

# The development of a simple electrochemical method for the selective determination of caffeic acid in wine using a molecularly imprinted polymer

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## CONTEXT

Caffeic acid (CA) is a potent antioxidant and one of the main hydroxycinnamic acids present in wine<sup>1</sup>. The use of traditional methods for its determination is costly, time consuming and require sample preparation<sup>2</sup>

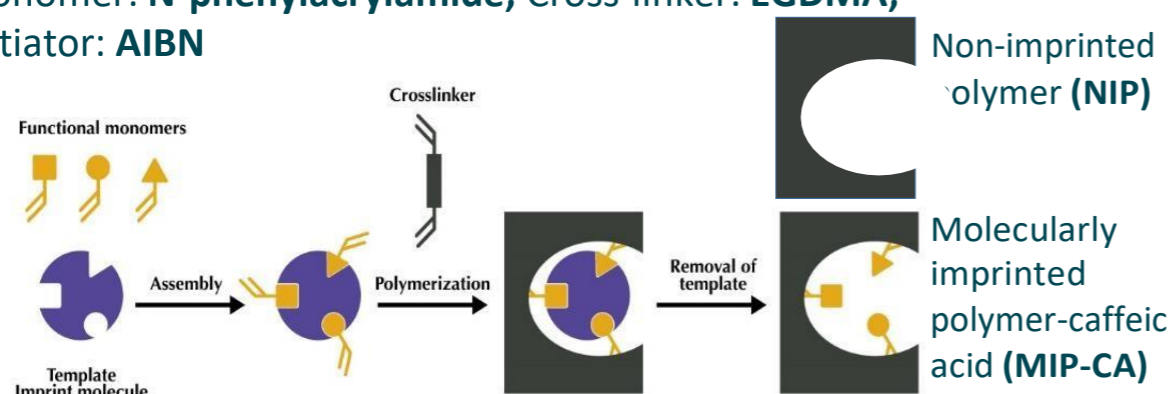
## OBJECTIVE OF THIS STUDY

Combining electrochemistry and molecular imprinting in order to obtain a simple method used for the selective determination of caffeic acid in hydroalcoholic medium, and its application in wine

MATERIAL AND METHODS

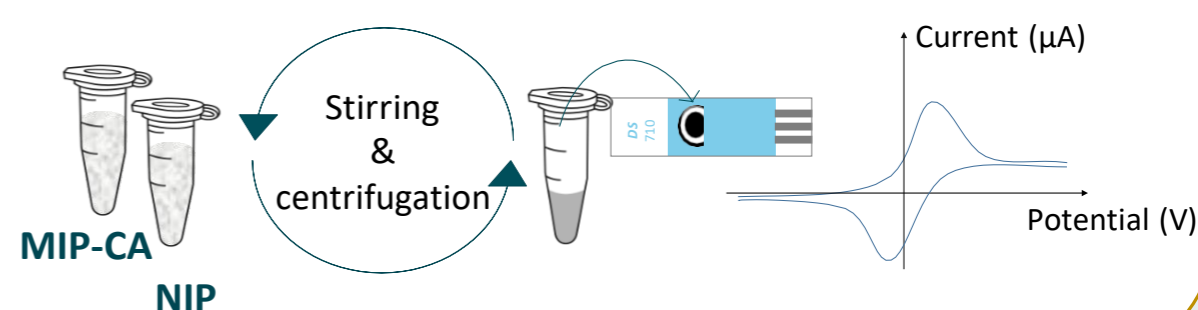
### 1 Synthesis of molecularly imprinted polymer specific to caffeic acid (MIPCA/NIP)

Solvent: CH<sub>3</sub>CN/MeOH 80/20 (v/v); Template: CA; Functional monomer: N-phenylacrylamide; Cross-linker: EGDMA; Initiator: AIBN



