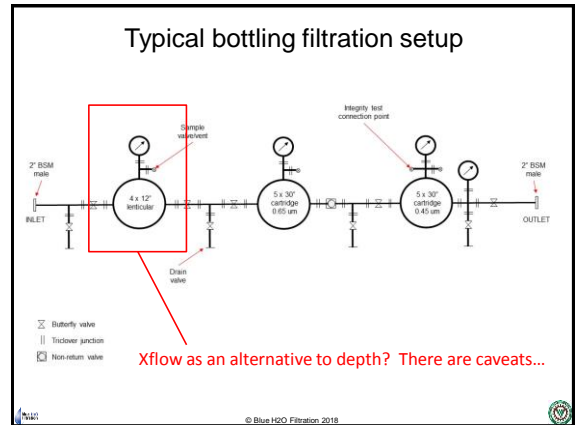
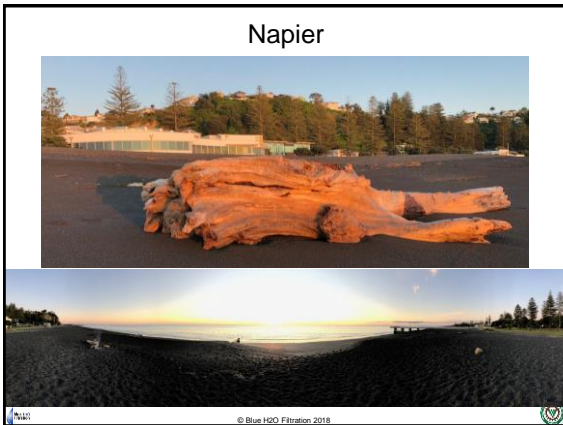
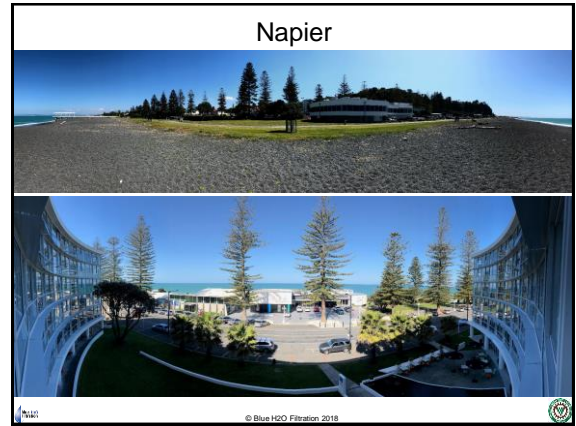


## Filterability measurement for Process Optimisation in Wine Packaging

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 www.bhfttechnologies.com.au  
 Greg Edwards (Vinpac International)

WEA, 17-18/10/2018 © Blue H2O Filtration 2018



### Membranes

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

Nylon, symmetrical, 0.45 µm, profile      PES, asymmetric, 0.45 µm, profile

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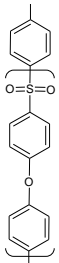
### Membranes

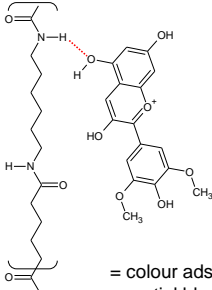
- Not a sheet with defined holes in it – it is cast polymer


