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Inspiration to Application

+ product development
+ process development
+ effective packaging
+ efficient manufacturing
+ sensory evaluation
+ analytical chemistry
+ winemaking
+ fermentation

Bottling: Is Your Headspace Vacant?

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Overview

- Australian market wine preferences
- Oxygen has impact on wine style
- Oxygen has impact on shelf life
- How oxygen gets in
- Headspace management critical

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Provisor is Effective Packaging

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Packaging Function

- Wine Integrity
- Image
- Ease of Access
- Sense of Occasion
- Application speed
- Reliability
- True Cost

Additional function

- Impact on wine style/quality

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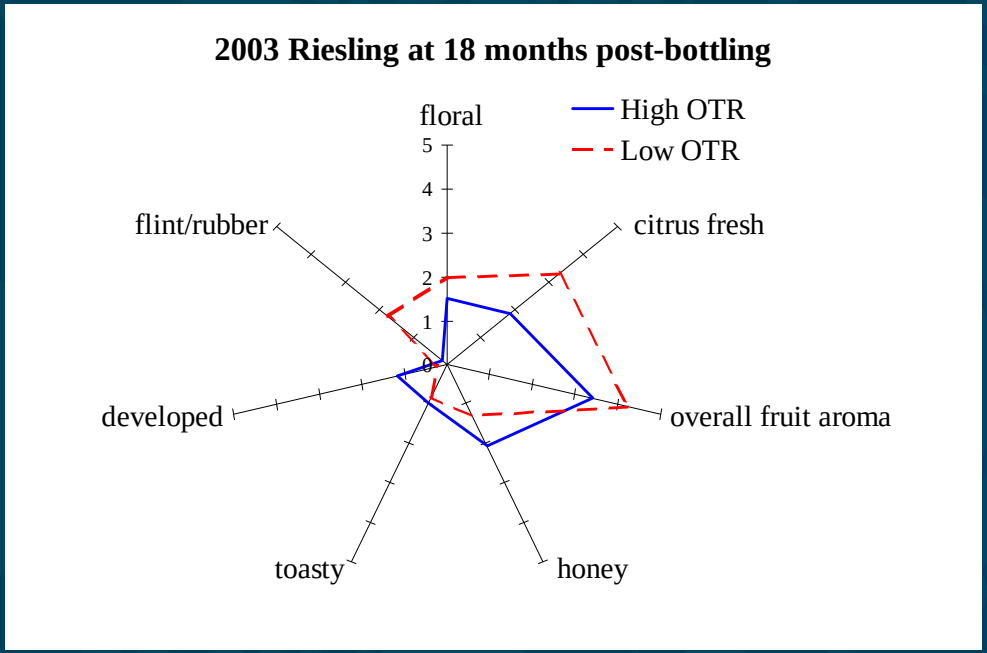
Market Perspective - Hedonic Testing

Amount of Oxygen Ingress Determines Wine Style



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Market Perspective - Hedonic Testing

Source: *Lattey et al, 33rd ASVO Proceedings October 2006*

- Preferred wine attributes
- Distinct preference grouping

	Likes	Dislikes
Consumer	***Floral***	***Bitter***
	Caramel	***Pepper***
	Confectionery	***Smoky***
		Astringent (coarseness)
Winemaker	***Spice***	
	Pepper	***Leather***
	Astringent (coarseness)	***Reduced***