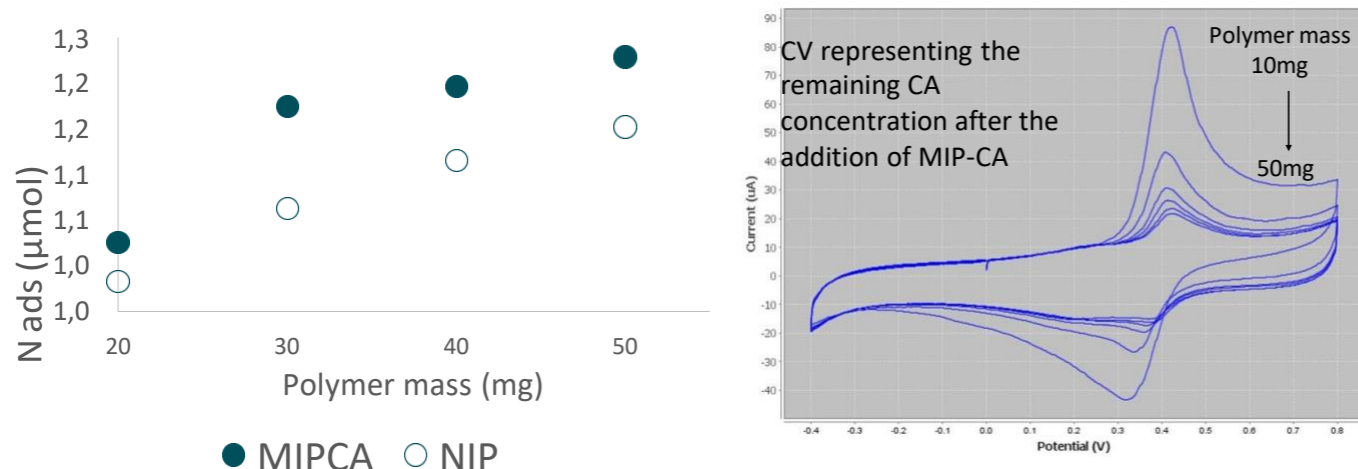
### 2 Application of MIP-CA/NIP in CA solutions

CA solutions are prepared in PBS/EtOH 90/10 (v/v), with several polymer mass, and cyclic voltammograms were carried out



