Date : **Wednesday 29 October 2008**
Mercredi 29 octobre 2008

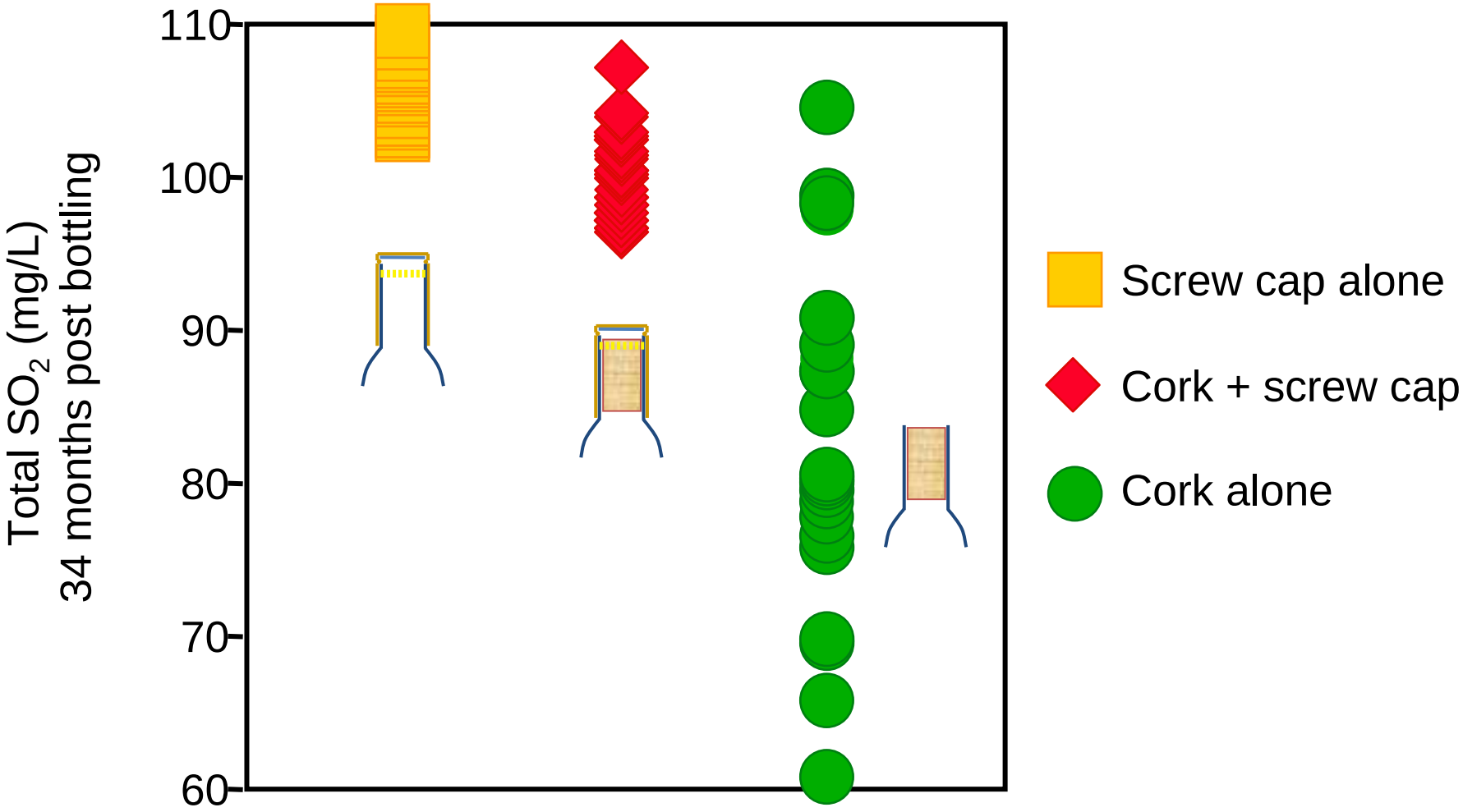
Title/Titre : **A new method to measure oxygen ingress into a wine bottle**

Speaker/ Intervenant : **Elizabeth Waters (The Australian Wine Research Institute, Australia)**

14 closures = 14 different wines

Range of colour 63 months post bottling (Godden et al 2001 Aust. J. Grape Wine Res. 7, 62-105)

Variation in OTR



(Caloghiris et al 1997 Aust. J. Grape Wine Res. 3:9-17)

How to determine OTRs ?

