

Voltammetric detection of Irbesartan by Molecularly Imprinted Polymer (MIP)-modified screen-printed electrodes

Camilla Zanoni¹, Riccardo Rovida¹, Lisa Rita Magnaghi^{1,2}, Raffaella Biesuz^{1,2} and Giancarla Alberti^{1,*}

Irbesartan determination by square wave voltammetry (SWV): optimization of the experimental conditions by a full factorial design 2³

a) Bare electrode

Table S1. Optimization of the SWV experimental conditions for the bare electrode by a Full Factorial Design 2³: level definitions for the parameters considered

Parameter	Minimum level (-1)	Maximum level (+1)
Frequency (Fz, Hz)	1	50
Impulse amplitude (A, mV)	50	100
Equilibration time (t, s)	120	300

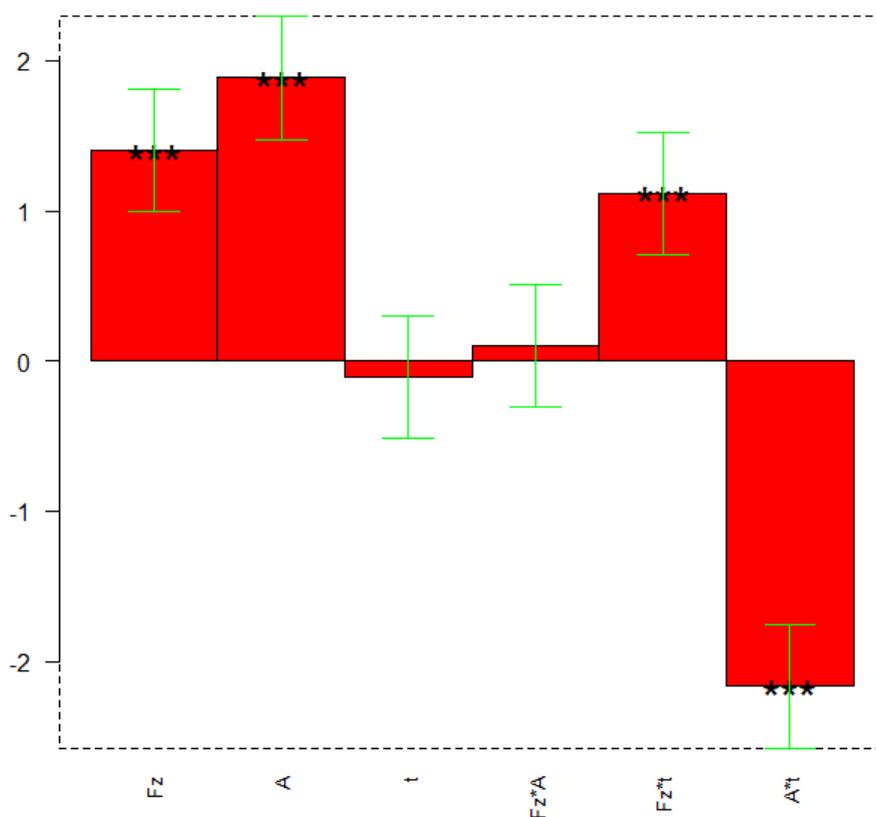


Figure S1. DoE to optimize SWV experimental conditions for the bare electrode. The greatest values and little black stars (regardless of the sign) suggest a significant influence of the respective parameter or interaction and significance (* $p \leq 0.05$, ** $p \leq 0.01$, *** $p \leq 0.001$).

The model equation can be written as follows:

$$i_p = b_0 + b_1 \cdot Fz + b_2 \cdot A + b_3 \cdot t + b_{12} \cdot Fz \cdot A + b_{13} \cdot Fz \cdot t + b_{23} \cdot A \cdot t$$

Table S2. Coefficients and significance (* $p \leq 0.05$, ** $p \leq 0.01$, *** $p \leq 0.001$) calculated for the optimization of the SWV experimental conditions for the bare electrode by a Full Factorial Design 2³.

Coefficient	Value	Significance
b_0	5.586	
b_1	1.402	***
b_2	1.886	***
b_3	-0.104	
b_{12}	0.102	
b_{13}	1.117	***
b_{23}	-2.166	***

Table S3. Optimization of the SWV experimental conditions for the bare electrode by a Full Factorial Design 2³: model validation by six replicates of the center point [0 0 0], i.e., Fz=25 Hz, A=75 mV and $t = 210$ s. CI = confidence interval at 95% confidence level.

	i_p (μA)
Average	5.5
Standard deviation	0.8
Upper bound CI	6.4
Lower bound CI	4.6
Predicted response (b_0)	5.586

b) MIP(NIP)-modified electrode.