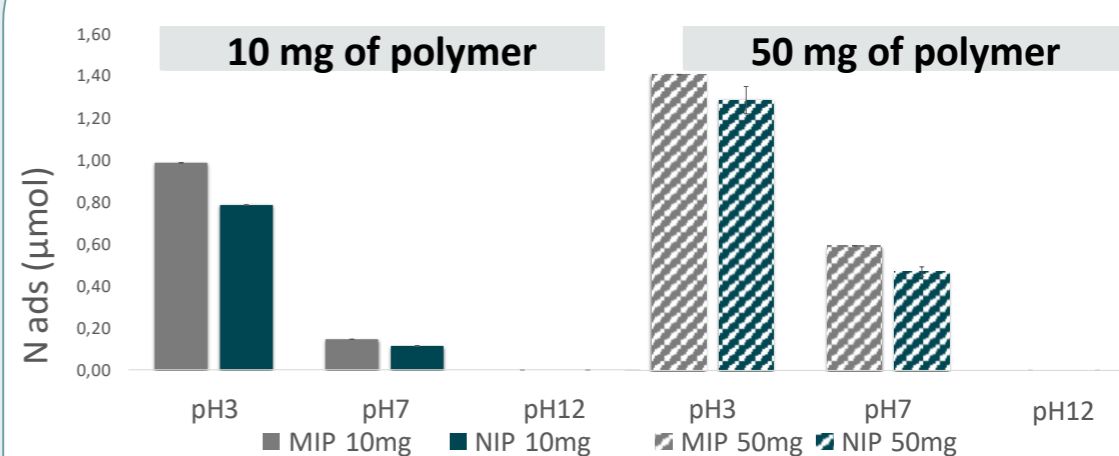
RESULTS

#### A. MIP-CA/NIP reuptake test in CA solution (1,11mM) at pH3



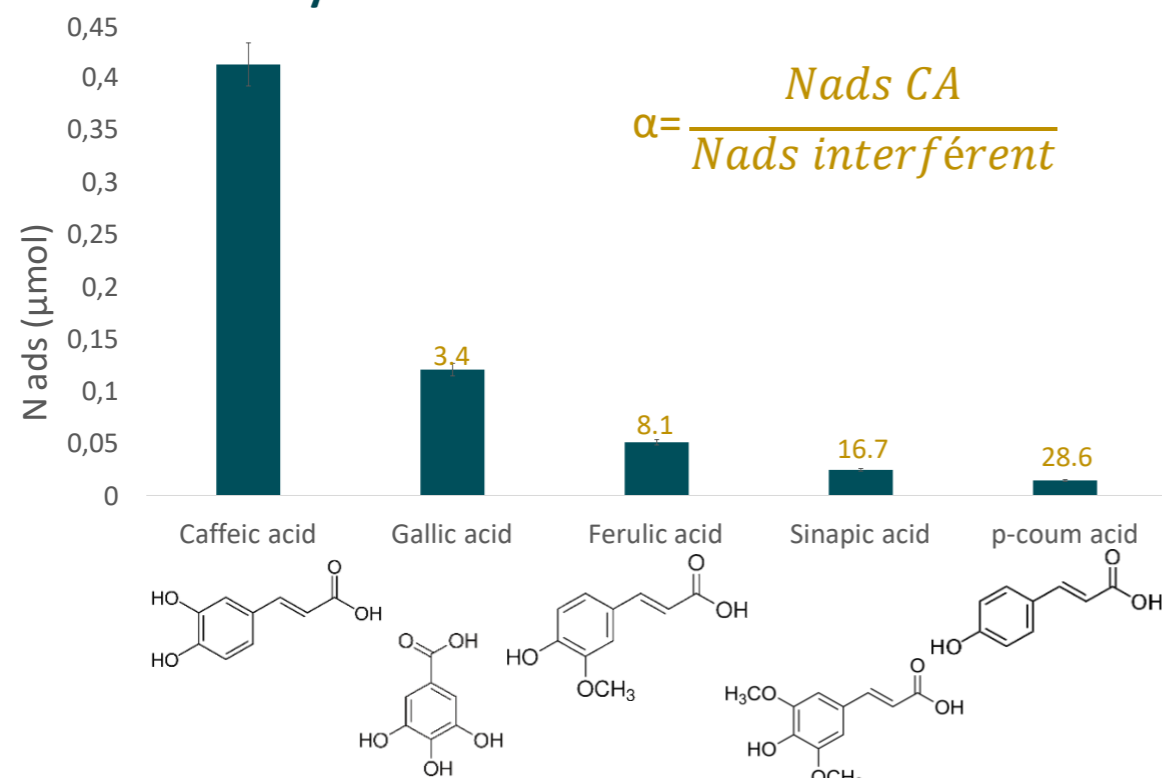
➔ Reuptake activity is proportional to the added polymer mass

#### B. pH effect on MIP-CA/NIP reuptake of CA (1,11mM)



➔ The best reuptake is carried out at pH3, where the majority of caffeic acid molecules are protonated

#### C. Selectivity tests:



➔ MIPCA is highly selective. It is 28,6 times more selective for CA than p-coumaric acid

#### D. Application in wine: results of addition-recovery experiments using MIP-CA for determination of CA concentration

Wine with added CA	Added [CA] (µmol/L)	Found [CA] (µmol/L)	Recovery (%)
1 <sup>st</sup> level	110	140	120
2 <sup>nd</sup> level	240	230	100
3 <sup>rd</sup> level	660	540	80

➔ MIPCA showed a reuptake activity of CA in wine, with recoveries ranging between 80% and 120%, indicating that the matrix had no influence on the polymer

## CONCLUSIONS AND PERSPECTIVES

- This method allowed a rapid and easy determination of caffeic acid. Electrochemistry requires a very small volume of sample without any preparation and the preparation of the polymer is relatively simple.
- MIPCA is highly selective for caffeic acid in model and real wine.
- It would be interesting to test the same MIPCA on MWCNT electrodes, and compare the signals.

<sup>1</sup>: Ilhami G. (2006). *Toxicology*;217:213-220; <sup>2</sup>: Elhachem, M. et al. (2021). *Antioxidants*;10(3).