

Oxidized and Reductive Characters – from sherry to stinky



Christine Mayr
Research Scientist
Flavour Group

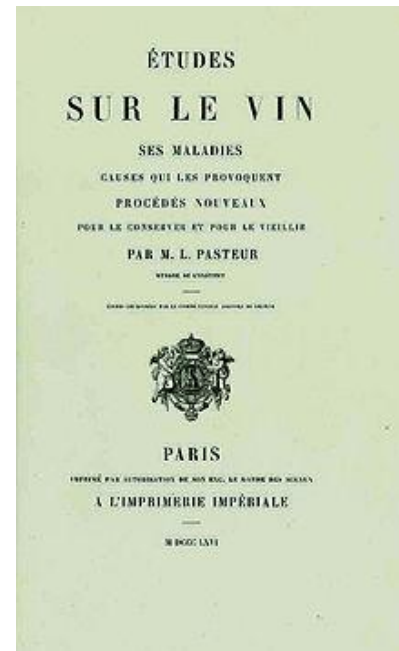
Oxygen in wine



The Australian Wine
Research Institute

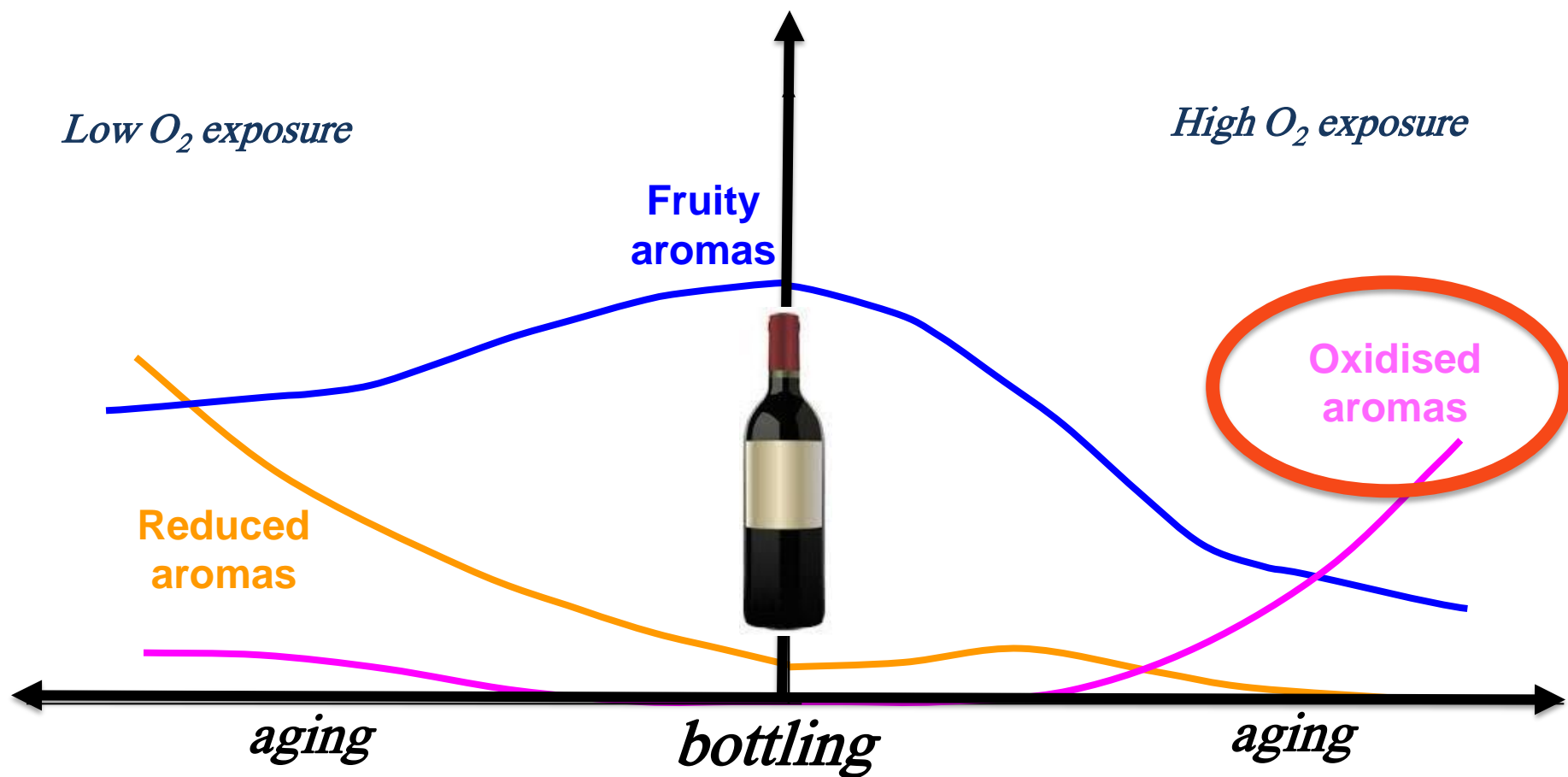


*Louis Pasteur,
1875*





