Measurement of redox potential as a new analytical winegrowing tool

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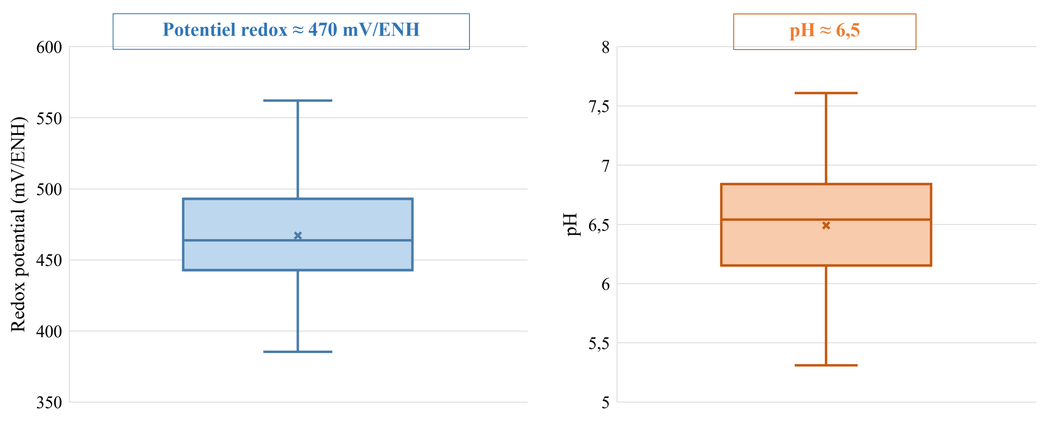
Introduction : Excell laboratory has initiated the development of an analytical method based on electrochemistry to evaluate the ability of wines to undergo or resist to oxidative phenomena. Electrochemistry is a powerful tool to probe reactions involving electron transfers and offers possibility of real-time measurements. In that context, the laboratory has implemented electrochemical analysis to assess oxidation state of different wine matrices but also in order to evaluate oxidative or reduced character of leaf and soil. Initially, our laboratory focused on dosage of compounds involved in responses of plant stresses and we were also interested in microbiological activity of soils. These analysis were compared with the measurement of redox potential (E_h) and pH which are two fundamental variables involved in the modulation of plant metabolism

Soil

1. Sampling (5 to 30 cm)
2. Preparation : drying, sieving, water + soil mixture
3. Measures pH, redox potential

Fig. 1: Statistical representation of the mean distribution of redox potential and pH of soils



The median pH on the soil is 6.5 for a redox potential value of 470 mV/ENH.

Fig. 2: Biological activity of soils of the same vineyard on two plots of different grape varieties