20 point wine judging system was not indicative of consumer preference

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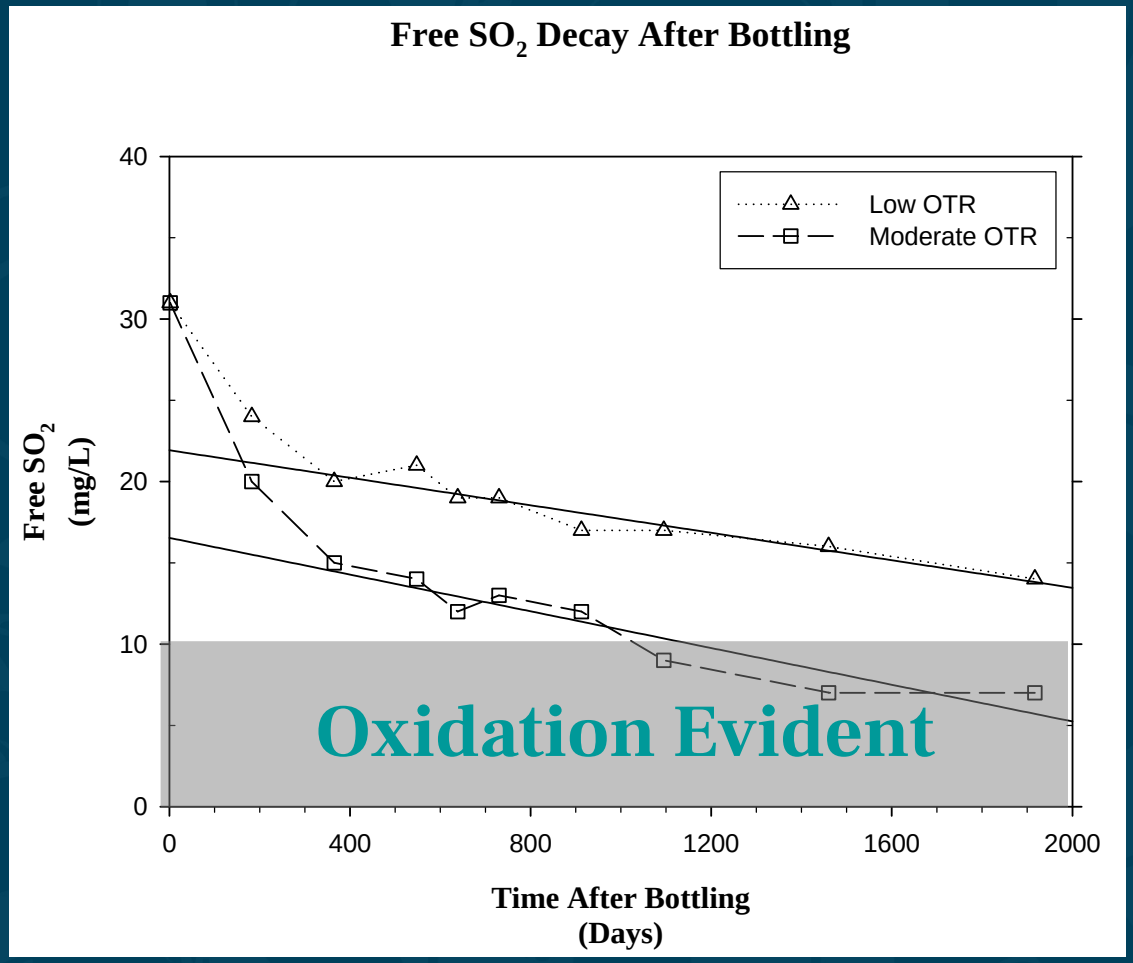
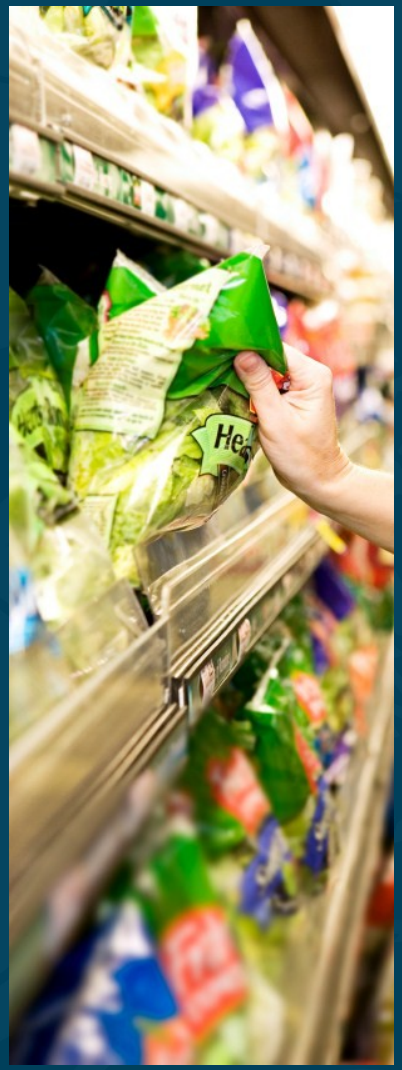
Shelf-life?