Impact of oxygen during bottle aging



Oxidation – more practical



The Australian Wine
Research Institute

Oxidation is the *loss* of **electrons**



Fe



$\text{Fe}^{2+} + 2\text{e}^{-}$



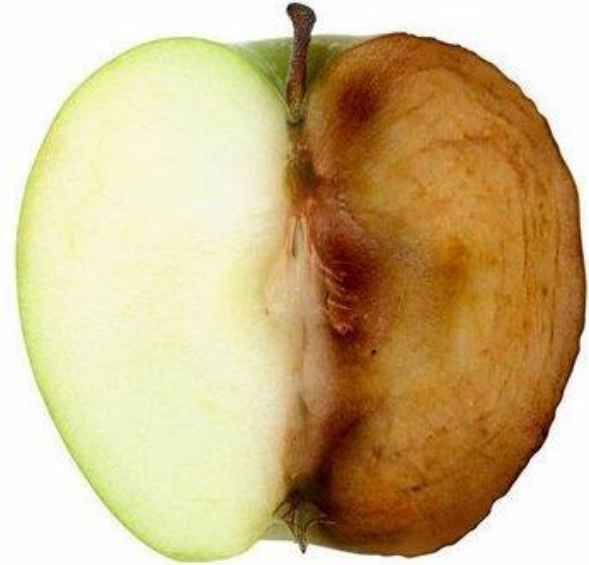
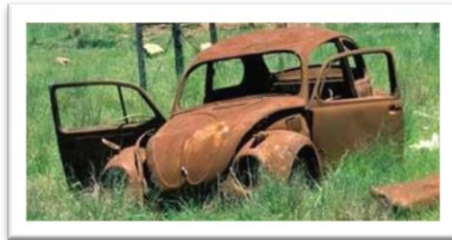
Oxidation is the *gain* of **oxygen**

