



Università di Firenze
Dipartimento
Biotechnologie Agrarie



CONTROL OF WINE REDOX POTENTIAL BY ELECTROCHEMICAL APPLICATIONS

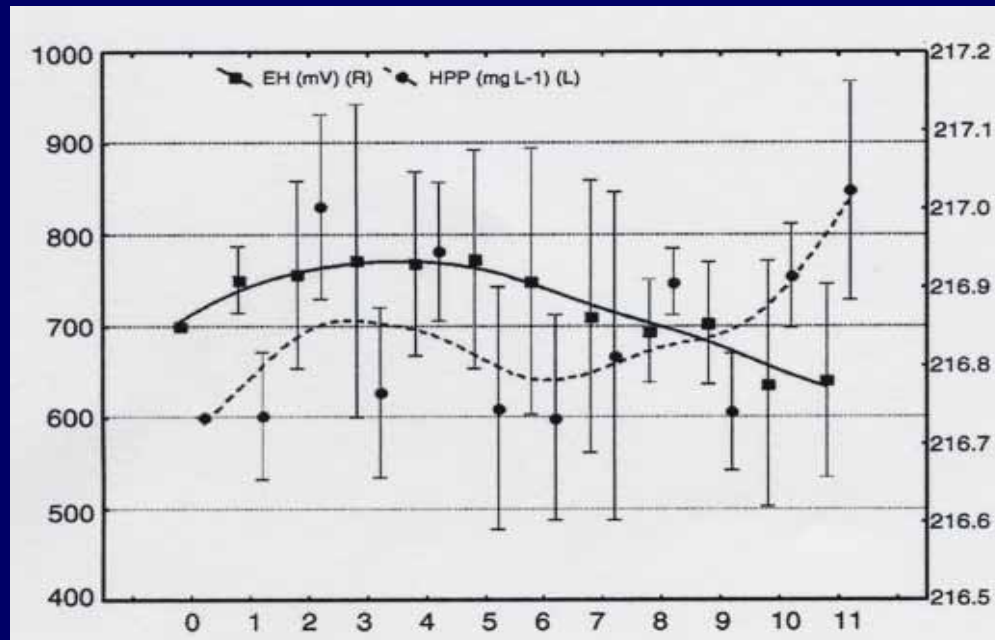