PES, asymmetric, 0.45 µm, top view      PES, asymmetric, 0.45 µm, profile

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### Membranes

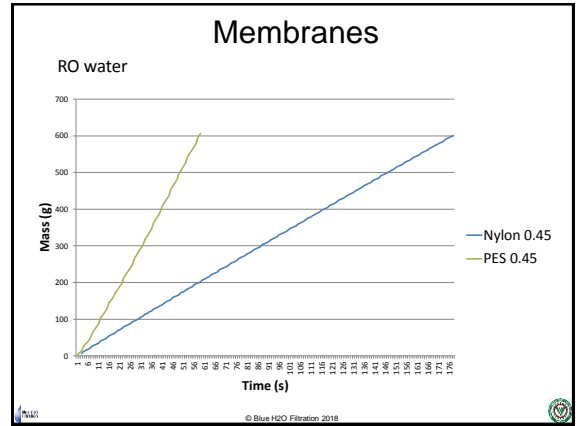






= colour adsorption  
= partial blocking

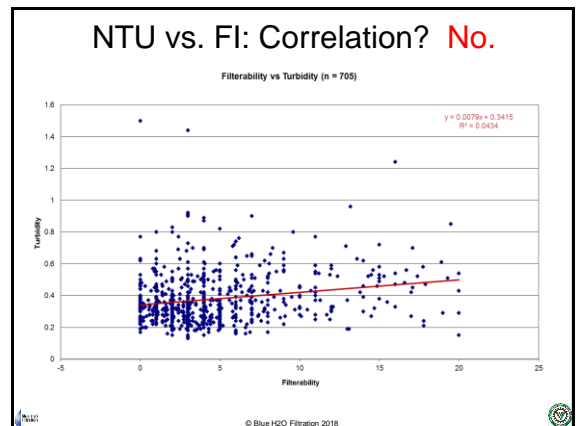
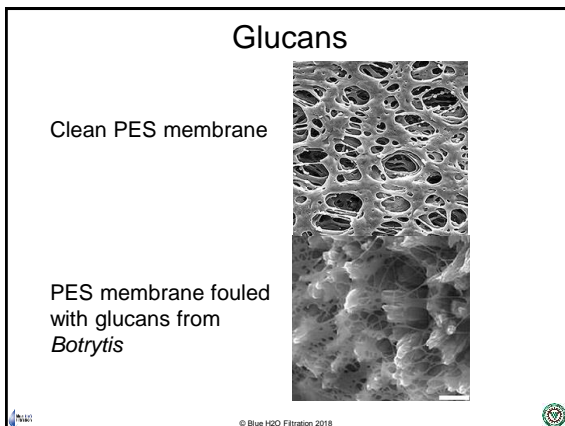
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## NTU & Filterability index (FI)

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- ### 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**).
- © Blue H2O Filtration 2018



## bhfttechnologies.com.au

- See article, The Australian and New Zealand Grapegrower & Winemaker: Paul Bowyer<sup>1</sup>, Greg Edwards<sup>2</sup> and Amelia Eyre<sup>2</sup> (2012) NTU vs. wine filterability index – what does it mean for you? *The Australian and New Zealand Grapegrower & Winemaker*, Issue 585 (October), 76-80.

<sup>1</sup> Blue H<sub>2</sub>O Filtration  
<sup>2</sup> Vinpac International

winemaking

### NTU vs wine filterability index – what does it mean for you?

Paul Bowyer, Greg Edwards and Amelia Eyre

**Introduction**  
THE BLOCKAGE OF sterile filtration media, either rapidly or slowly via an exponential decline, can occur during wine bottling even though the wine meets a pre-bottling turbidity specification suitable for the chosen filtration media. This article will explore the relationship between turbidity and the filterability of wine.

**Background**  
Turbidity is used as a means of assessing the particulate level in a wine (total clarity) and therefore its suitability for

and the wine is to be sterile filled, then it is recommended that the wine receive extra filtration. This may be crossflow filtration in the cellar or depth filtration on line depending on the severity of the problem and the cost to the owner of the wine.

A sophisticated 'filterability meter' measures the extent that light is scattered by any suspended particulate in the sample. This method of analysis is used when bottling wine as a means of ensuring how the suspended material may block filtration media, but does have some limitations. For example, two wines may have similar turbidity

There is surprisingly little in the way of published research literature that covers the relationship between filtration fouling and turbidity in wine. Roger Boulton published an article in 2008 in which he states specifically that "fouling of wine on membrane filters is not related to their clarity" (Alicante-Monaster and Boulton 2008). Since clarity is typically expressed as turbidity (NTU), this is an important statement. He also points out the strong influence of temperature on fouling in an earlier publication, that in cooler temperatures will typically produce reduced filterability (La Gruta

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## 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.

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## Filterability measurement



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## Usual NZ filterability method

Measures **volume** for given times. Rankine method.