New method developed at AWRI

Uses two reagents in model wine

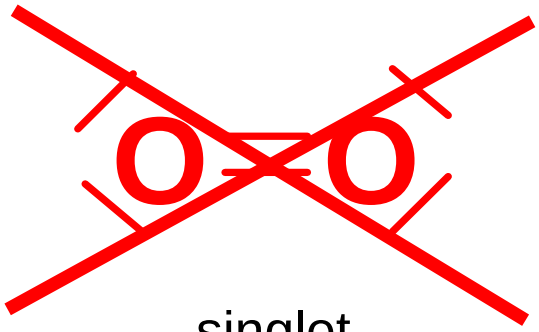
- **methylene blue** and **light** to convert oxygen from triplet to singlet state
- bis-9,10-anthracene-(4-trimethylphenylammonium) dichloride (**BPAA**) as an oxygen trap

BPAA is coloured

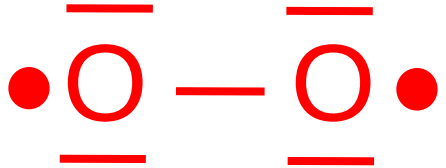
Reaction between oxygen and BPAA

- produces a colourless product
- is stoichiometric
- consumes oxygen

What does an oxygen molecule look like?



singlet



triplet

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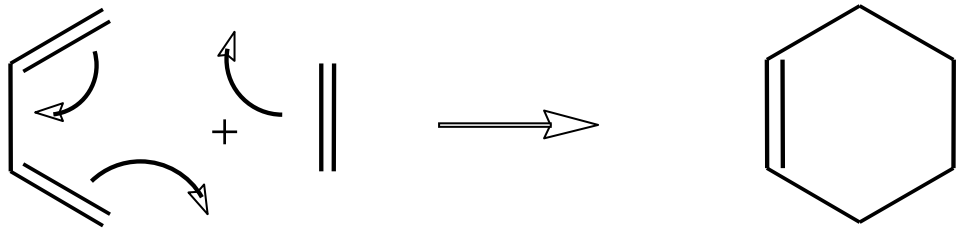
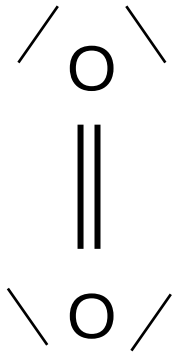
•Excited oxygen: singlet state.

Diels Alder Reaction

Diels-Alder reactions utilize a diene (4 π electrons) and a dienophile (2 π electrons)



Dienophile is singlet oxygen



Criteria for a diene singlet oxygen trap

Soluble in wine-like medium: 10 -15% (v/v) ethanol in water, pH 2.8 - 4.2

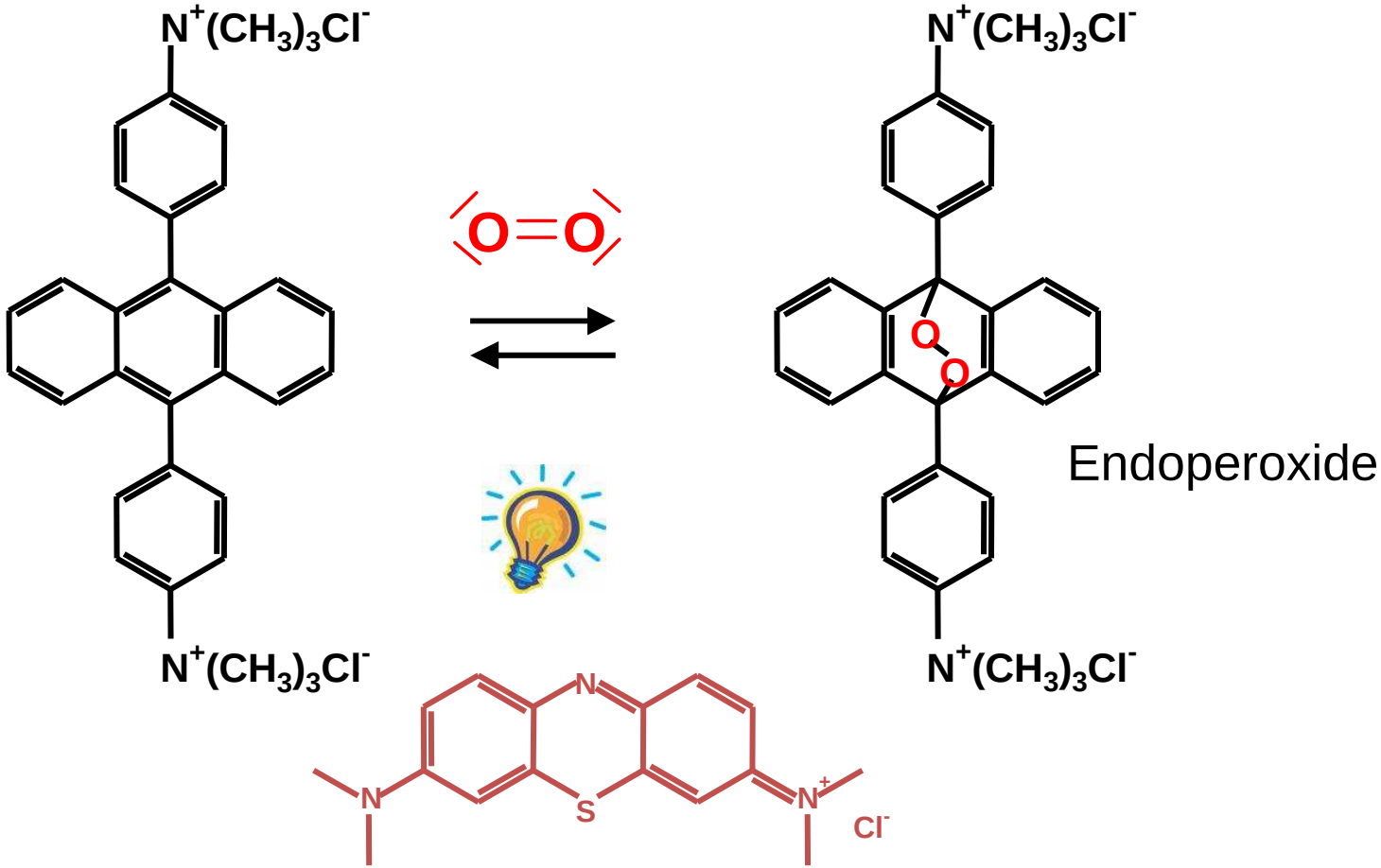
- more than 1900 compounds reported as singlet oxygen traps
- Most are organic i.e. not water soluble
- Most of the water soluble conjugated dienes are insoluble in acidic medium.