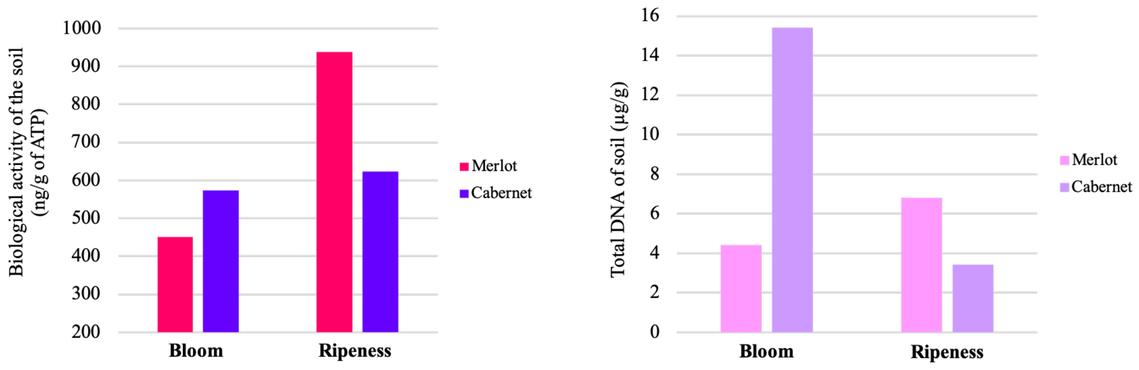
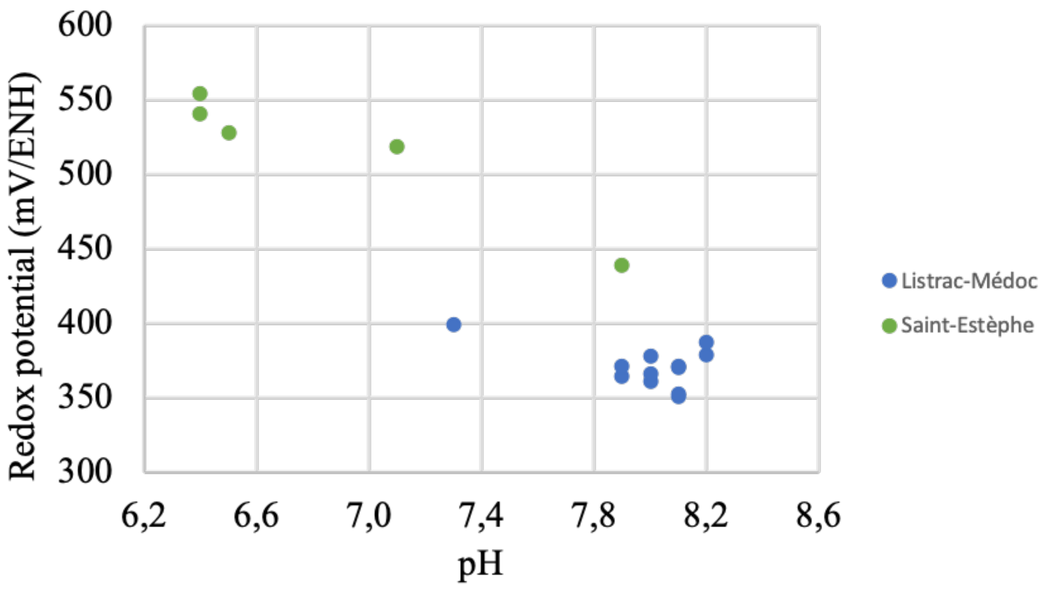


Fig. 3: Redox potential – pH diagram according to the different types of grape variety for soil analysis



Leaves

1. Sampling (40 leaves during photosynthesis)
2. Preparation : Leaf juice (blade + petiole)
3. Measures pH, redox potential, conductivity