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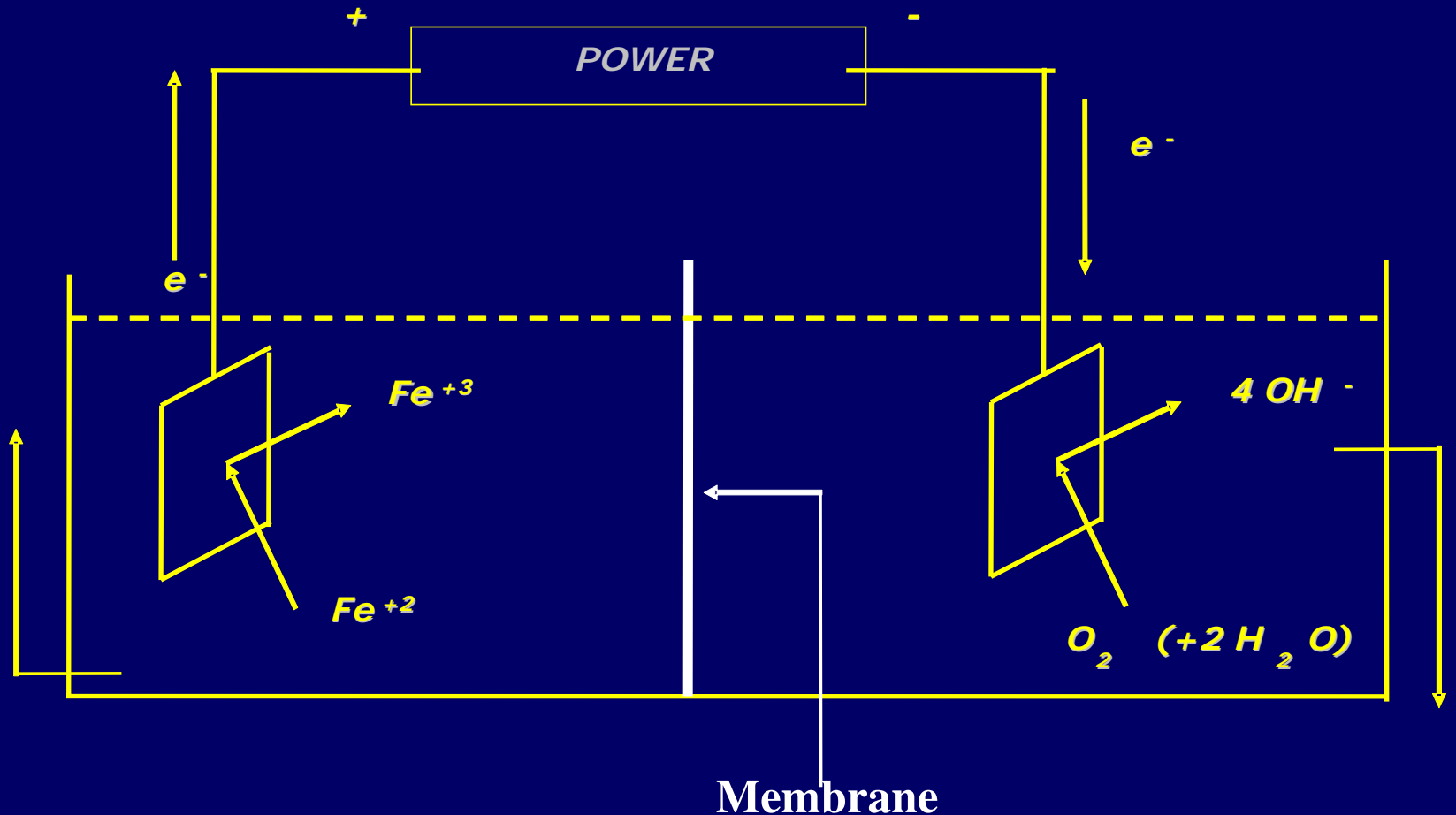
Influence of oxygen content on redox potential of red wine (Vivas et al. 1992).