The first published water soluble cation singlet oxygen trap was described in 1997: BPAA

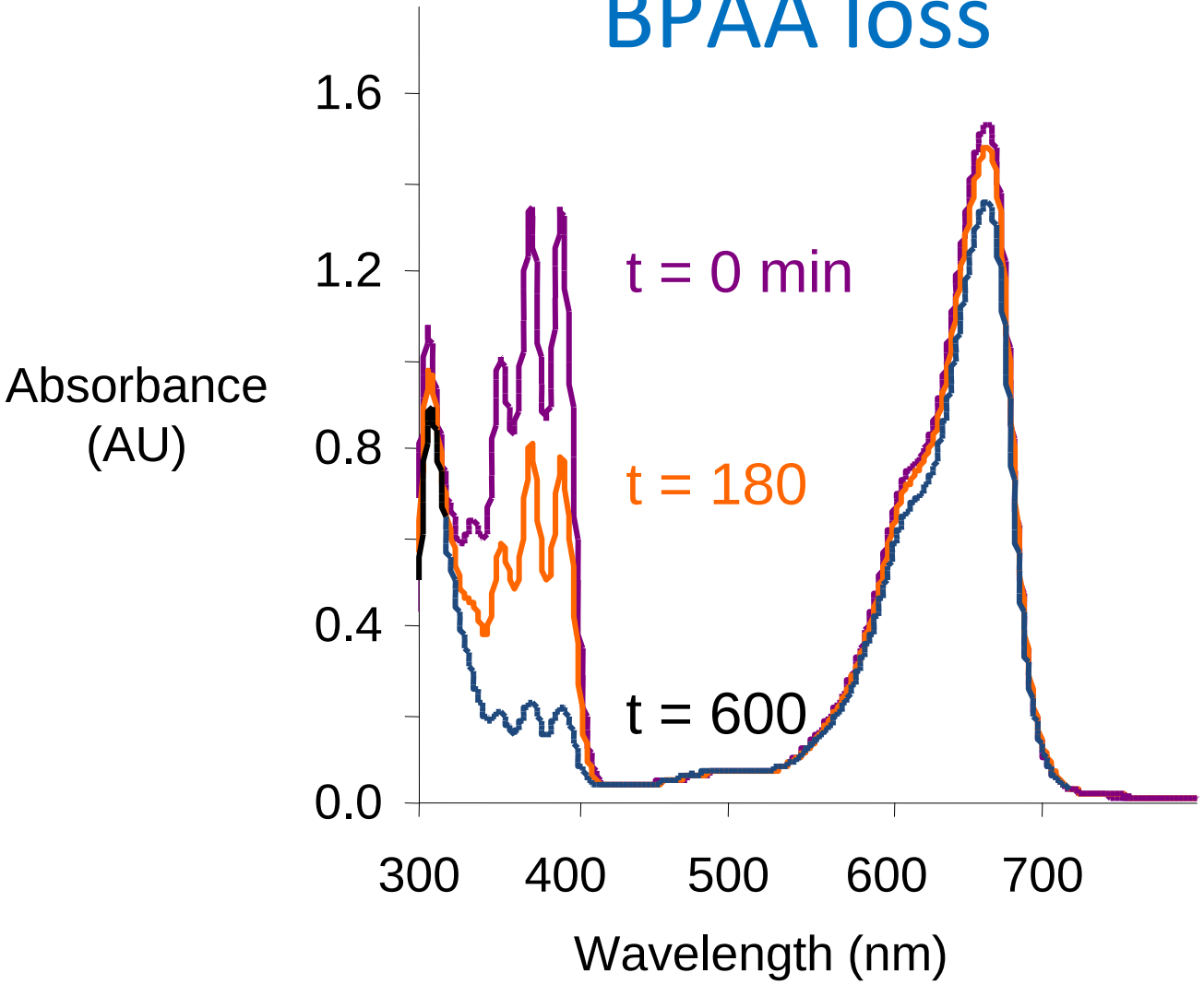
No reaction with the photosensitizer