Amount of Oxygen Ingress Determines Shelf Life





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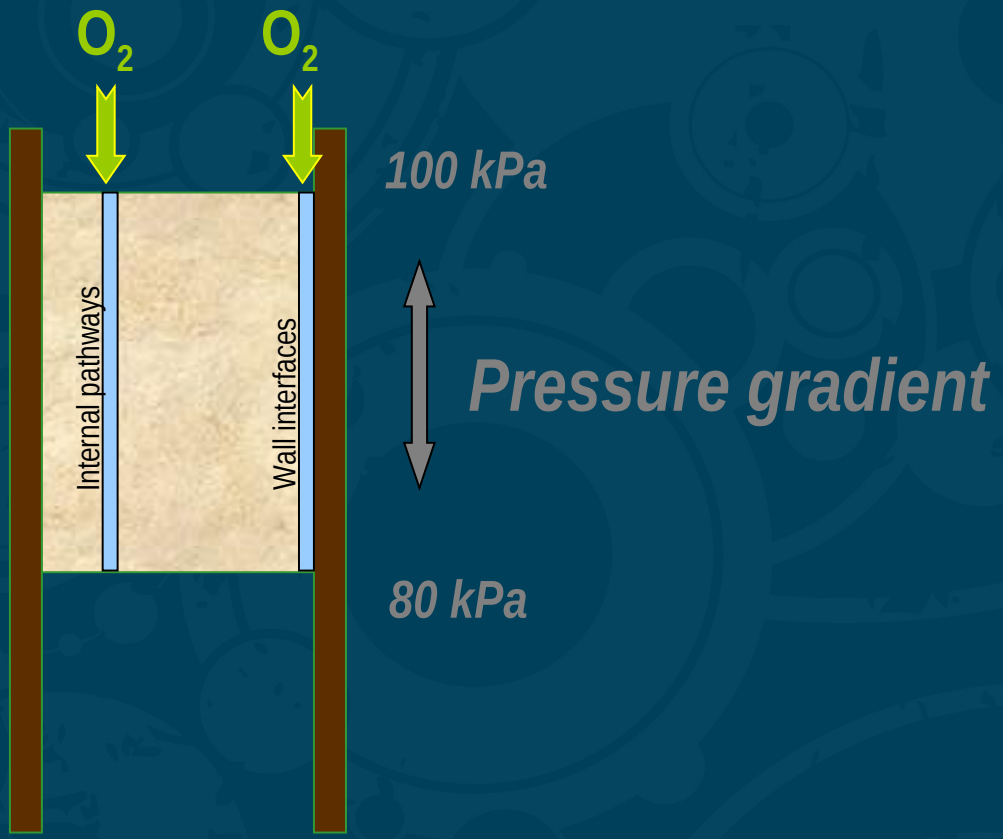
Mechanisms for O_2 ingress

- Pressure driven flow

Flowrate a function of
- *Gradient*
- *Diameter*
- *Length*
- *Path Tortuosity*



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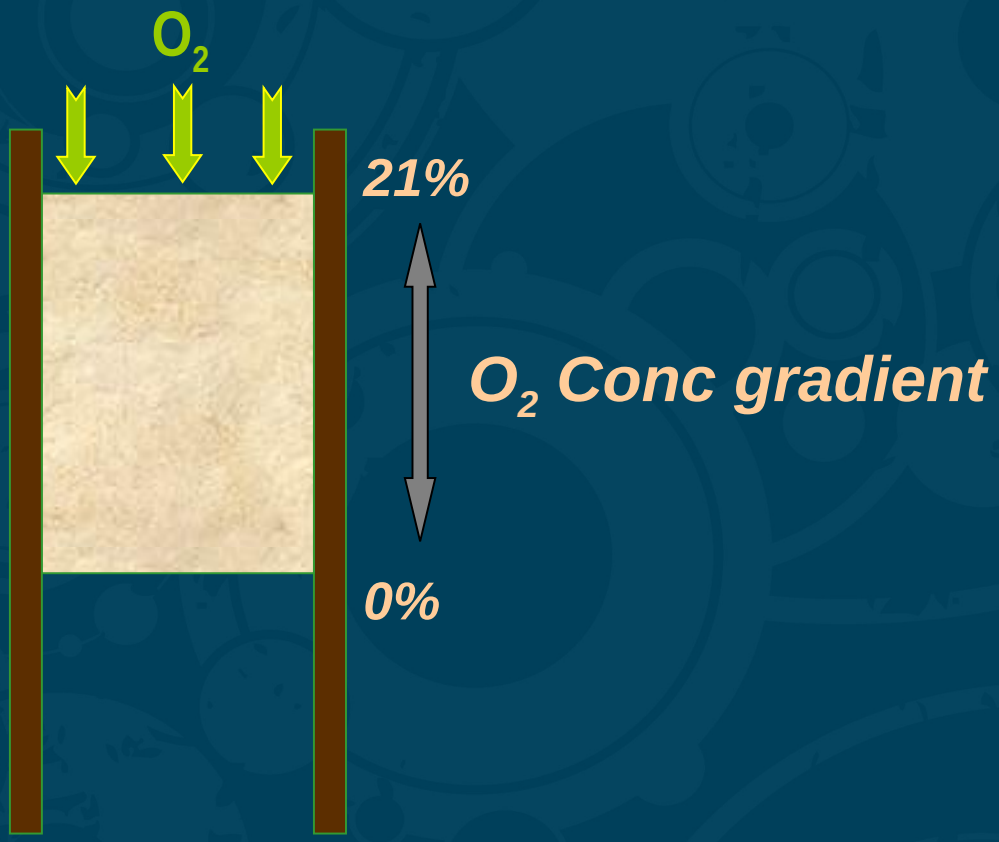
Mechanisms for O_2 ingress