Table S4. Optimization of the SWV experimental conditions for the MIP(NIP)-modified electrode by a Full Factorial Design 2³: level definitions for the parameters considered

Parameter	Minimum level (-1)	Maximum level (+1)
Frequency (Fz, Hz)	1	10
Impulse amplitude (A, mV)	50	100
Equilibration time (t, s)	210	300

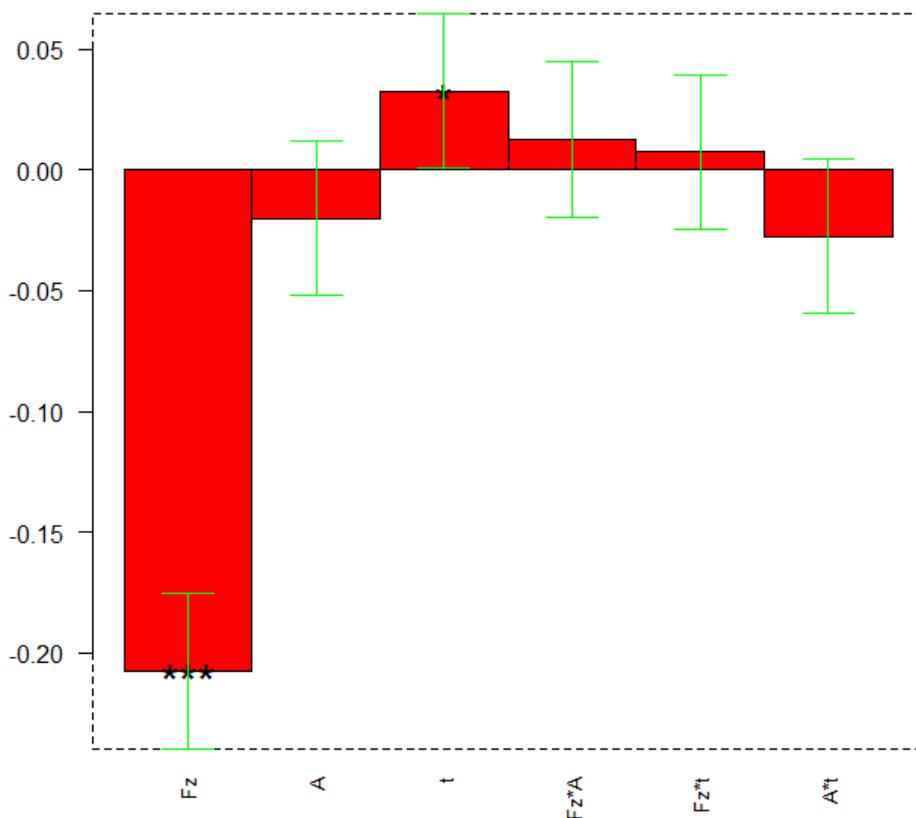


Figure S2. DoE to optimize SWV experimental conditions for the MIP(NIP)-modified electrode. The greatest values and little black stars (regardless of the sign) suggest a significant influence of the respective parameter or interaction and significance (* $p \leq 0.05$, ** $p \leq 0.01$, *** $p \leq 0.001$).

The model equation can be written as follows:

$$i_p = b_0 + b_1 \cdot Fz + b_2 \cdot A + b_3 \cdot t + b_{12} \cdot Fz \cdot A + b_{13} \cdot Fz \cdot t + b_{23} \cdot A \cdot t$$

Table S5. Coefficients and significance (* $p \leq 0.05$, ** $p \leq 0.01$, *** $p \leq 0.001$) calculated for the optimization of the SWV experimental conditions for the MIP(NIP)-modified electrode by a Full Factorial Design 2^3 .

Coefficient	Value	Significance
b_0	0.2975	
b_1	-0.2075	***
b_2	-0.02	
b_3	0.0325	*
b_{12}	0.0125	
b_{13}	0.0075	
b_{23}	-0.0275	

Table S6. Optimization of the SWV experimental conditions for the MIP(NIP)-modified electrode by a Full Factorial Design 2^3 : model validation by six replicates of the center point [0 0 0], i.e., Fz=5 Hz, A=75 mV and $t = 120$ s. CI = confidence interval at 95% confidence level.

	i_p (μA)
Average	0.299
Standard deviation	0.003
Upper bound CI	0.302
Lower bound CI	0.296
Predicted response (b_0)	0.2975