Have visible absorption

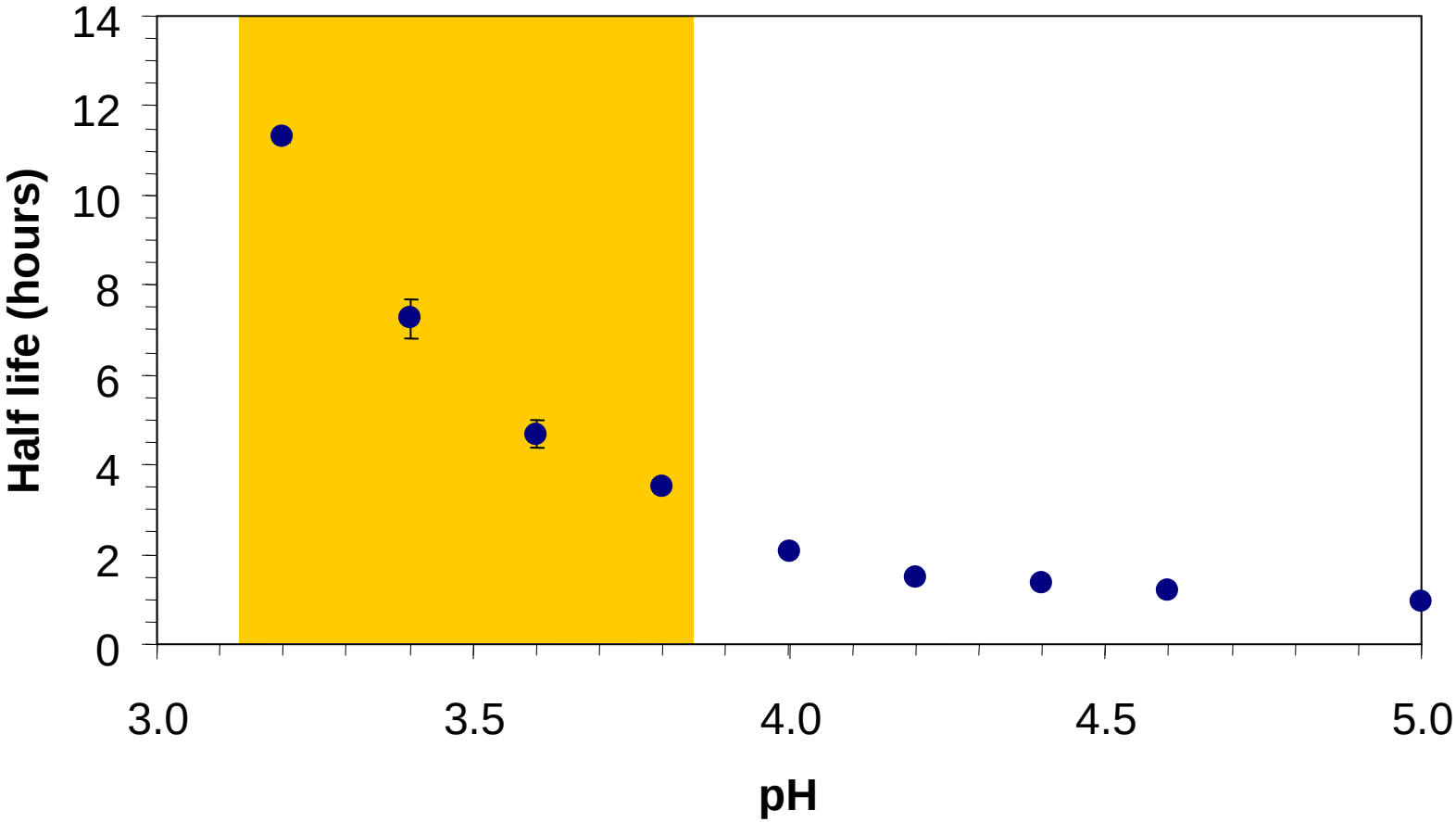
BPAA: Bis-9,10-anthracene-(4-trimethylphenylammonium) dichloride