O ₂ (mg/L)	E _H (mV)	Δ E _H
0.1	263	
0.8	280	17
2.5	340	77
4.8	424	161
5	434	171

Changes of redox potential (E_H) and high polymeric polyphenols (HPP) in the wine aged in stainless-steel tanks with oak chips for 11 months (del Alamo et al. 2006)



If the reagents which participate in RedOx reactions are electrons and positive charges, we can assume it is possible to guide, regulate and control them by electrochemical means

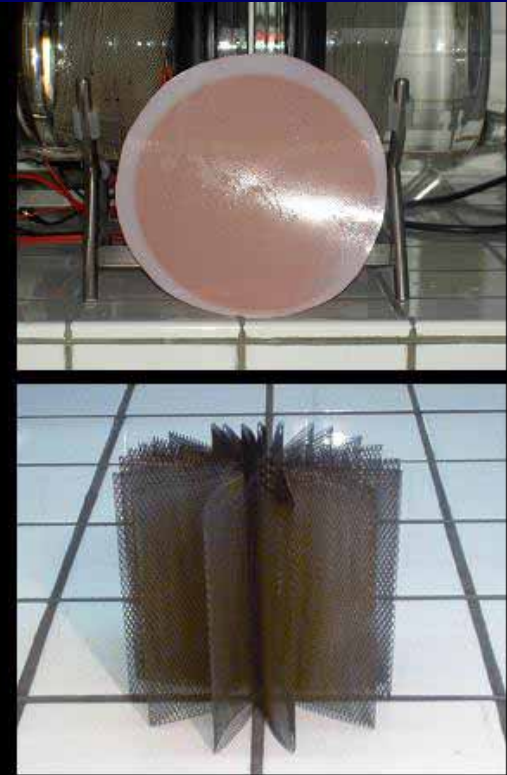


The effect of electricity in white wine fermentation

Membrane



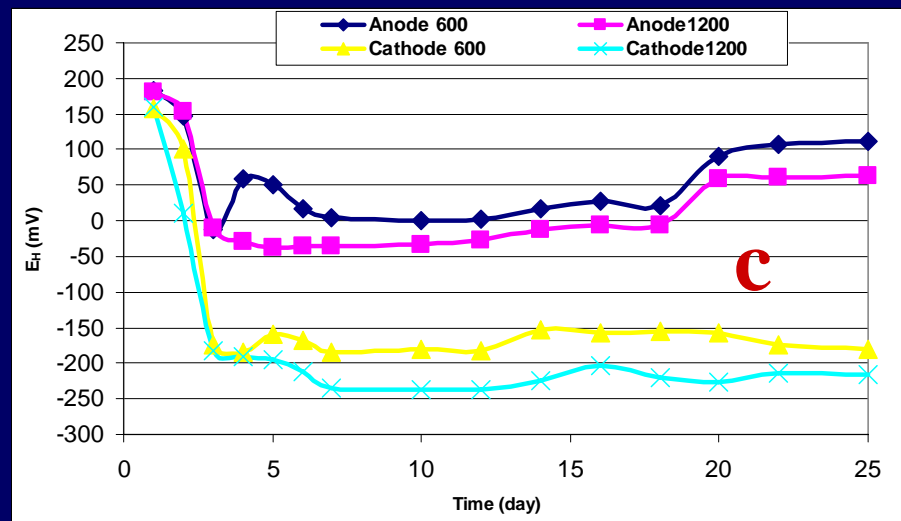
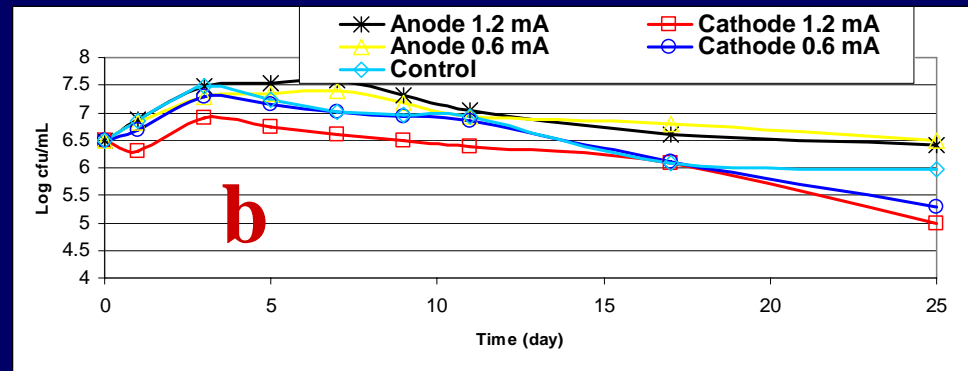
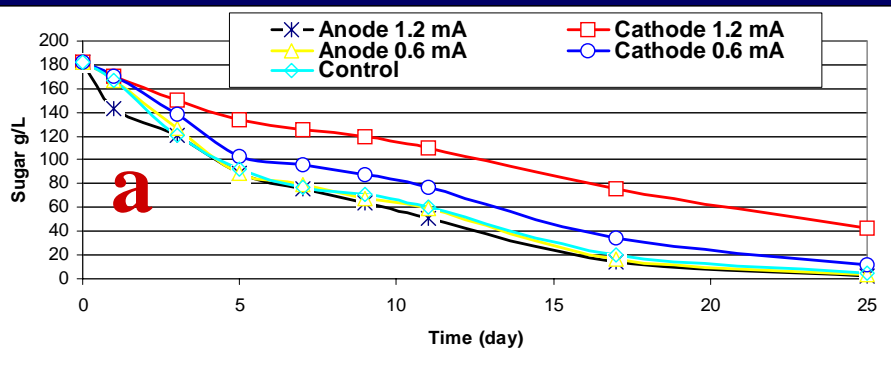
Electrochemical cell



