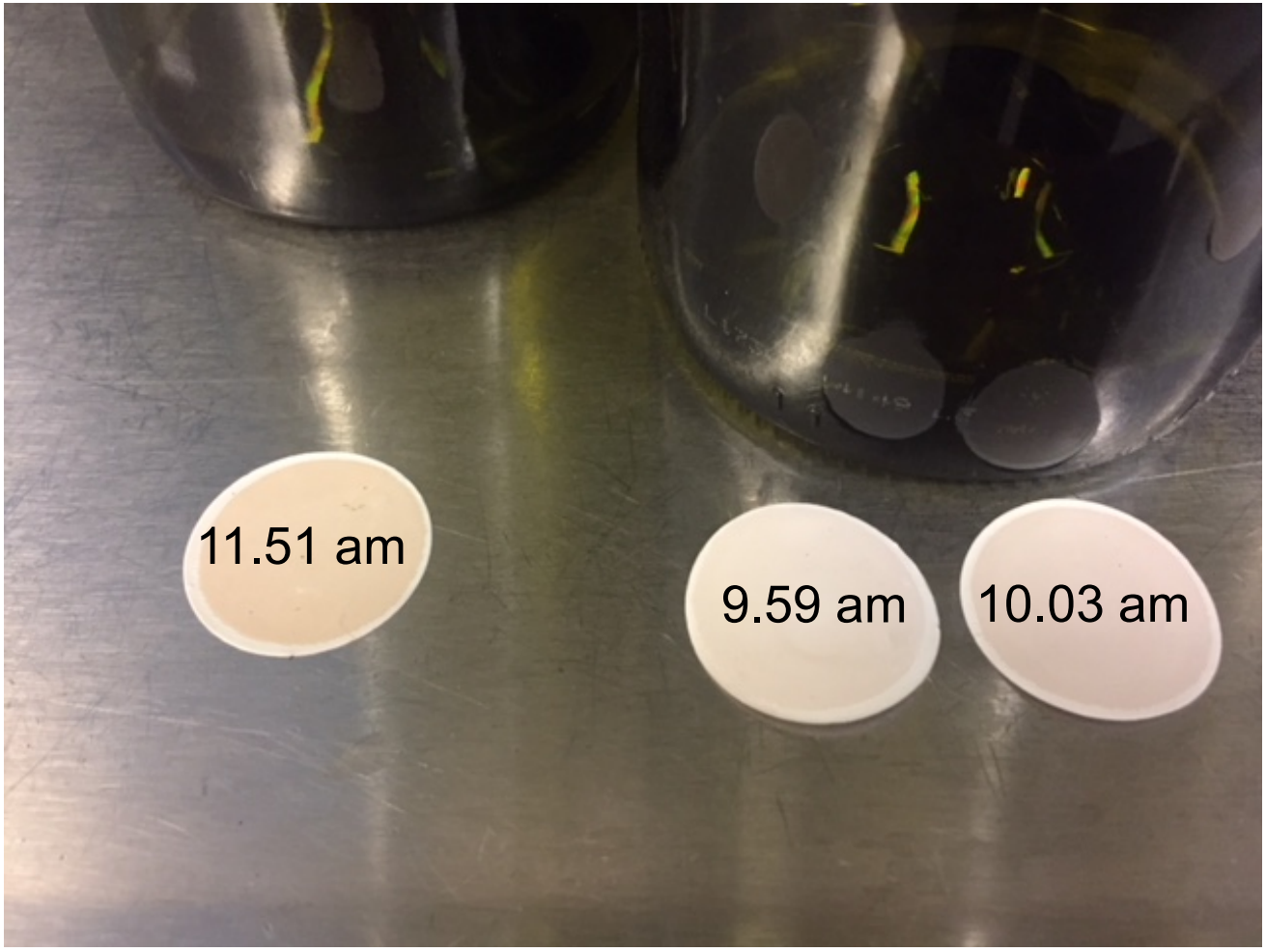
Cell	Replicate	FI	FIm
1A	1	5.0	3.0
	2	31	117
	3	40	472
2A	1	11	6
	2	5	3
3A	1	4	3
	2	3	2
4A	1	6	4
	2	16	23
1B	1	5	3
	2	5	3
2B	1	16	31
	2	22	47
3B	1	4	3
	2	5	4
4B	1	16	12
	2	7	6