- Diffusion

Flowrate a function of
- *Gradient*
- *Material*
- *Length*
- *Diffusive Coefficient*



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Stages of O_2 Diffusion

Through Closure
(measurement by mocon ASTM F-1307)

Into Headspace

Solution into liquid (measurement by oxysense)
Through liquid
Reaction(s)

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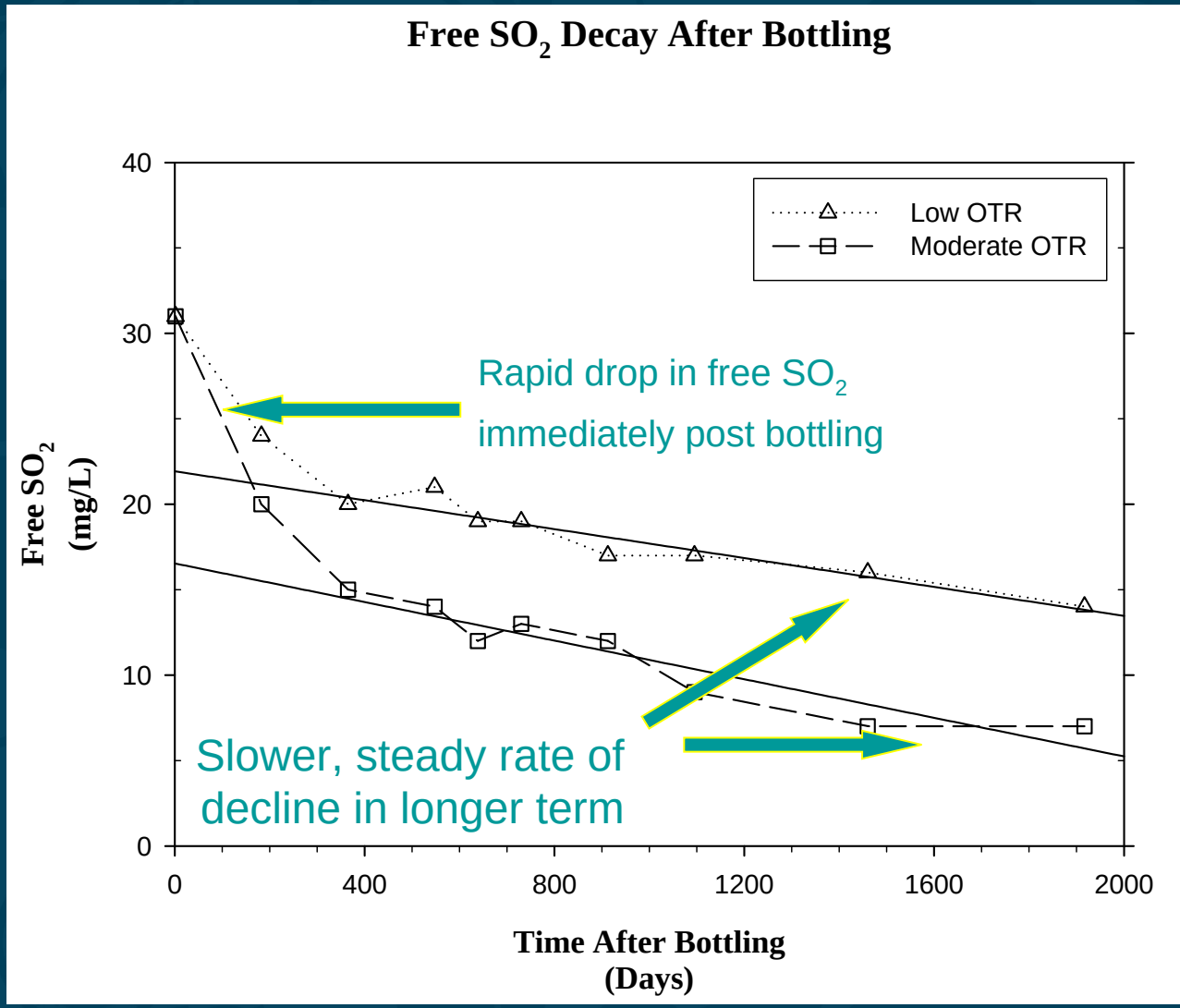
OTR Immediately post bottling