Monitoring oxygen ingress by BPAA loss

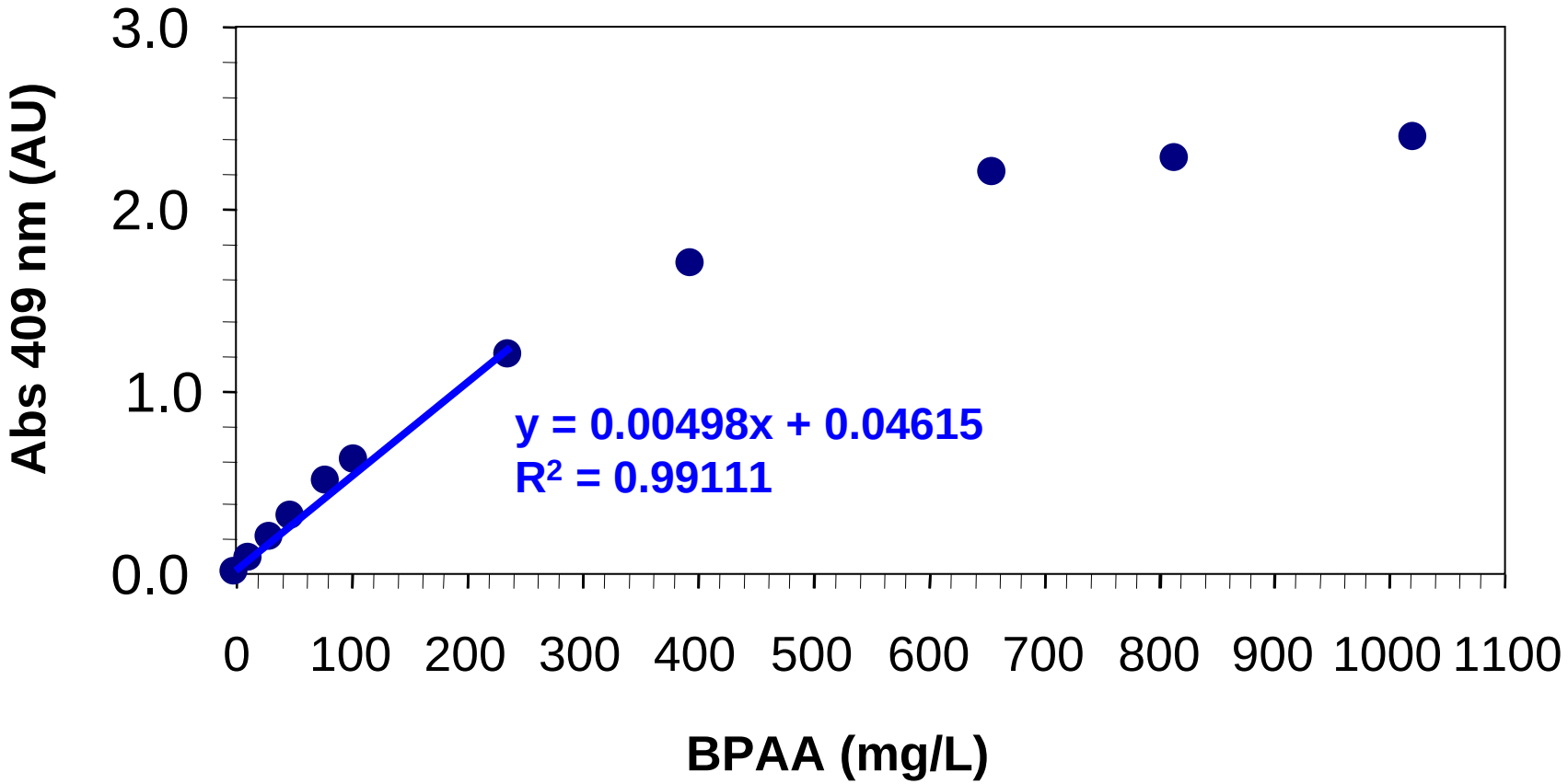


Impact of pH on BPAA half life