Monitoring xflow performance

Cell	Replicate	FI	FIm
1A	1	5.0	3.0
	2	31	117
	3	40	472
2A	1	11	6
	2	5	3
3A	1	4	3
	2	3	2
4A	1	6	4
	2	16	23
1B	1	5	3
	2	5	3
2B	1	16	31
	2	22	47
3B	1	4	3
	2	5	4
4B	1	16	12
	2	7	6

Monitoring xflow performance

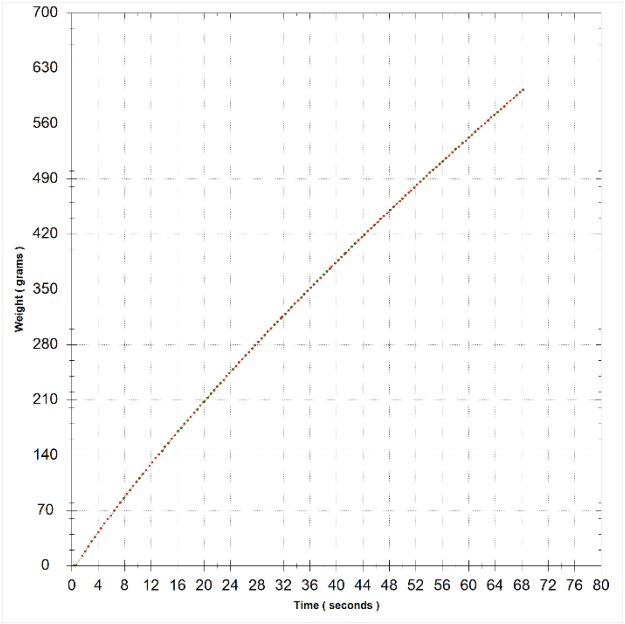
Cell 1A



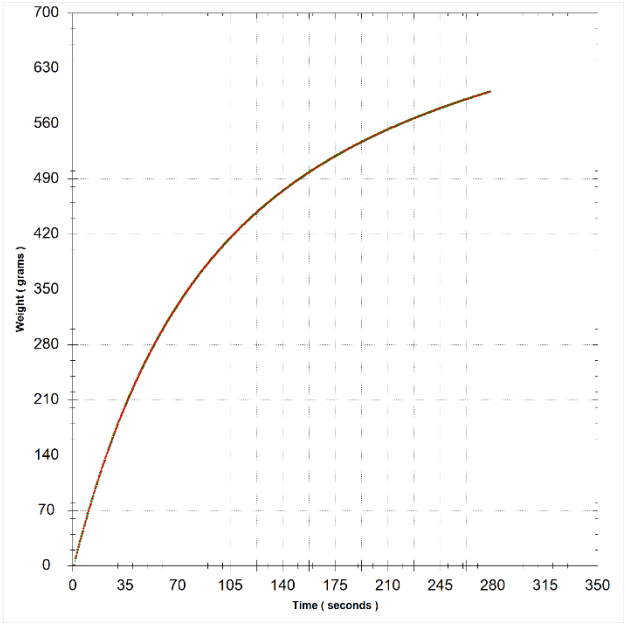
Monitoring xflow performance

Cell 1A

