

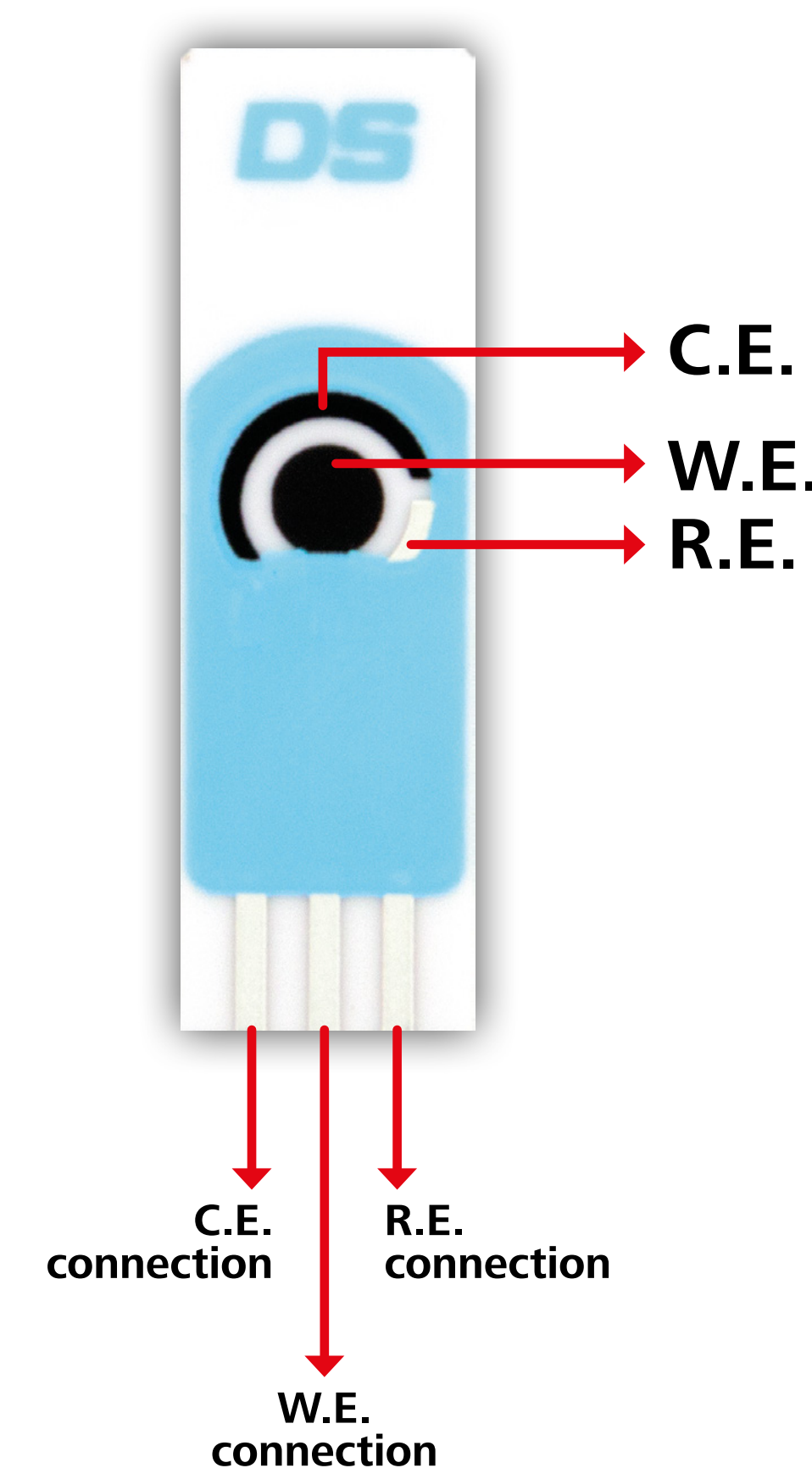
## Introduction

In the wine industry, malolactic fermentation is employed to lower the overall tartness of wine, and is usually monitored by following diminishing levels of L-malic acid along with increasing levels of L-lactic acid. Thus, the monitoring of L-lactic acid levels during fermentation plays an important role in wine quality testing [1-2]. L-lactic acid is typically determined using chromatography based techniques. Although these methods are precise, they require bulky instrumentation, trained personnel, and are expensive. Therefore, electrochemical biosensors are as promising alternatives for the development of simple, fast, low-cost and portable platforms for *in situ* L-lactic acid analysis. In this work, an enzymatic electrochemical sensor for the determination of L-lactic acid in wine samples was developed. These single-use, small sized, sensors allowed the specific determination of L-lactic acid between 0.02 mM and 0.3 mM. Different wine samples were assayed with the proposed sensors and the obtained results indicate that the developed methodology has an accurate performance.