- *Wine matrix*
- *Variable OTR*
- *Head space*
- *Pressure driven flow*

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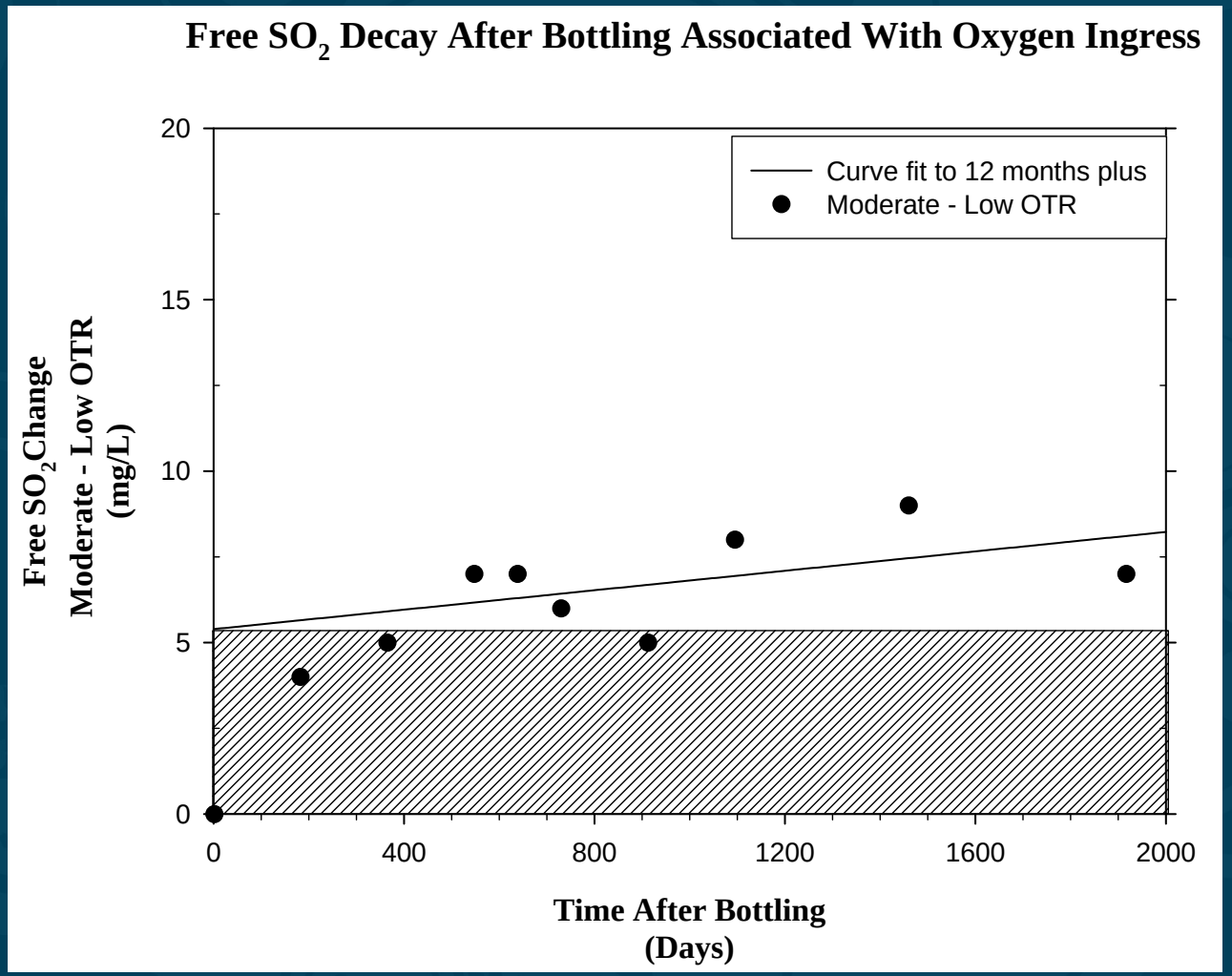
OTR Immediately Post Bottling