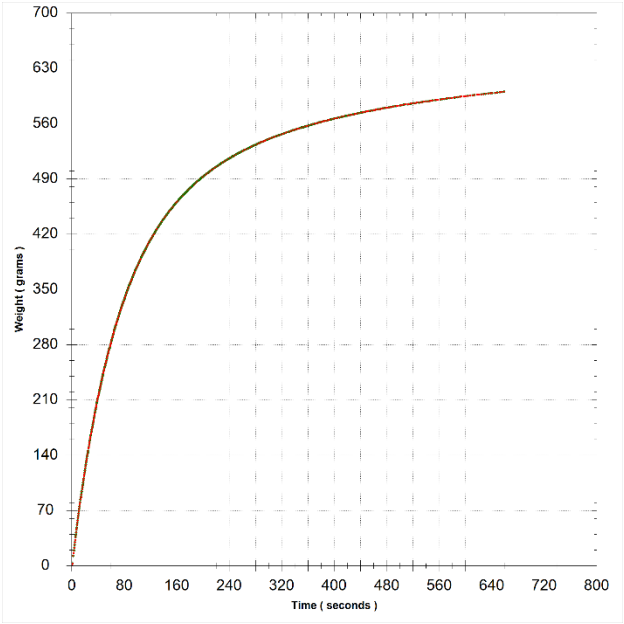
9.59 am



10.03 am



11.51 am



Note time scale changes

Take home:

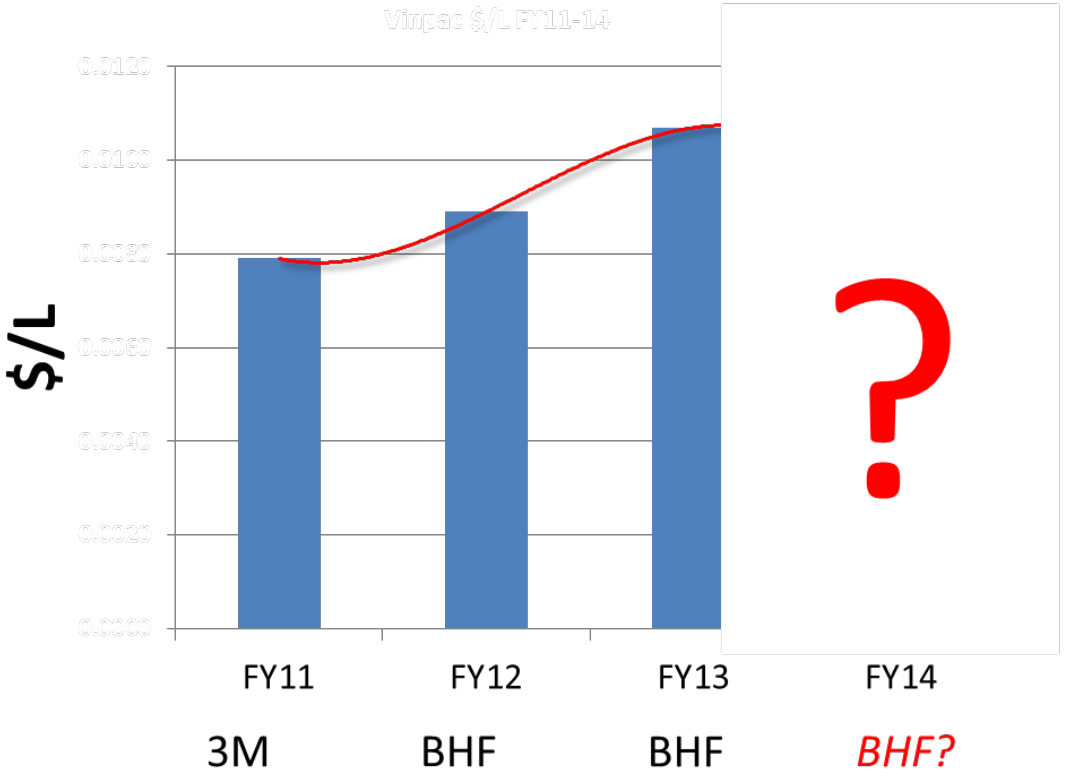
Recheck wine FI just before packaging and monitor your xflow performance using FI to maximise performance and minimise $/L

Does reliable FI measurement minimise packaging cost and improve process efficiency?