Fe O

Oxidative browning



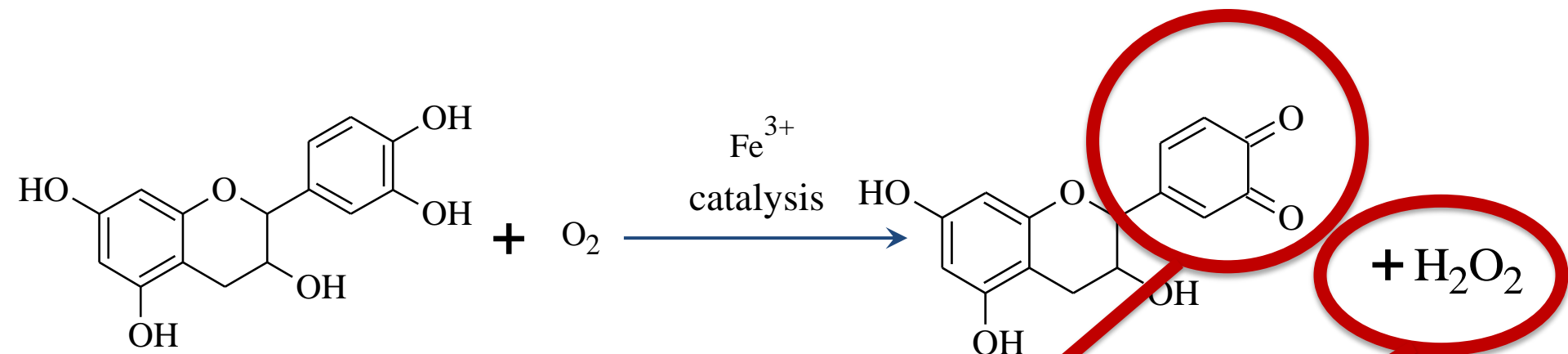
The Australian Wine
Research Institute



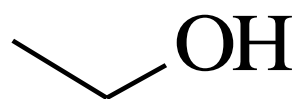
Wine Oxidation - chemistry



The Australian Wine
Research Institute



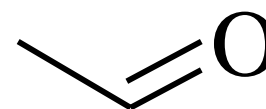
- Phenolic polymerization
- Strecker reaction with amino acids
- Trapping of SH-compounds



Ethanol



Fe^{2+}



Acetaldehyde

Aroma descriptors of oxidized wines



The Australian Wine
Research Institute

'sherry'



'honey'



'cider'



'bruised apple'



'hay'



'cardboard'



'woody'