- *Higher OTR through closure post bottling*
- *Head space oxygen*
- *Pressure driven flow*

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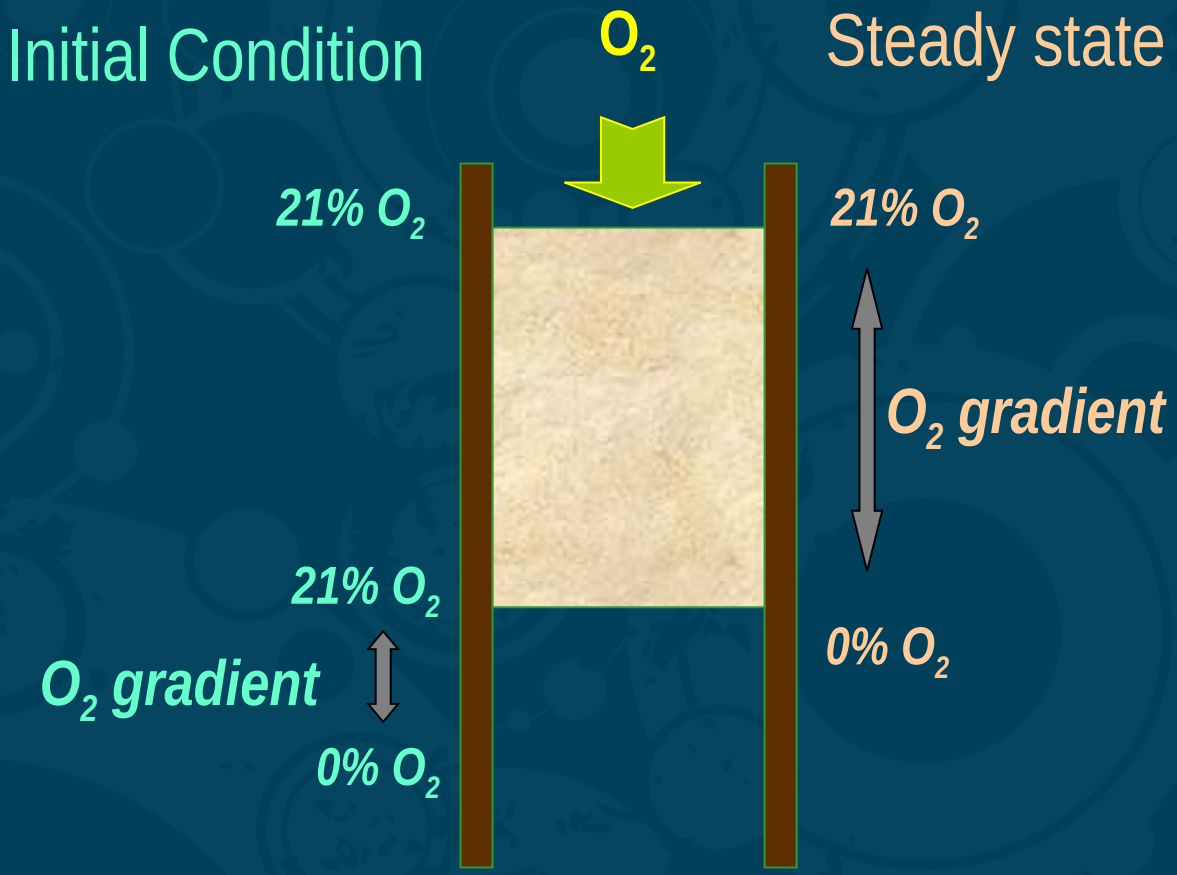
Closure O_2 Reservoir