Case study:
Vinpac International

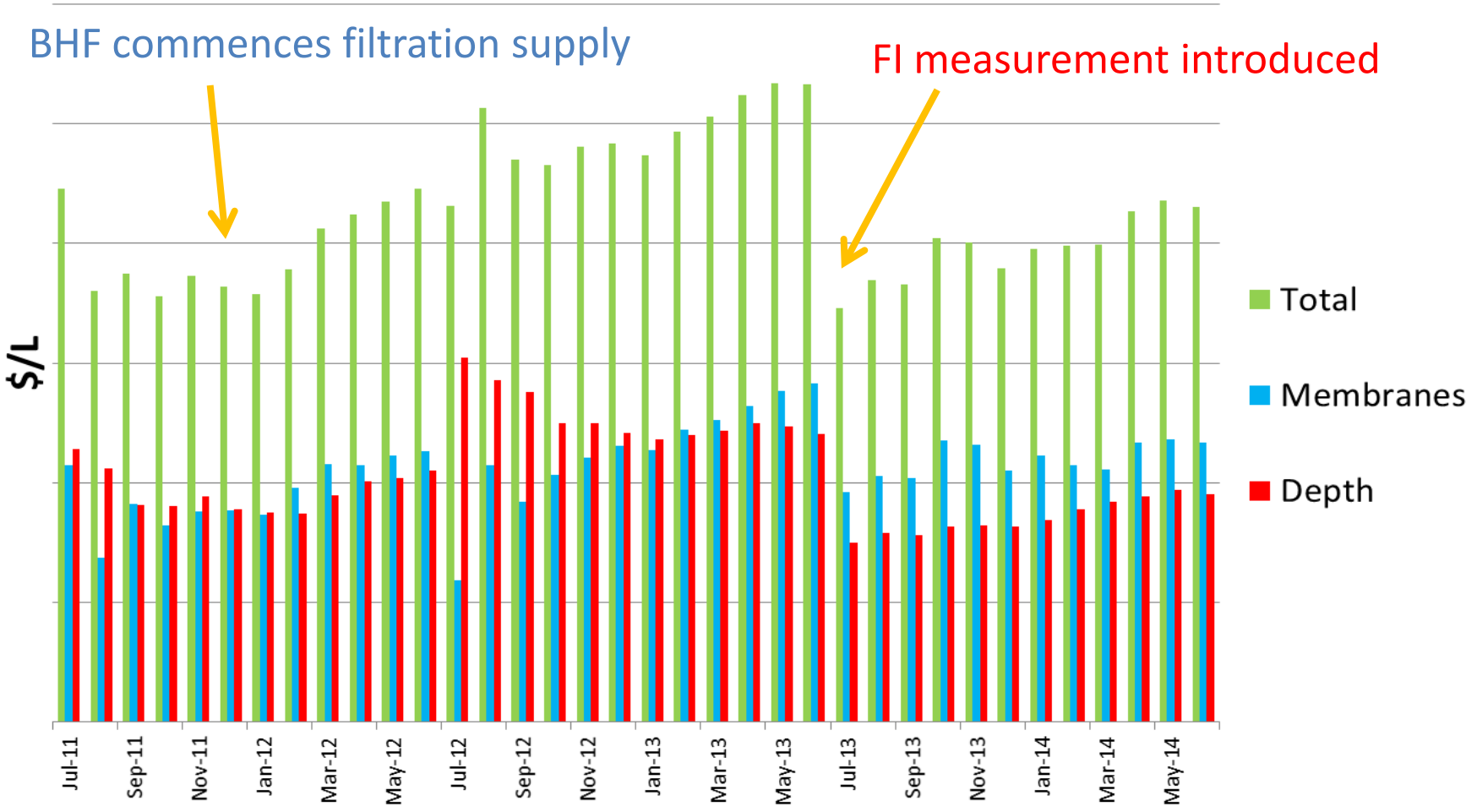
Vinpac filtration costs

- 2011 SA vintage wet = Botrytis on fruit = glucans in wine
- Strong negative impact of V11 wines on filtration costs due to reliance on NTU.
- Inability to detect wines with poor filterability
- Sneaky winemakers: 2011 wines added to V12 and 13 wines…