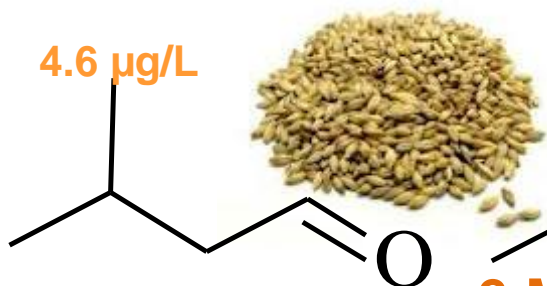


Aroma compounds of oxidized wines



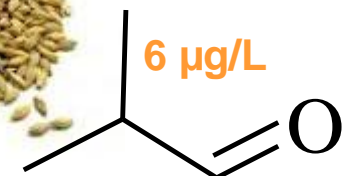
The Australian Wine
Research Institute

4.6 µg/L



3-Methylbutanal

6 µg/L



2-Methylpropanal

0.5 µg/L



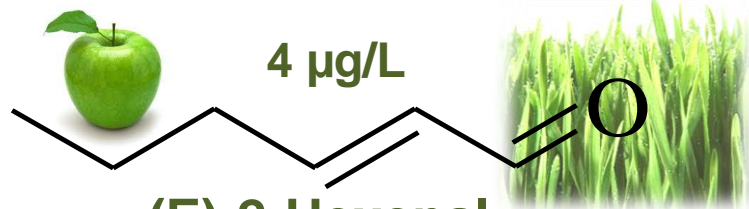
Methional

1 µg/L



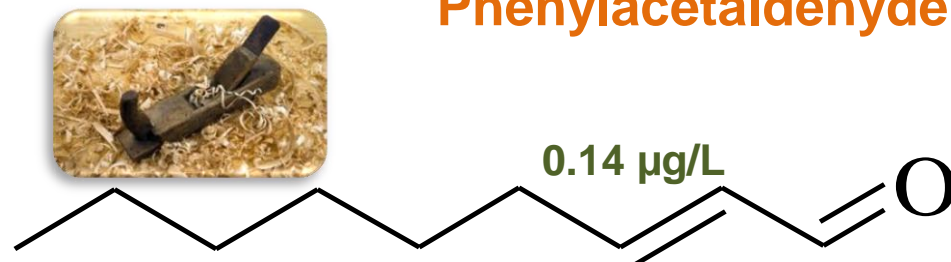
Phenylacetaldehyde

4 µg/L



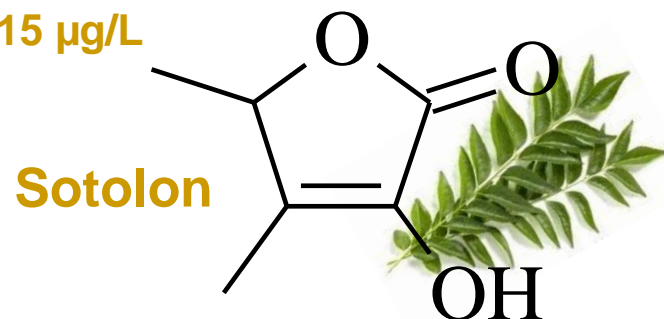
(E)-2-Hexenal

0.14 µg/L

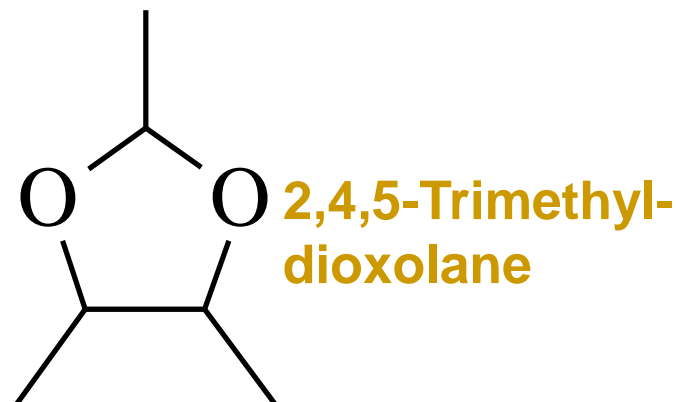


(E)-2-Nonenal

15 µg/L



Sotolon



2,4,5-Trimethyl-
dioxolane

Closure study – oxidized compounds



The Australian Wine
Research Institute



Closure study – oxidized compounds



The Australian Wine
Research Institute



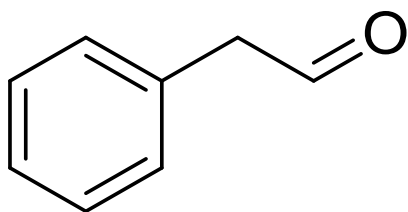
Compound (µg/L)	Control N ₂	Control Air	Screw cap	Natural Cork 1	Natural Cork 2	Synthetic Cork 1	Synthetic Cork 2
benzaldehyde	25	7	19	26	25	8	23
methional	0.7	4	1	4	5	18	23
2-methylpropanal	63	88	56	73	91	101	114
3-methylbutanal	4	12	4	13	28	64	99
phenylacetaldehyde	3	5	3	9	12	27	19
sotolon	< 2	< 2	< 2	< 5	< 5	7	17

So – Let's smell something!

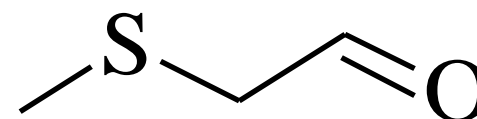


The Australian Wine
Research Institute

Phenylacetaldehyde



Methional

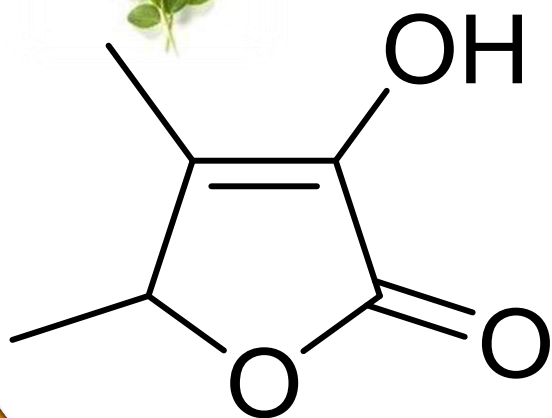


Does this remind you of tawny port ????



The Australian Wine
Research Institute

Sotolon



?