Anode/cathode

Results

Time-course of sugar degradation (a), viable yeast population (b), and redox potential (E_H) (c) under different current intensities



The application of microcurrents influence

- total sugar consumption
- yeast cell viability
- characteristics of freshness in wine

Electrochemical micro-oxygenation of red wine



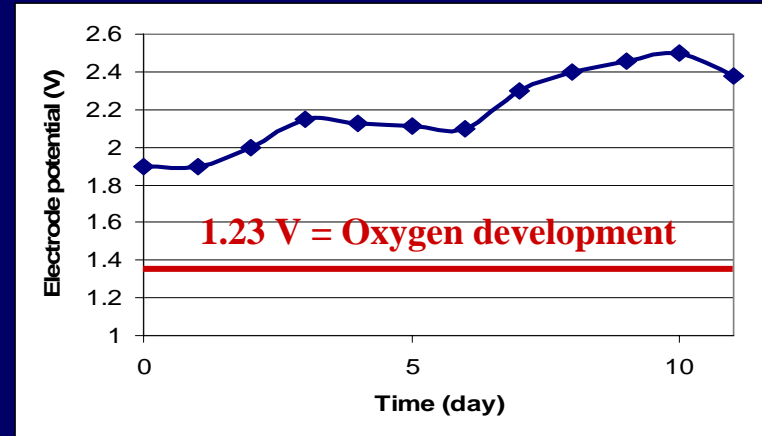
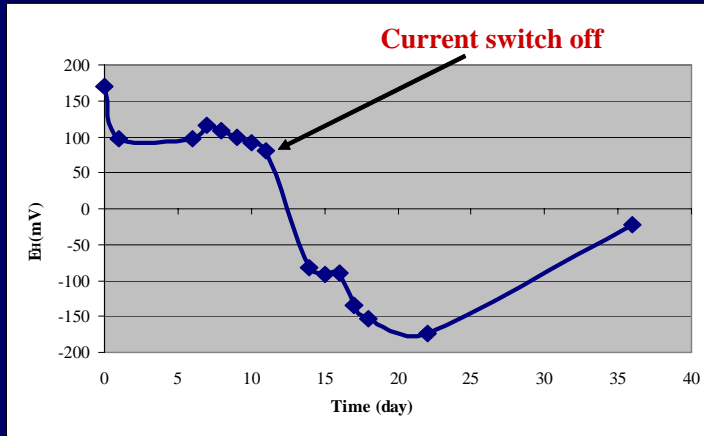
Sangiovese wine treatments

Two months after the end of fermentation, the wine was distributed to:

- **a stainless-steel tank 25 Hl: control**
- **a stainless-steel tank 25 Hl equipped with micro-oxygenation device (5ppm_{O2}/L/month)**
- **a barrique**
- **a elettrochemical cell (25 Hl) applying for 10 days a current of 0.75 A (300 mA/l, equal to 60 ppm_{O2}/L/month).**