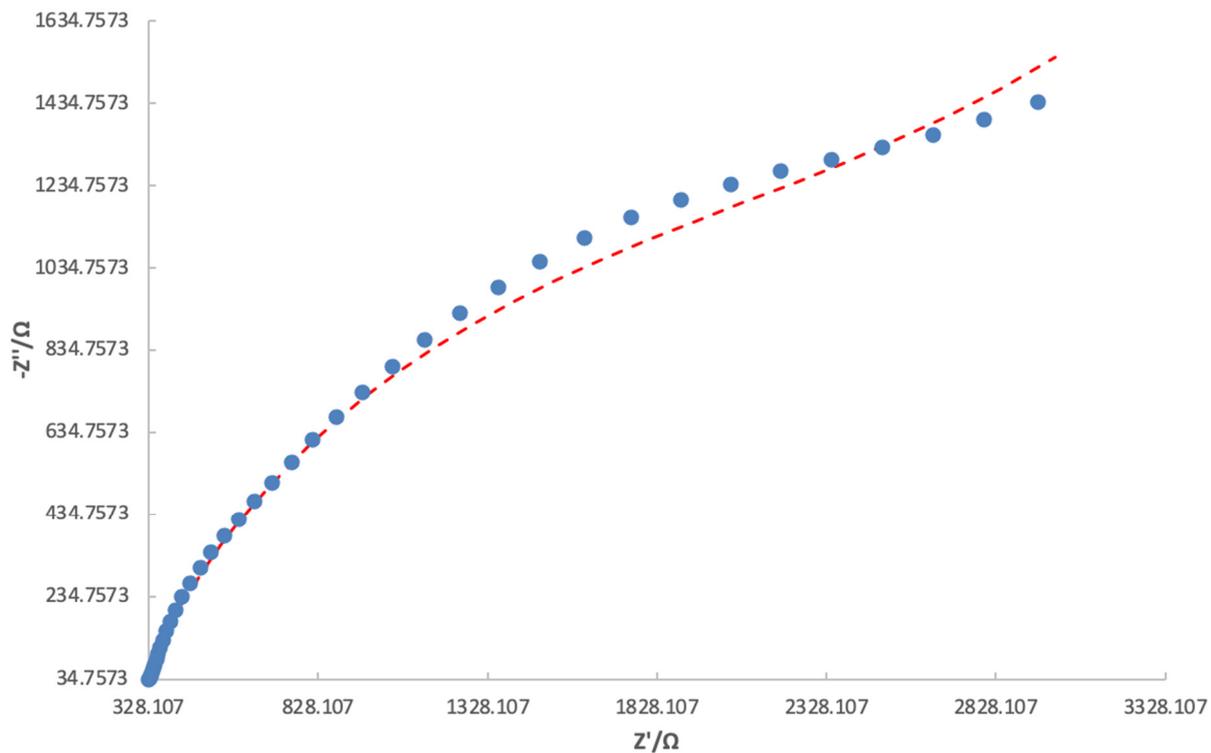


Figure S3. Nyquist plots of the MIP-modified electrode after the template removal. Electrochemical probe: 5 mM $K_4Fe(CN)_6$ /0.1 M KCl solution at pH 7.2.