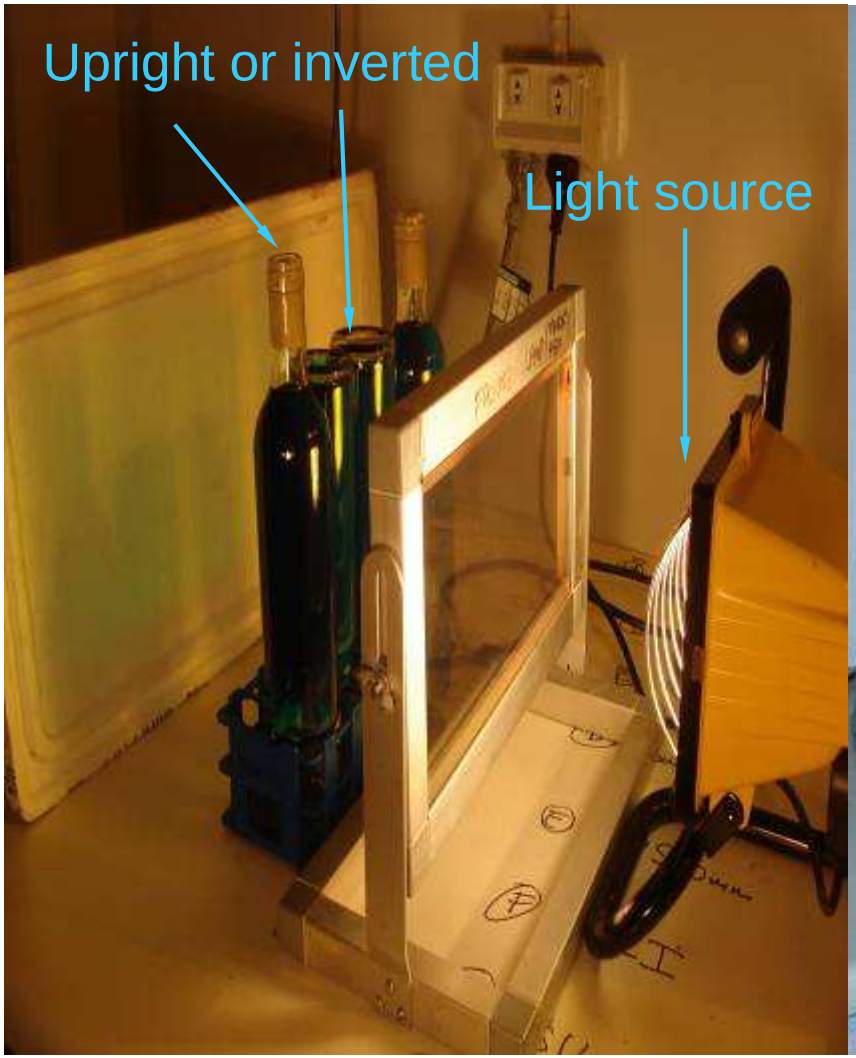


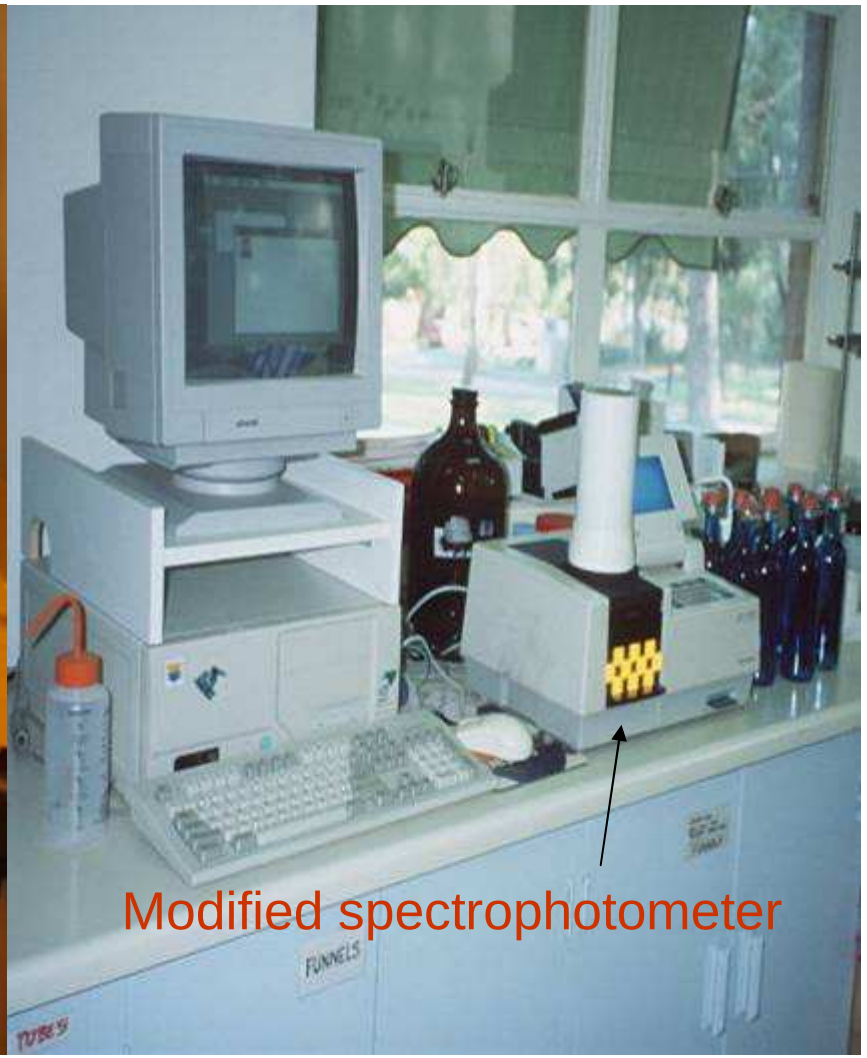
Conditions: acidified (HCl) 10% ethanolic solution open to the air