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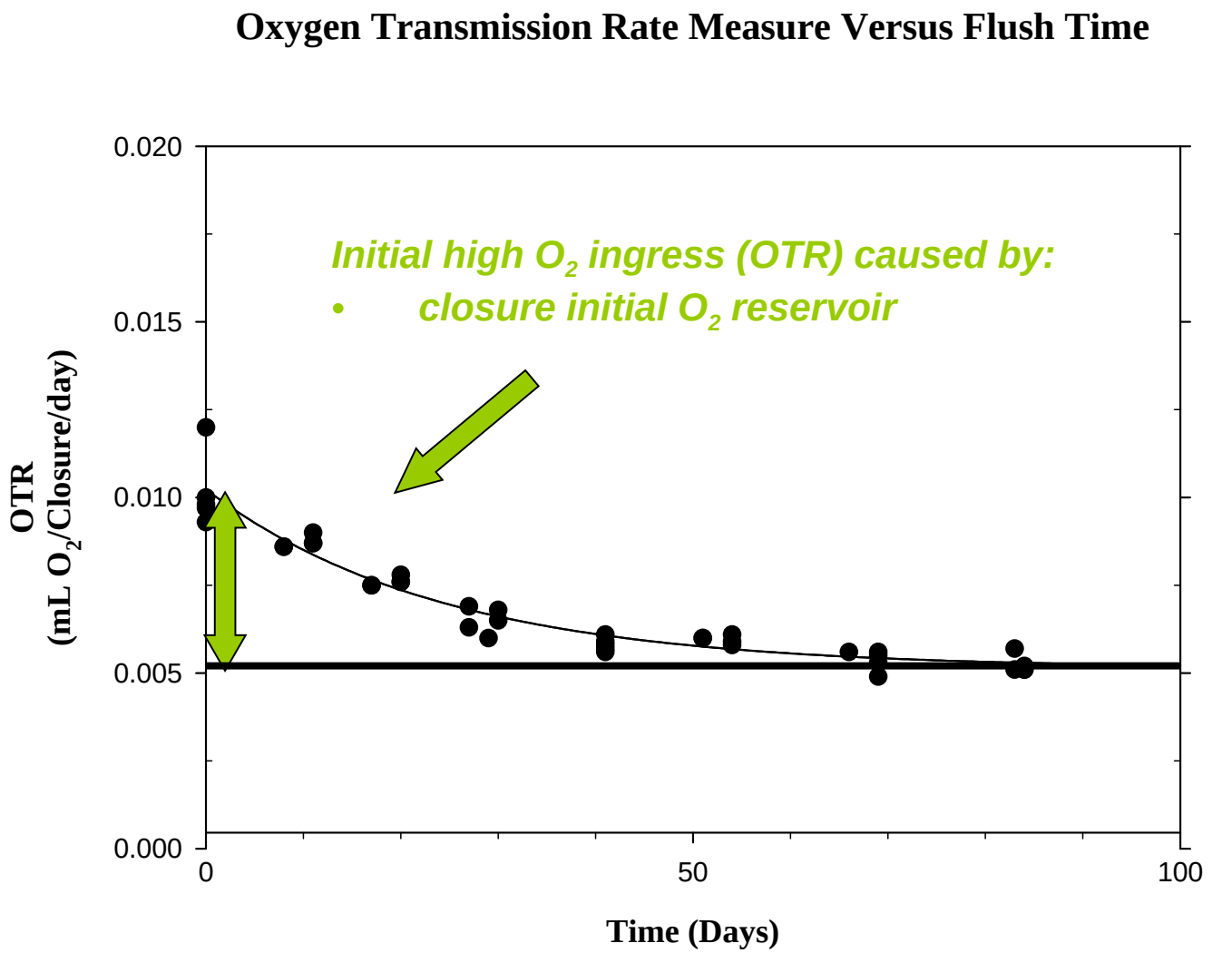
Closure OTR Transients



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Headspace O_2

- Collaboration with Richard Gibson and Pryde Measurement
- Significant shelf life implications

