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EVALUATION OF REDOX PEPTIDE MODIFIED SURFACES FOR BIOSENSING APPLICATIONS

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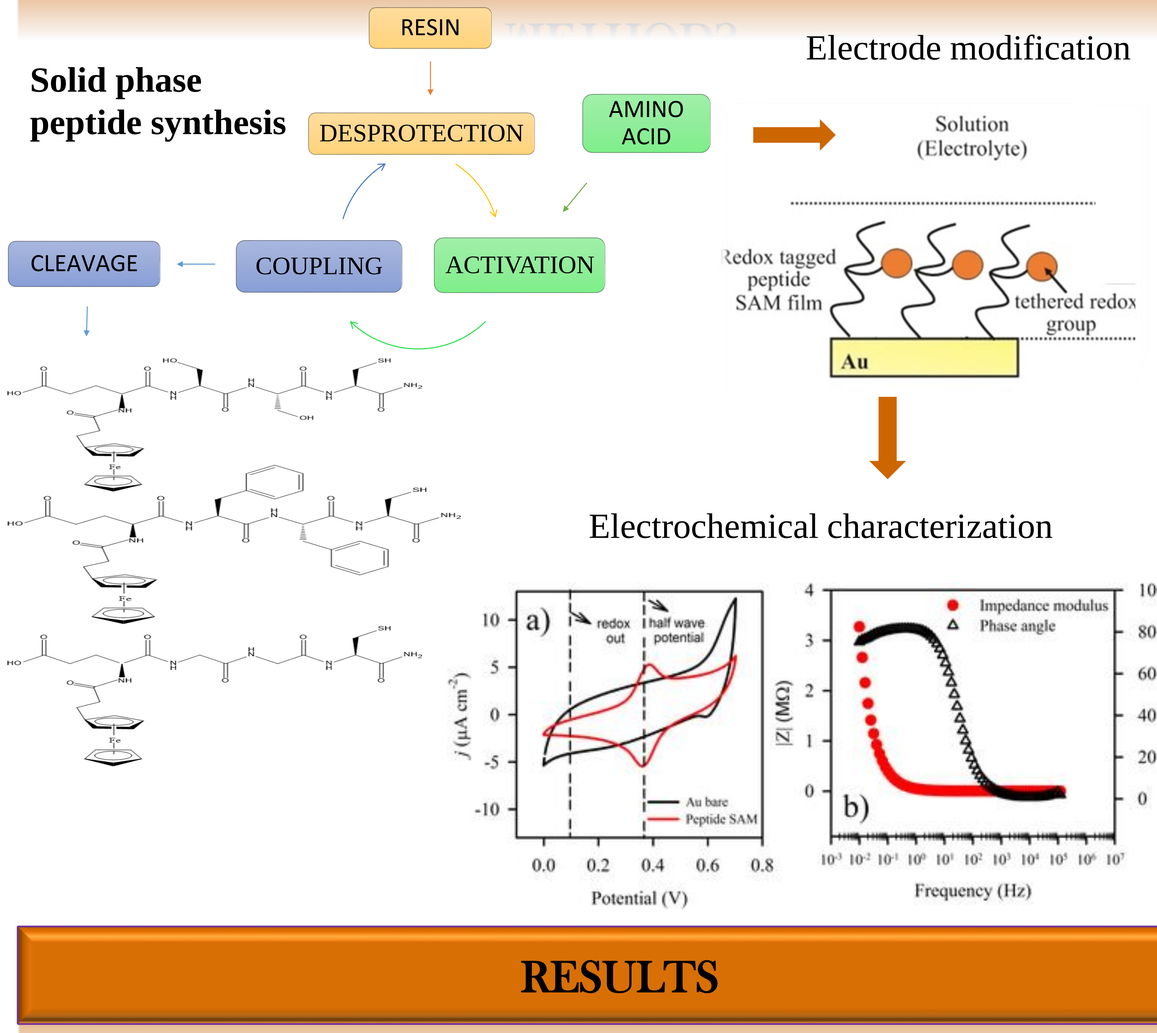
INTRODUCTION

(Re)emerging diseases are one of the biggest threats to public health. Thus, electrochemical label-free biosensors appear as a rapid and sensitive detection tools for clinical analysis. In order to create such devices, self-assembled monolayers (SAMs) have been evaluated as potential interfaces for receptor immobilizing (CHINNADAYYALA et al., 2019). Electroactive peptides SAM, such as that obtained from Fc-Glu-$(Ala)_2$-Cys-NH_2 sequence, has been successfully evaluated as a transduction interface in electrochemical capacitance biosensors (PICCOLI et al., 2016). The design of this peptide includes a cysteine that binds to the gold electrode and a glutamic acid in the N-terminal position (for redox probe coupling in $–NH_2$ group). The remaining δ-carboxyl group can be used for further receptor immobilization. In this work, the peptides Fc-Glu-$(Ser)_2$-Cys-NH_2, Fc-Glu-$(Phe)_2$-Cys-NH_2 and Fc-Glu-$(Gly)_2$-Cys-NH_2 are evaluated as new structures for SAMs preparation envisioning sensitive biosensors.