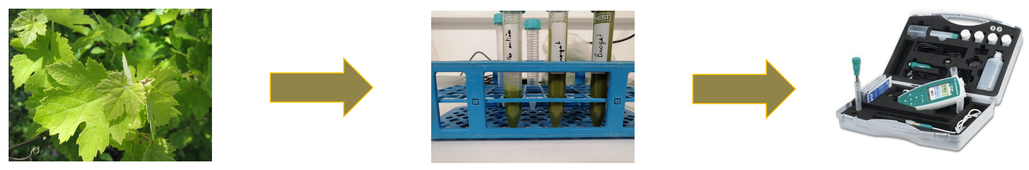
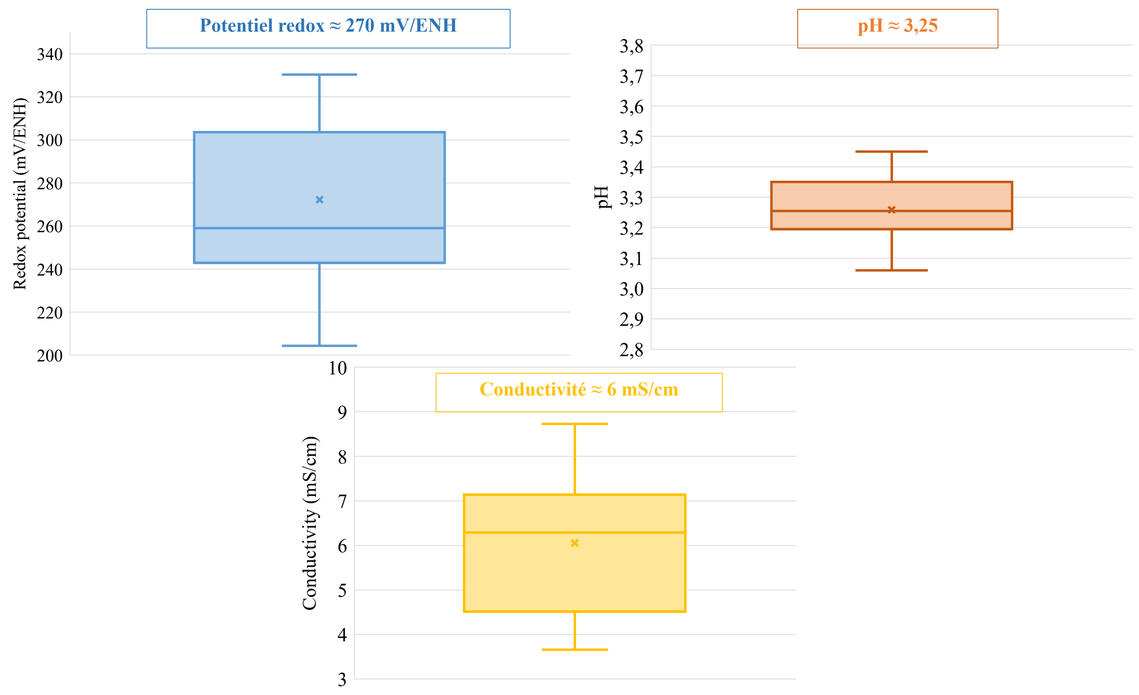
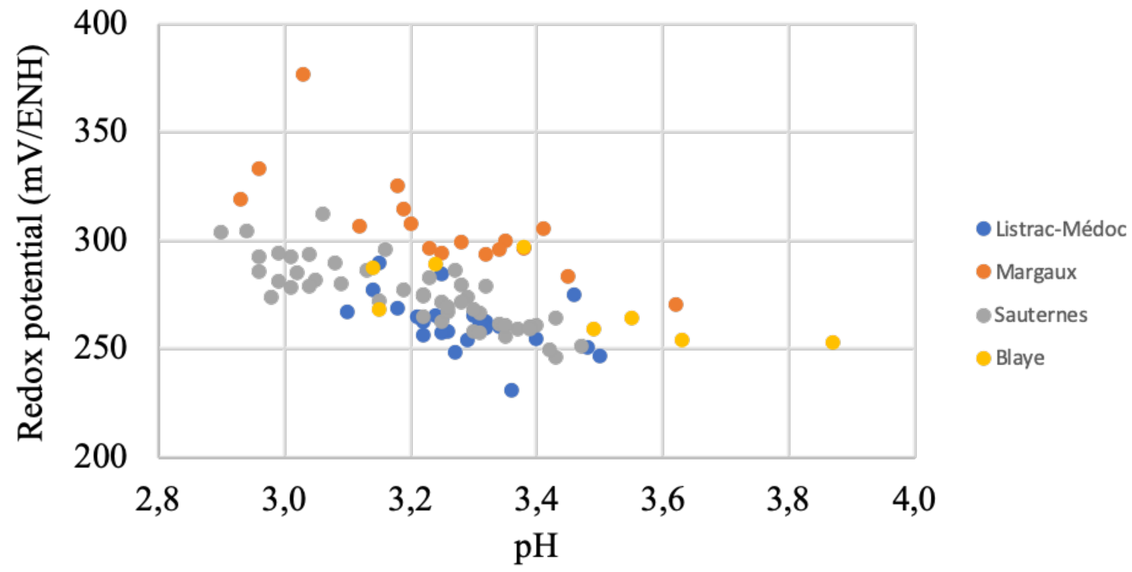


Fig. 1: Statistical representation of the mean distribution of redox potential, pH and conductivity of leaves



The median pH measured on the leaf juice is 3.25 for a redox potential value of approximately 270 mV/ENH. For conductivity, the median value is 6 mS/cm. However, these parameters show variability depending on the samples.

Fig. 2: Redox potential – pH diagram according to the different types of grape variety for foliar analysis



This mapping allows to separate the geographical areas according to their plant metabolism indicated by this redox potential - pH link. In particular, the samples from the studied vineyard of the AOP Margaux are characterized by the highest redox potentials (oxidized). On the contrary, the samples from the vineyards studied, the AOP Listrac Médoc, are the weakest (reduced).

Conclusion : The objective of this work was to carry out assays in order to provide robust analytical results based on reference methods in terms of sample preparation but also in the performance of the analysis themselves. The analytical approaches presented here will be coupled with assays of key compounds in plant metabolism but also analytical developments in soil microbiology.

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