	Initial	No degas, No headspace flush, no screwcap flush	After degas	After filling	After headspace flush, no screwcap flush	After headspace flush with screwcap flush
Gas (mL)	750	8.5	750	8.5	8.5	8.5
O_2 % vol	20.7	20.7	0.3	13.2	12.2	1.1
O_2 (mL)	155	1.8	2.3	1.1	1.0	0.1
O_2 (mg/L)		3.4		2.1	1.9	0.2
SO_2 loss (mg/L)		***13.4***		***8.4***	***7.6***	***0.8***

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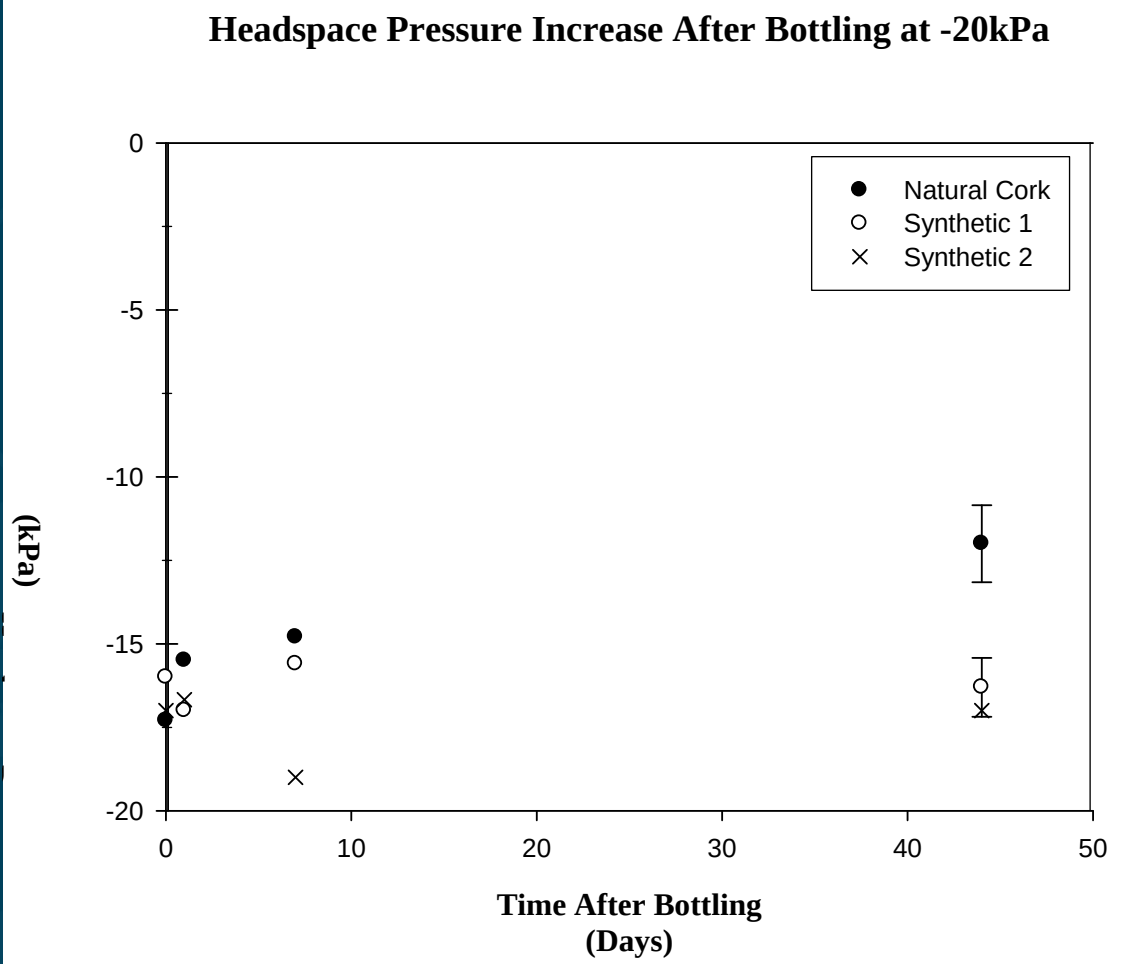
Pressure Driven Flow (Headspace Vacuity)



Ingress Rate
cc/closure/day
Pressure: 0.2
Diffusion: 0.001

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