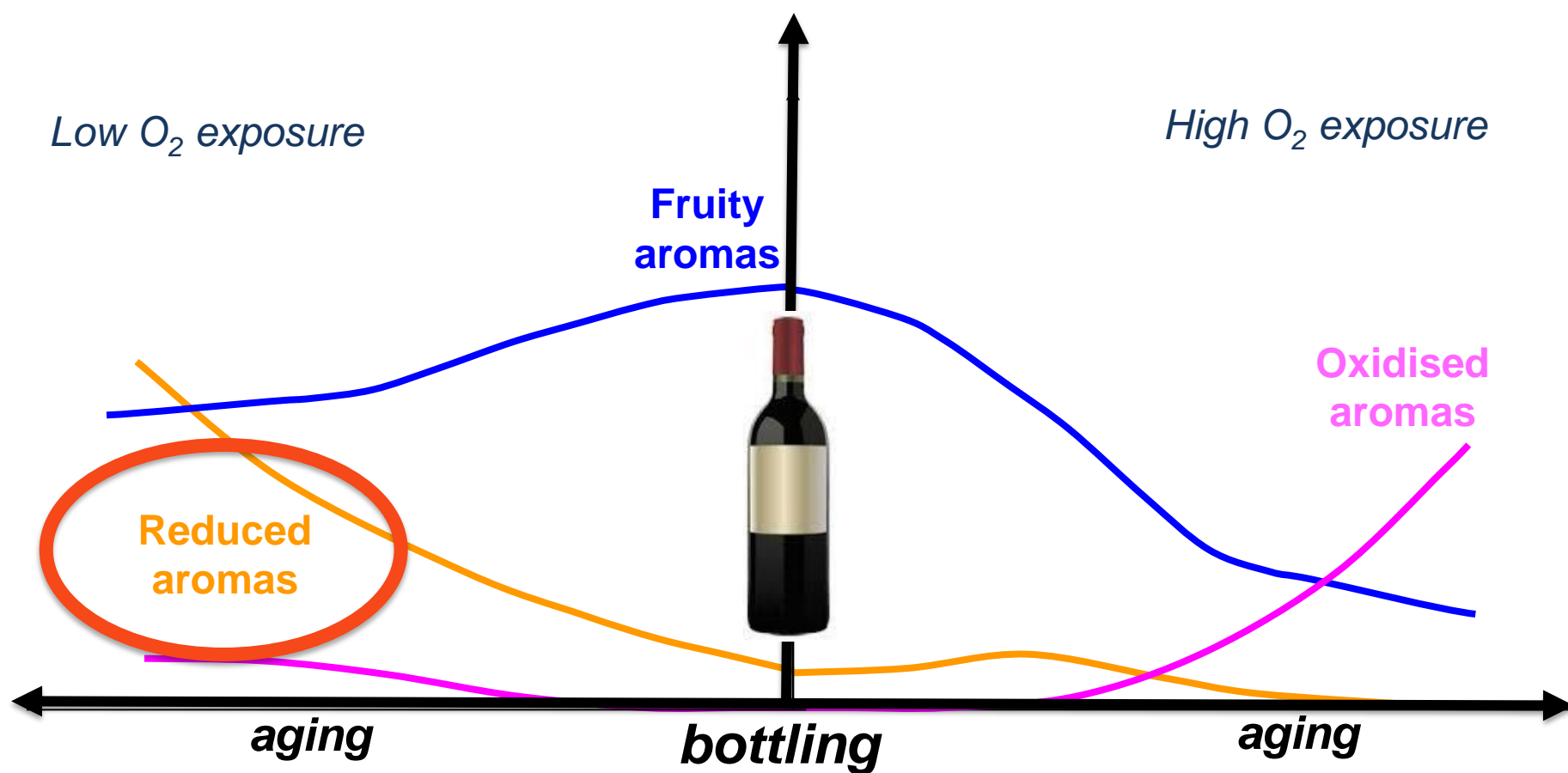
=



Impact of oxygen during bottle aging



The Australian Wine
Research Institute



Oxidation - Reduction



The Australian Wine
Research Institute

Reduction *gain*
Oxidation is the **loss** of **electrons**



Fe



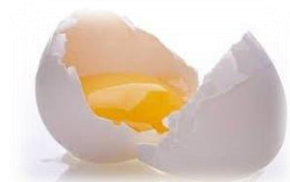
$\text{Fe}^{2+} + 2\text{e}^{-}$

Aroma descriptors of 'reduced' wines



The Australian Wine
Research Institute

'rotten egg'



'cabbage'



'garlic'



'burnt rubber'



'sewage'



'sulfurous'



What does smell so bad??