In summary, these enzymatic electrochemical sensors revealed to be robust, highly stable, user-friendly and time-saving, demonstrating the possibility of being used for the decentralized monitoring of L-Lactic acid in wine samples as an analytical trustful tool.

## Experimental

### Screen-printed electrode configuration



Electrochemical Cell	
Working Electrode (WE) (4 mm diameter)	Carbon ferrocyanide enzymes
Counter Electrode (CE)	Carbon
Reference Electrode (RE)	Silver

Strip dimensions: 3.4 x 1.0 x 0.05 cm  
(Length x Width x Height)

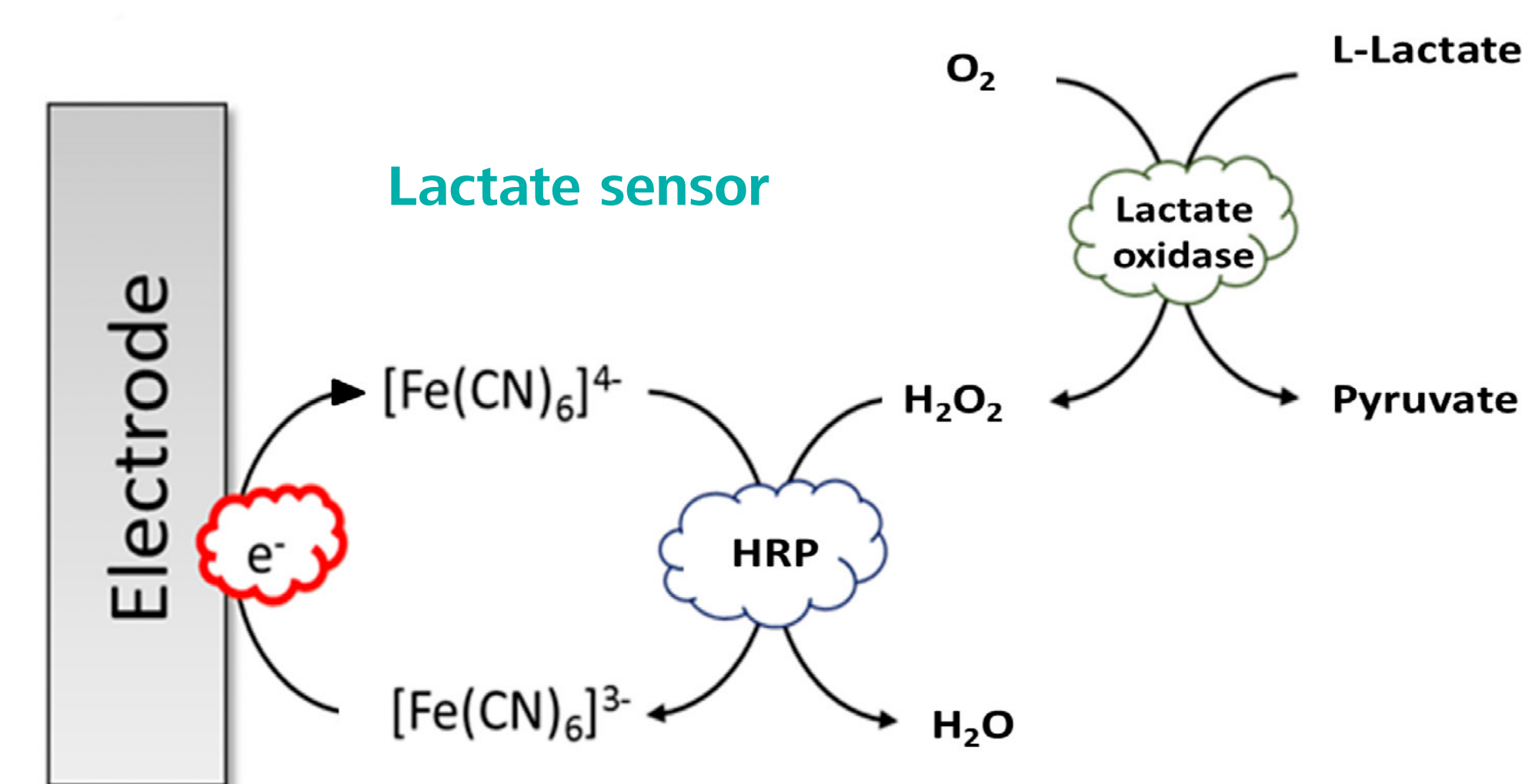
### Electrochemical Assay Parameters

Amperometric detection  
Potential: -0.1 V  
Time: 75 s  
Buffer: 0.1 M Tris-HNO<sub>3</sub>, pH 7.2  
Sample drop: 50 µL