Determining BPAA concentration in bottle

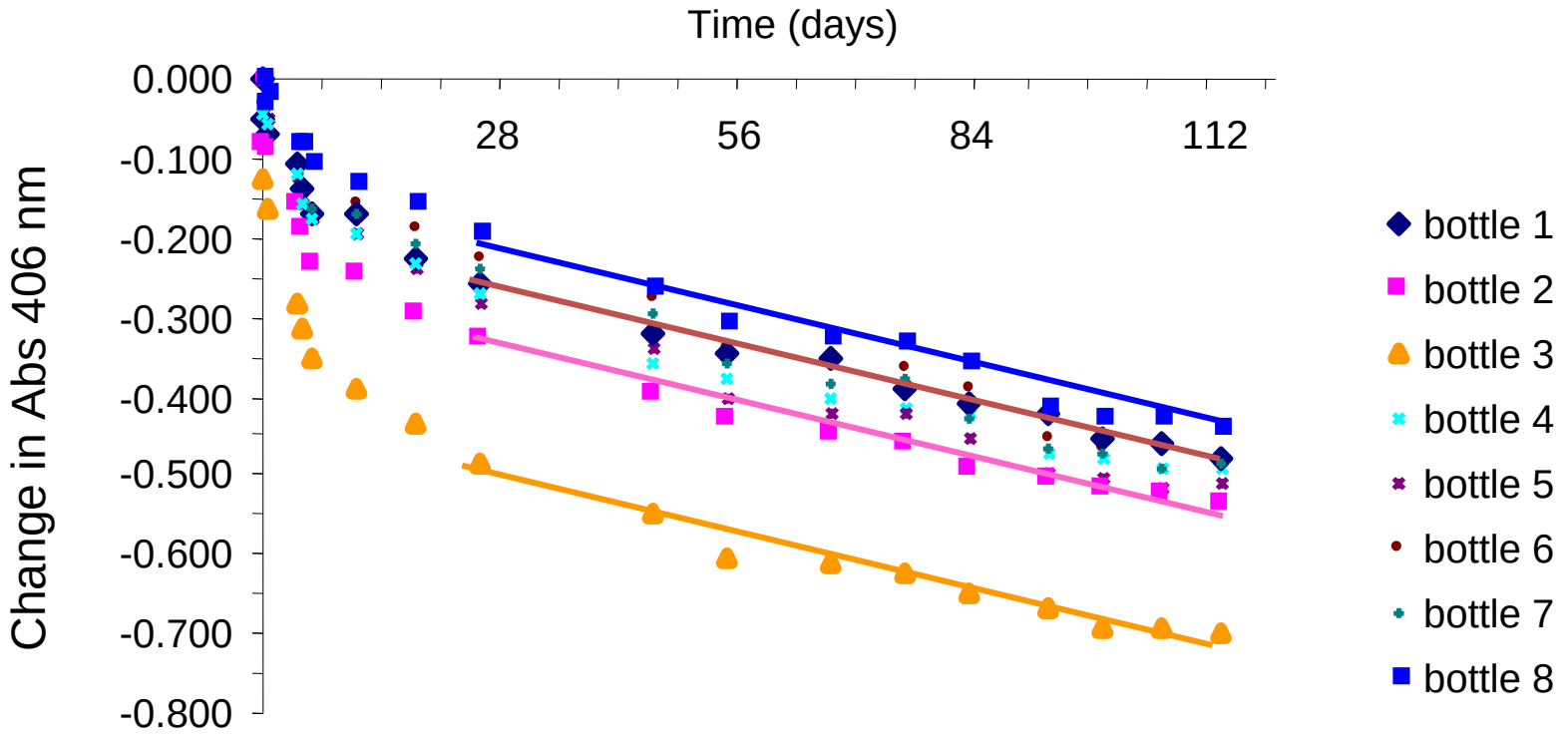


Simple set up

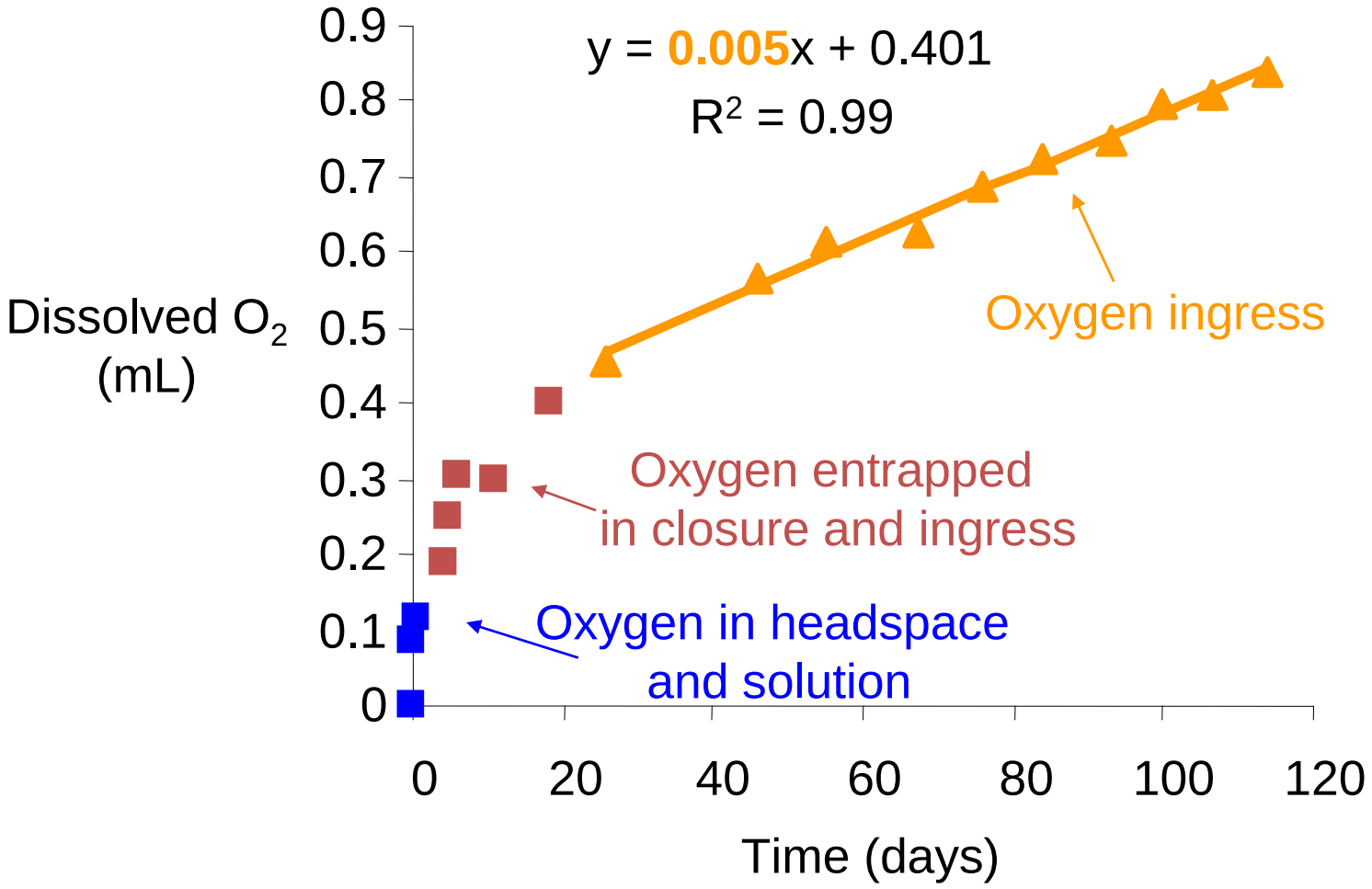




Example of raw data obtained



Interpreting the data



How does the BPAA method compare to others?

For a synthetic closure, upright storage

Mocon

- **0.0050** mL O_2 / day

Lopes et al (2005) J Agric Food Chem. 53: 6967-6973

- **0.0078 - 0.009** mL O_2 / day

BPAA

- **0.0052** mL O_2 / day.

Picture courtesy of Jim Peck, G3 Enterprises

Pros and cons

Disadvantages

- Only measuring dissolved oxygen
- Cannot be done in real wine

Advantages

- Model wine mimics real life conditions (humidity, ethanol)
- Oxygen is consumed
- Also provides data on oxygen pickup at bottling

Summary

BPAA method can estimate

- Oxygen permeation rates **PLUS**
- Oxygen entrapped in the closure
- Oxygen pickup at bottling

This tool allows wine producers to

- Select the most appropriate closure for the wine
- Audit bottling line performance

Acknowledgements

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