Results

Evolution of Redox (E_H) and electrode potentials during treatment

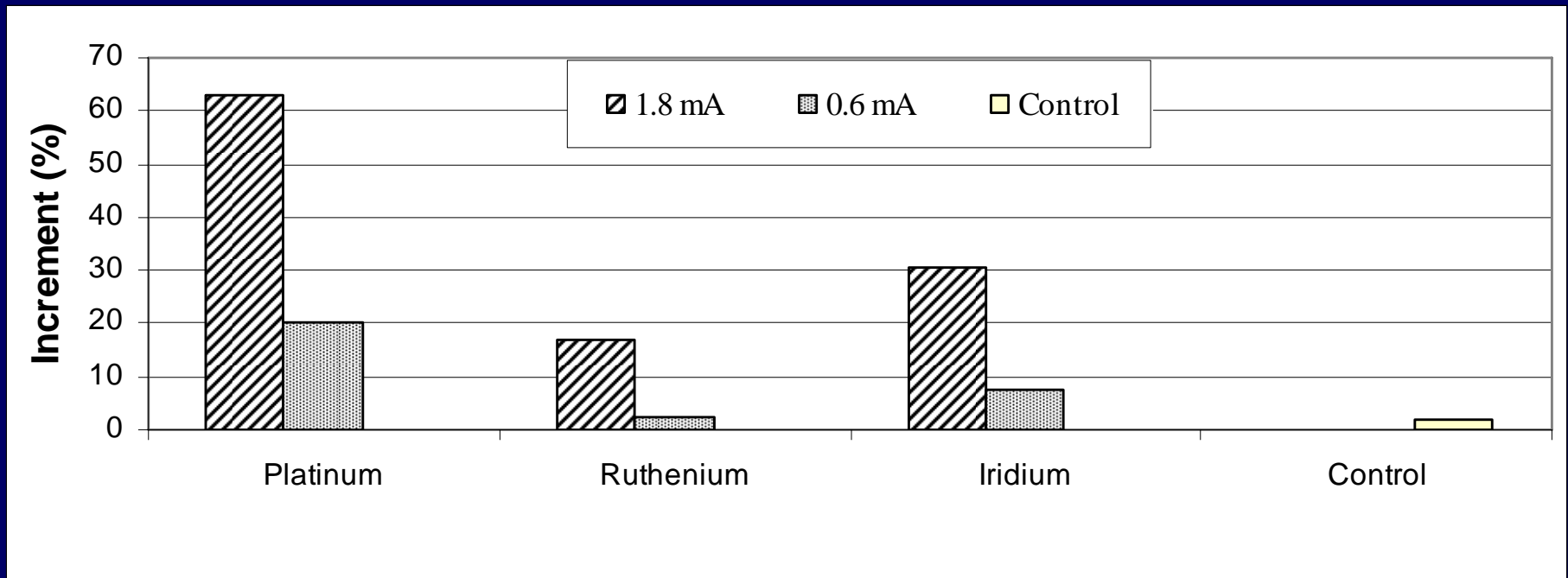


Effect of the different maturation conditions on anthocyanin fractions, color intensity and hue

Parameter	Maturation conditions			
	Control in stainless steel tank	Micro-oxygenation in stainless steel tank	Barrique	Electrical current by Titanium electrodes
Free anthocyanins (mg/L)	49	50	46	32
Polymeric anthocyanins(mg/l)	190	199	207	247
Color intensity	8.84	9.13	8.85	10.03
Hue	0.78	0.79	0.81	0.71

Wine maturation without oxygen production

Effect of coating of titanium electrodes



Increment (%) of polymeric anthocyanins during electrochemical treatments

Conclusion


The results of this study confirm the influence of application of microcurrents on:

- the fermentation of white wine,
- the processes of polymerization and stabilization of colour compounds of red wines, also in the absence of oxygen,
- the preservation of varietal fruity character

If platinum is used as coating on the electrodes, it is possible to supply greater currents with significantly lower potentials and avoid the development of oxygen.

THE LANCET

Volume 131, Issue 3383, 30 June 1888, Page 1310

doi:10.1016/S0140-6736(02)16702-X  Cite or Link Using DOI
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Annotations.

ARTIFICIAL MATURATION OF WINE BY ELECTRICITY.

SIGNOR P. MENGARINI has published some results obtained by passing a powerful current of electricity, equal to nearly four amperes, through various samples of Italian wine. Some acetic acid was found, and a perfume was imparted to the wine similar to that acquired by maturing. It is suggested that, if electricity could be made to destroy the *mycoderma aceti* so as to prevent the formation of acetic acid, it might prove a valuable method of treating wine. It is well known that it was at one time proposed to add salicylic acid to wines with this object. These are not the first experiments of the kind that have been made, as a short time ago Blaserno and Carpeno examined the effect of the galvanic current on wine, and found that artificial maturation was thus induced, or at all events simulated, various oxidation products being formed.