Stinky sulfur compounds



Hydrogensulfide



1.1 µg/L



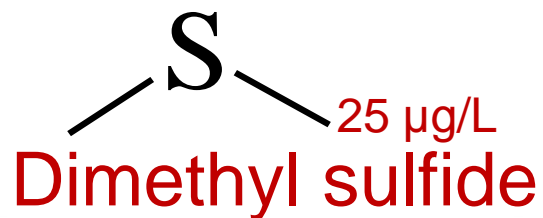
Methane thiol

1.8 µg/L



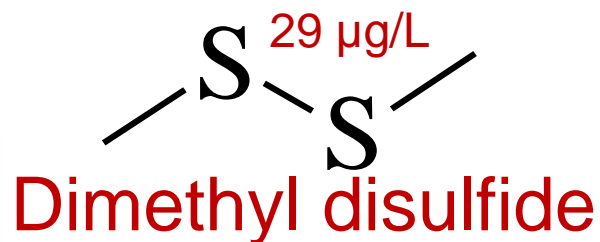
1.1 µg/L

Ethane thiol



25 µg/L

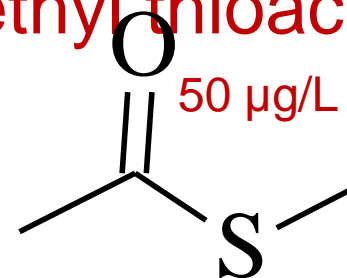
Dimethyl sulfide



29 µg/L

Dimethyl disulfide

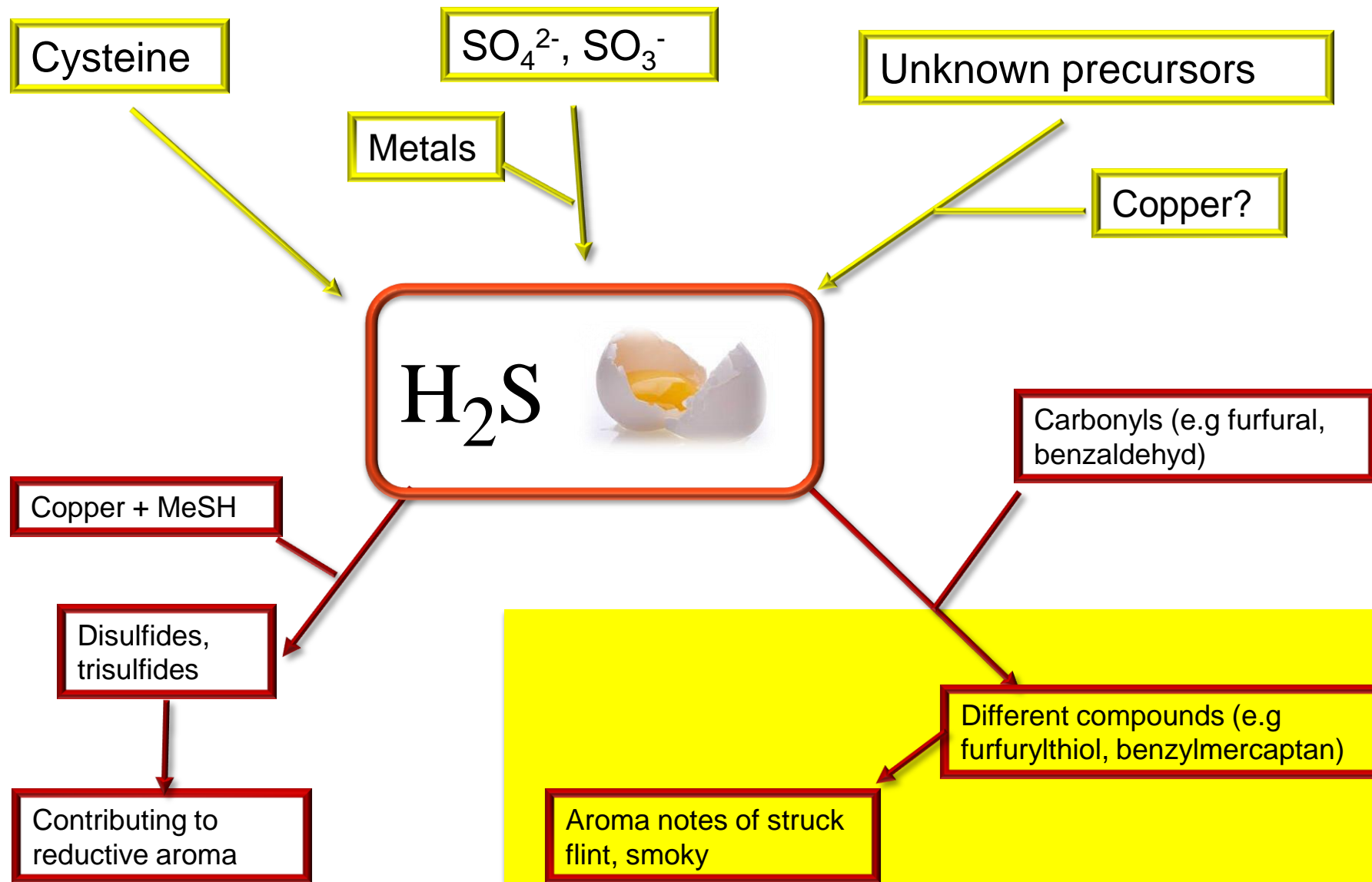
Methyl thioacetate



50 µg/L



Formation and degradation of H₂S

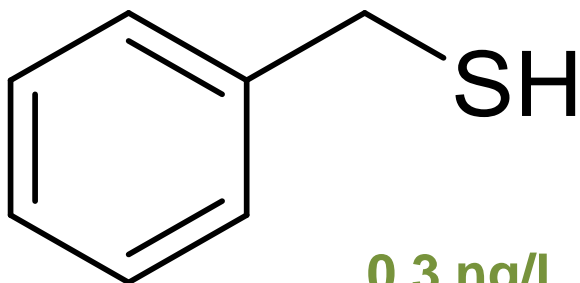


Is this aged or reduced?



The Australian Wine
Research Institute

Benzylmercaptan



0.3 ng/L



What does smell so bad??

Stinky sulfur compounds

H_2S
Hydrogensulfide



1.1 $\mu\text{g/L}$



Methane thiol
1.8 $\mu\text{g/L}$