### Optical Method

L-Lactate Assay Kit (Colorimetric),  
λ<sub>max</sub>=450 nm

## Instruments



## Results

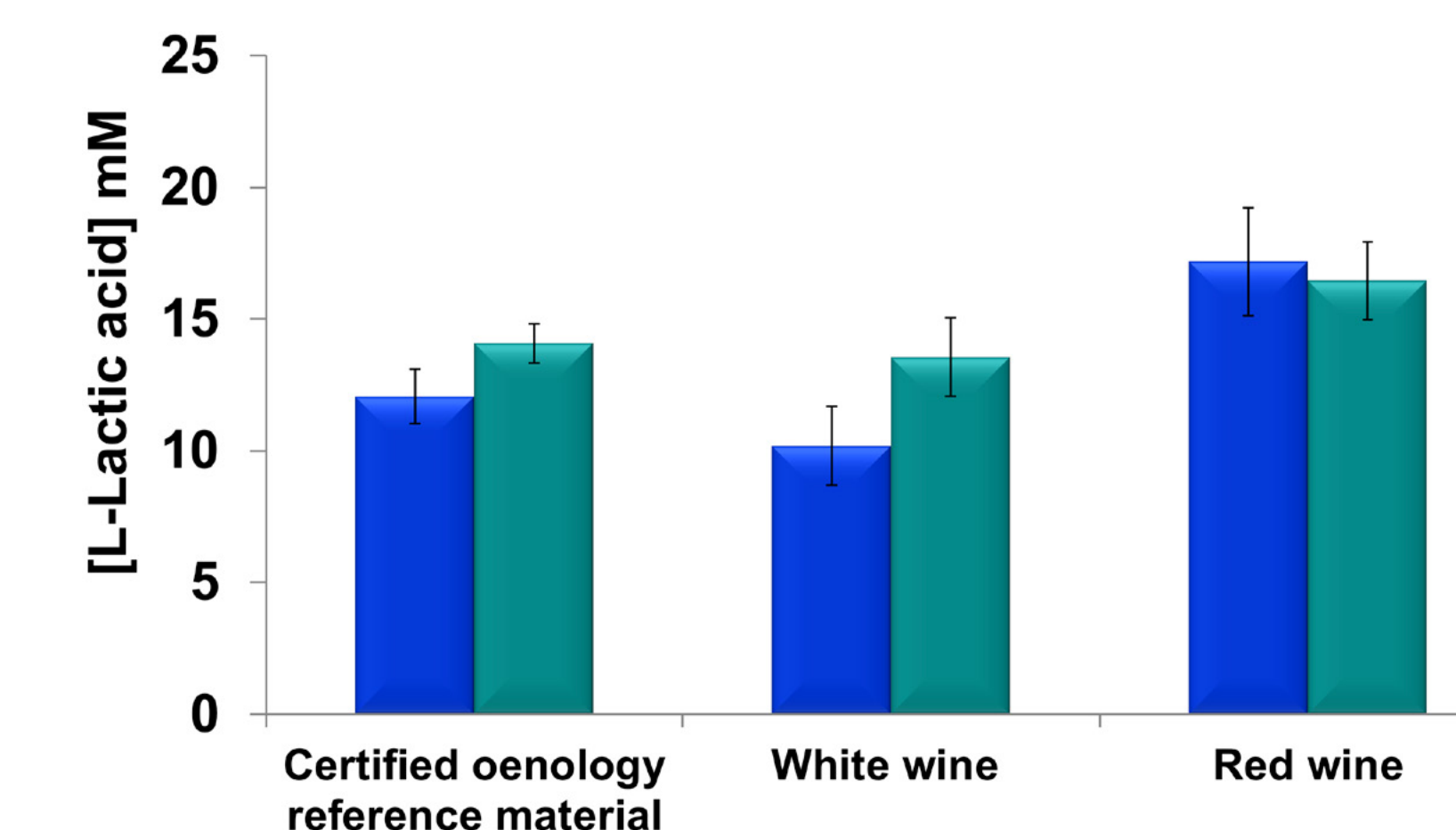
	DRP-LACT10		Optical assay- control	
	[L- Lactic acid] mM		[L- Lactic acid] mM	
Certified oenology reference material	Mean: 12.05	SD: 1.03	Mean: 14.07	SD: 0.74
White wine	Mean: 10.19	SD: 1.49	Mean: 13.55	SD: 1.48
Red wine	Mean: 17.18	SD: 2.04	Mean: 16.45	SD: 1.48
Number of tested samples (n)	n = 6		n = 2	

Certified Oenology Reference Material	
	[L-Lactic acid] mM
Inferior limit	12
Superior limit	13.6