1. 25 mm 0.45 um cellulose nitrate membrane (but bottling using 0.45 um PES)
2. Sample @ 2 bar
3. Record volumes for 30-90 s (T1) and 120-180s (T2).
4. **FI = T2/T1**
5. FI ≥ 1.20 = fail.

Note:

- The division dilutes the data. Small numbers are problematic.
- Difficult to interpret results – is there much value in such a narrow data range?
- Is it valid to call 1.19 a pass but 1.20 a fail? A narrow line.
- Is the method reproducible and accurate?
- Does not accommodate modern membranes with high flux.

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## 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.

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So how do we make FI measurement easy enough to be routine?

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### FI values

2013 Clare Cabernet Sauvignon

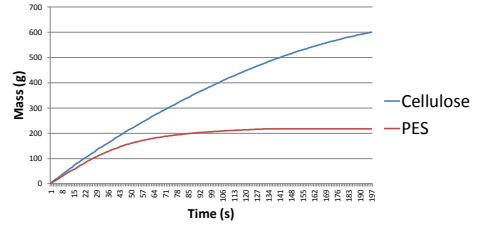
Disc type	FI	FIm
PES 0.45 um	17	23
Cellulose ester 0.45 um	23	61
Nylon 0.65 um (manufacturer A)	162	186
Nylon 0.45 um (manufacturer B)	161	1100

In this example:

- Compare FI and FIm values...
- PES membranes - will work well
- Nylon membranes - not so much...

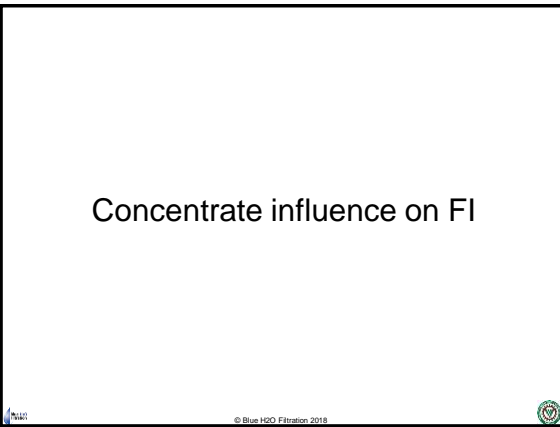
### Membrane comparison 0.45 um

2014 Merlot NTU 0.5



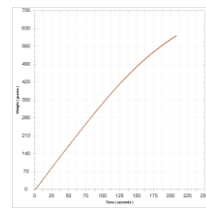
	FI	FIm
PES 0.45 um	Fail	Fail
Cellulose 0.45 um	15	36

### Concentrate influence on FI



### Concentrate

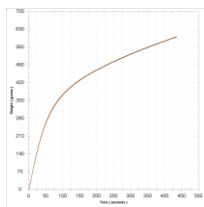
- 2014 Riesling tank sample



FI	FIm
8.1	24

### Concentrate

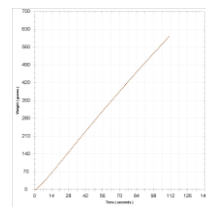
- 2014 Riesling + 5 g/L concentrate



FI	FIm
53	228

### Concentrate

- 2014 Riesling + 5 g/L conc. post 0.1-0.3 um depth (Beco 170)



FI	FIm
1.9	1.6

## Xflow influence on FI

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### Xflow influence on FI

FILTERABILITY INDEX	$IF = T2 - 2 * T1$	261.882
MODIFIED FILTER INDEX	$IFm = (T3 - T1) - 2 * (T2 - T1)$	384.881
MAX VOLUME	$Vmax = 400 * ((400 * T1) / IF)$	478.853

NOTES

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### Xflow influence on FI

Colloids

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

High FI

Xflow

Low FI

Time

High FI

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### Believe it or not, what BHF wants to see is:

FILTERABILITY INDEX	$IF = T2 - 2 * T1$	0.000
MODIFIED FILTER INDEX	$IFm = (T3 - T1) - 2 * (T2 - T1)$	∞
MAX VOLUME	$Vmax = 400 * ((400 * T1) / IF)$	Infinity

And beyond!!

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### 2016 winners - packaging

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### Thank you.

Paul Bowyer (BHF)  
Greg Edwards (Vinpac International)

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