METHODS



RESULTS

Figure 2. Electrochemical characterization of the Fc-Glu-Ser-Ser-Cys-NH_2 peptide. (a) Cyclic voltammetry performed at different scan rates. The anode and cathode current peaks presents a linear function with the scan rate (b), characteristic of electroactive monolayers. (c) Electrochemical impedance spectroscopy performed at E_{NF} and E_{formal}, potentials, and (d) capacitive Nyquist plot for the data shown in (c).

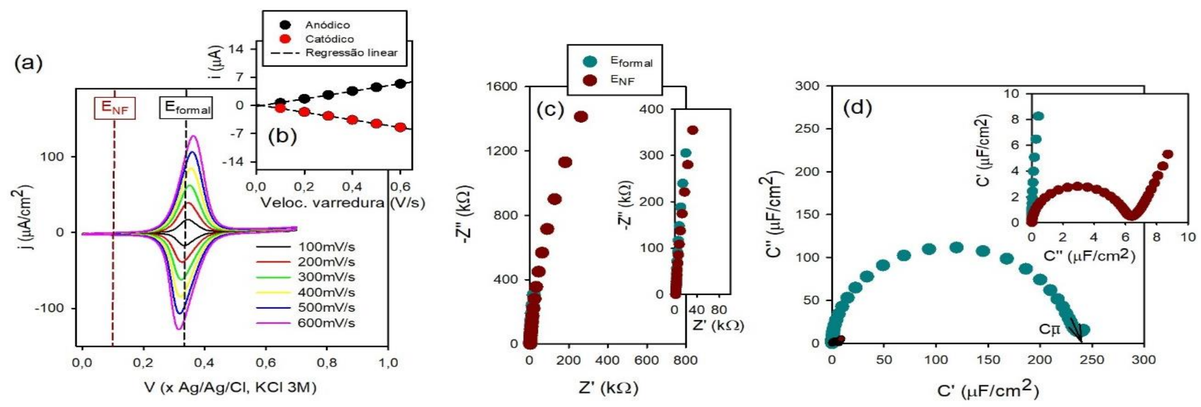
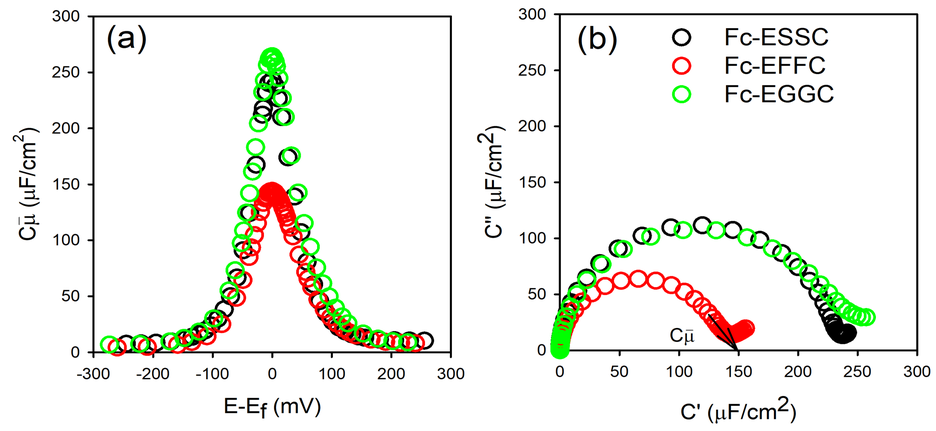


Figure 2. (a) Density of States (DOS) obtained by electrochemical capacitance spectroscopy (the potentials are normalized by E_f). (b) Capacitive Nyquist plot for the different peptides.



CONCLUSION

All the evaluated peptides form electroactive SAMs that present reversible electrochemical processes (i.e. the quotient between the anodic and cathodic current peaks in CV is unitary). The SAM obtained by using Fc-Glu-$(Gly)_2$-Cys-NH_2 structure showed both the highest surface coverage (Γ) and electrochemical capacitance (Cμ), and then it can be potentially use for biosensor applications.

Table 1. Parameters of the self-assembled peptides monolayers on a gold surface.

Peptide	E_{formal} (mV)[b]	Γ (10^{-10} mol/cm²)[a]	N (10^{14})[c]	$C_{\bar{\mu}}$ (μF/cm²)	Laviron (k_{ET})
Fc-Glu-Ser-Ser-Cys-NH_2	354±11	2.3±0,2	1.5±0,2	244±50	18±5
Fc-Glu-Phe-Phe-Cys-NH_2	362±5	1.5±0,2	1.1±0,1	156±18	26±6
Fc-Glu-Gly-Gly-Cys-NH_2	374±3	2.6±0,2	1.6±0,1	270±35	17±3

a. By cyclic voltammetry / b. Potential x Ag/AgCl, 3 mol/L KCl. [c]N = number of electronic states/energy per unit area (cm²).

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