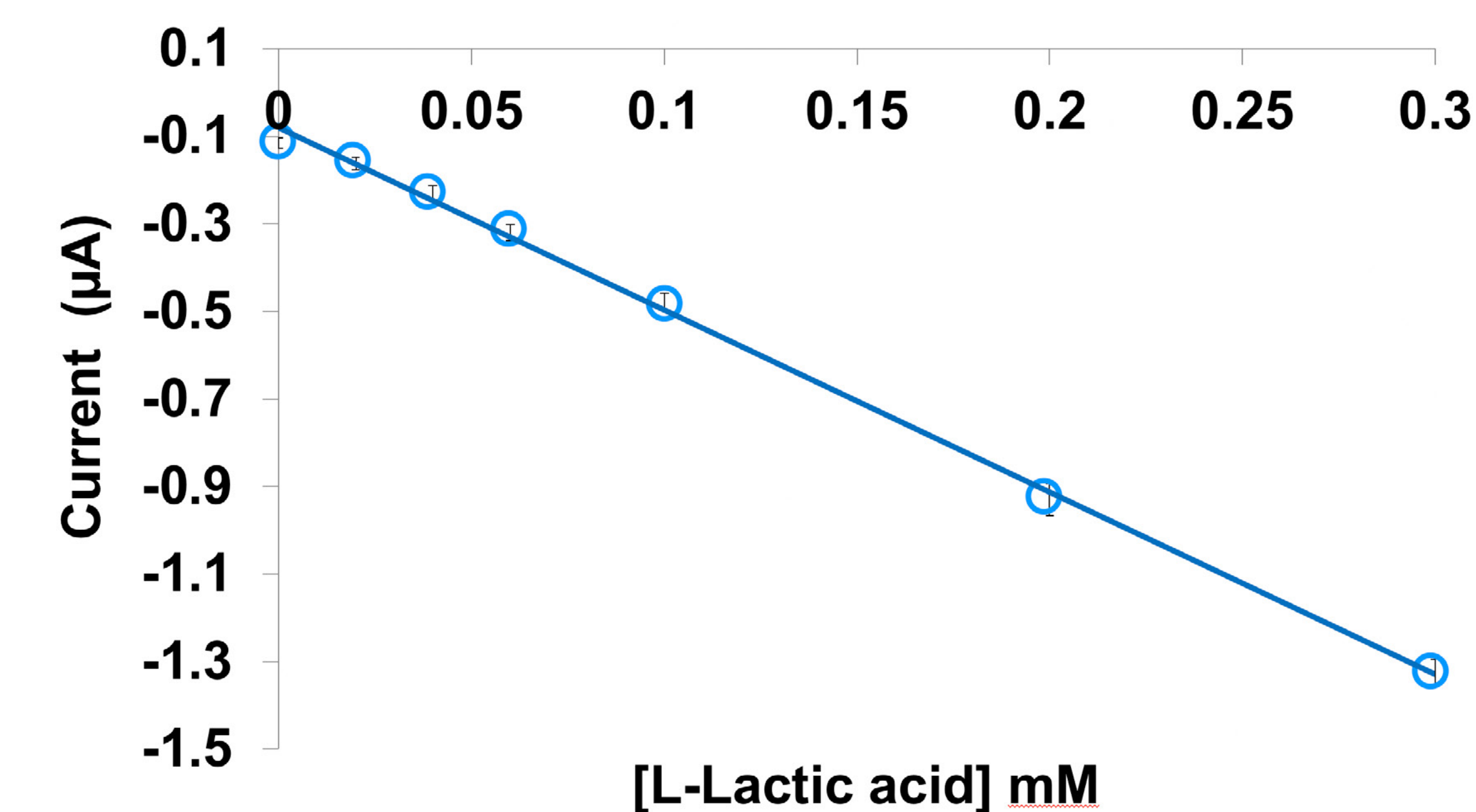
Certified oenology reference material concentration 12.8 nM

The electrochemical DRP-LACT10 sensor performance is within the established L-Lactic acid range for the certified sample.

The results obtained with electrochemical DRP-LACT10 sensor and the optical assay are very similar.



### Calibration curve for L-Lactic acid detection



$$\text{Current } (\mu\text{A}) = -4.168 [\text{L-Lactic acid}] \text{ mM} - 0.075$$

$$R^2 = 0.998$$

## Conclusions

- » Disposable small-sized electrochemical enzymatic sensors (DRP-LACT10) were developed for the detection and quantification of L-Lactic acid
- » DRP-LACT10 was successfully employed in the detection of L-Lactic acid in wine samples
- » DRP-LACT10 performance was corroborated against an optical assay and using a certified oenology reference material as control sample
- » DRP-LACT10 revealed to be robust, highly stable, user-friendly and time-saving sensor for the decentralized monitoring of L-Lactic acid in wine samples

## References

- (1) Analytical and Bioanalytical Chemistry (2014) 406:123–137
- (2) Biochemistry and Biophysics Reports (2016) 5:35–54