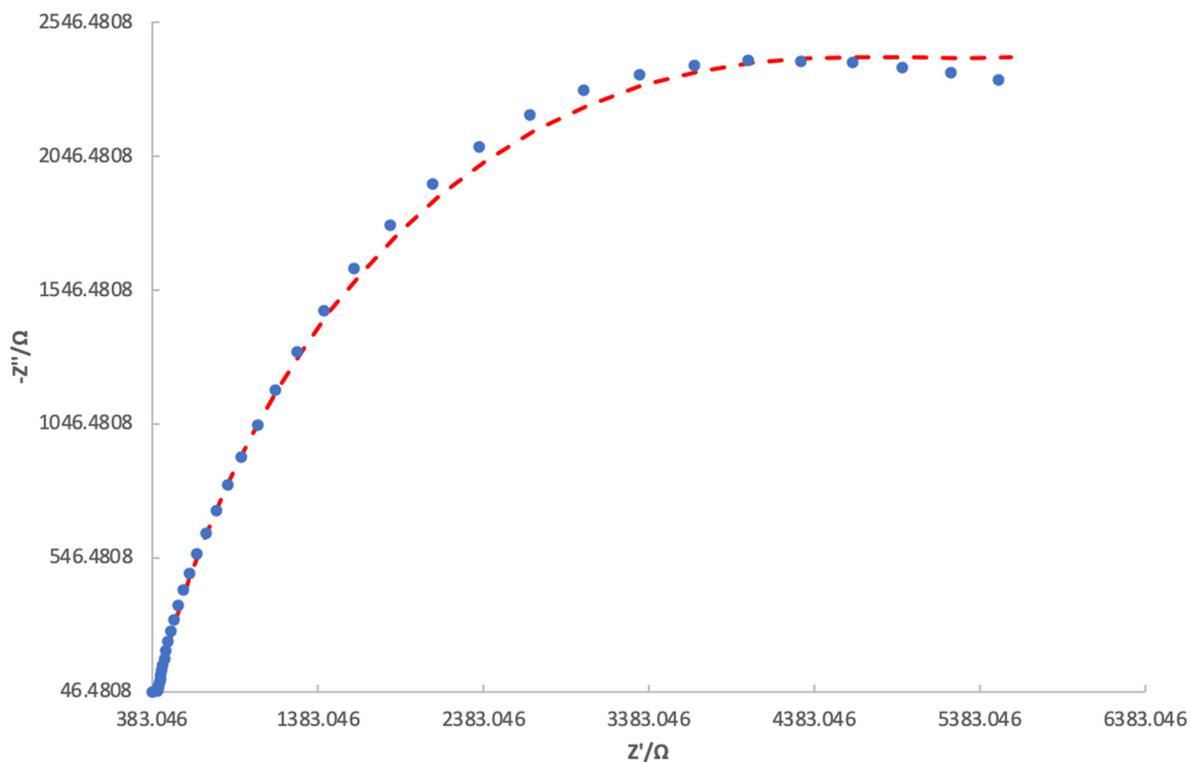


Figure S4. Nyquist plots of the cleaned MIP-modified electrode after contact with IRB solution. Electrochemical probe: 5 mM $K_4Fe(CN)_6$ /0.1 M KCl solution at pH 7.2.

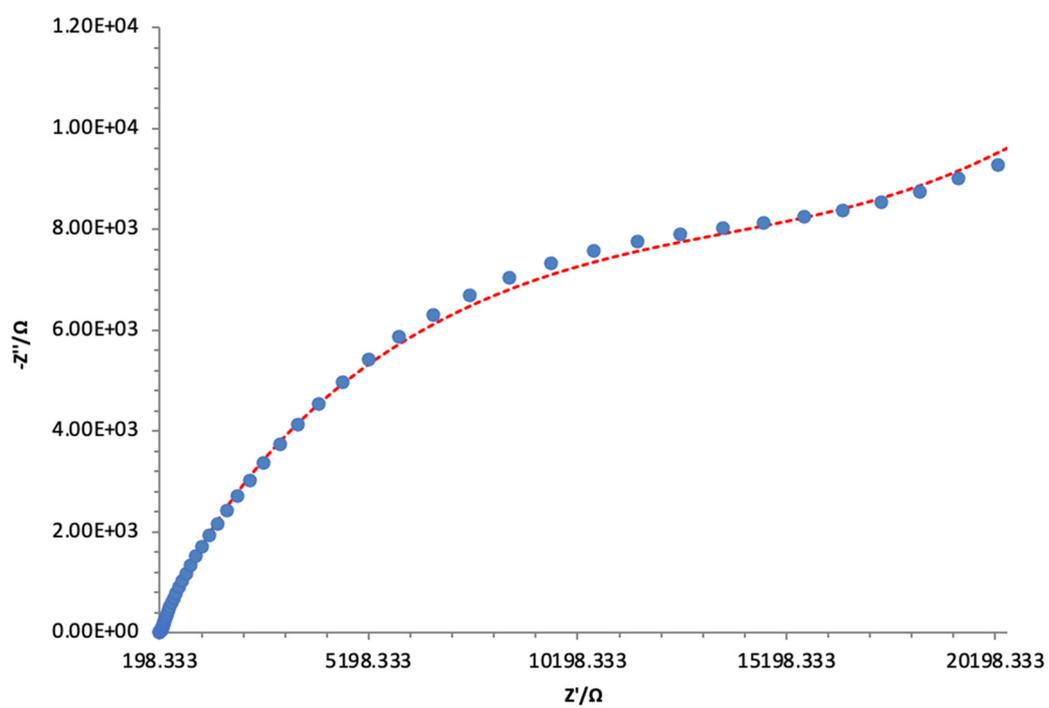


Figure S5. Nyquist plots of the NIP-modified electrode. Electrochemical probe: 5 mM $K_4Fe(CN)_6$ /0.1 M KCl solution at pH 7.2.