Ethane thiol

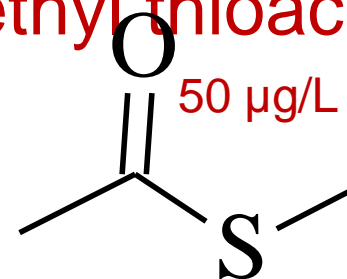
1.1 $\mu\text{g/L}$

S
Dimethyl sulfide
25 $\mu\text{g/L}$



$\text{S}-\text{S}$
Dimethyl disulfide
29 $\mu\text{g/L}$

Methyl thioacetate

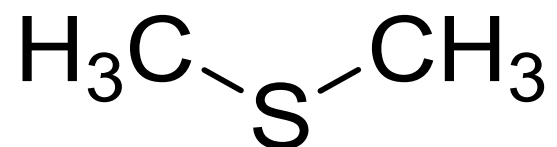


Blackcurrant or canned corn??



The Australian Wine
Research Institute

Dimethylsulfide (DMS)



Acknowledgements



The Australian Wine
Research Institute

The Australian Wine Research Institute, a member of the Wine Innovation Cluster in Adelaide, is supported by Australia's grapegrowers and winemakers through their investment body, the Grape and Wine Research Development Corporation, with matching funds from the Australian government.