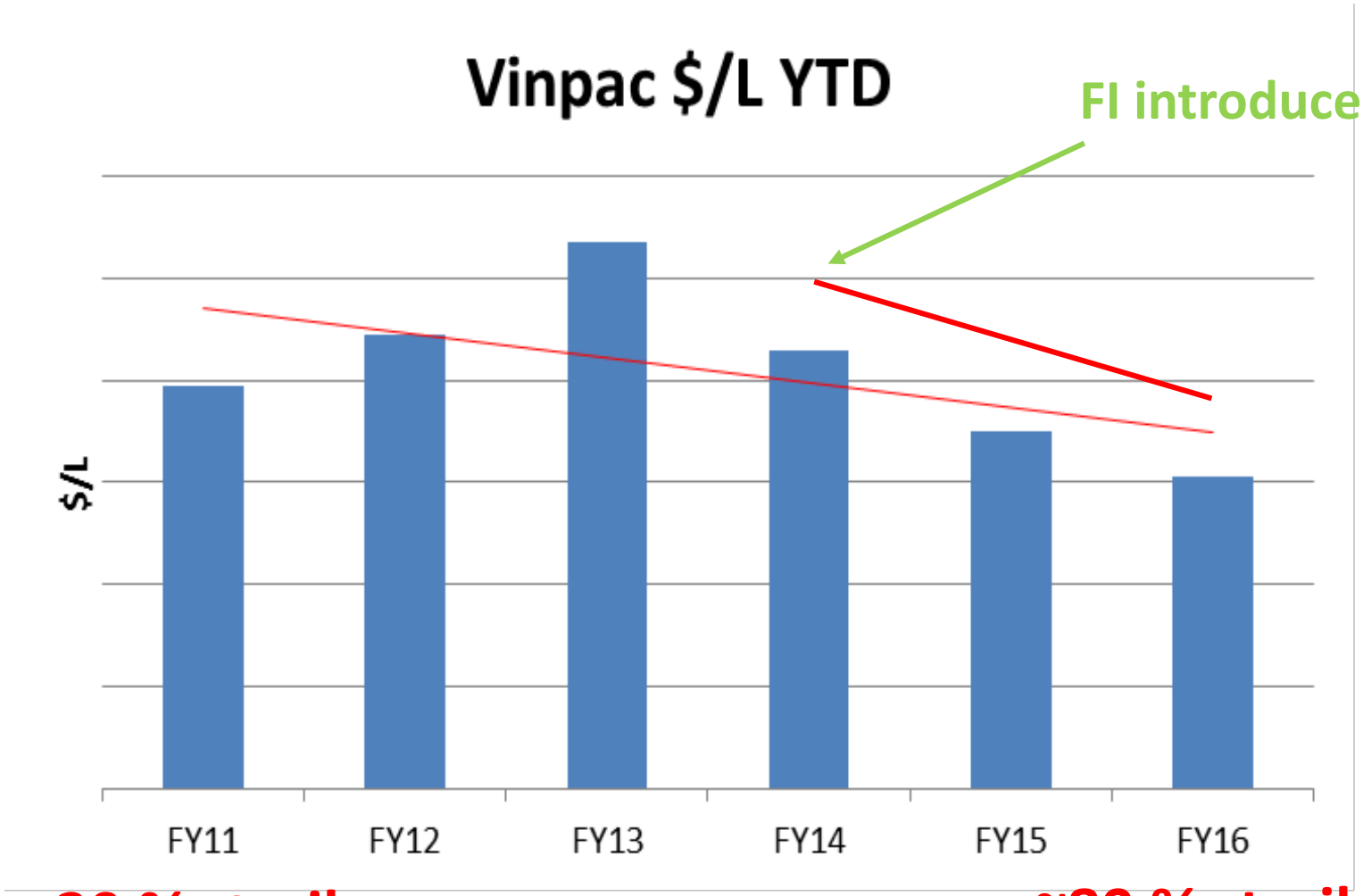


Cost efficiency

What impact does implementing FI analysis have?



Cost efficiency



~20 % sterile

~80 % sterile

+ process advantage: virtually no down-time = $$$

Does reliable FI measurement minimise packaging cost and improve process efficiency?

YES!

…but mainly through minimised down-time

WISA 2016 winners - packaging

WISA 2019 finalists:

Packaging

Winemaking

Thank you.

Paul Bowyer (BHF)
Greg Edwards (Vinpac International)