Electrochemical behaviour of Cortisol: implications of mixed mass transport regime for mechanism elucidation

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Cortisol (COR), commonly known as the stress hormone, regulates mood, appetite, sleep, and immunity. Elevated hormone levels are linked to cardiovascular diseases, sleep disorders and anxiety. Moreover, it jeopardizes the development of some aquatic species and has been found in rivers and coastal parts of the ocean. Thus, the development of efficient and reliable analytical methods for detection and quantification of such compounds is of utmost importance. Due to its adsorptive characteristics, a key step is understanding their chemical reactivity and electrochemical redox behaviour. However, the lack of electrochemical mechanistic data on COR and other steroid-like molecules in the literature hinders the development of electroanalytical methods. This word describes the electrochemical behaviour of COR and Finasteride (FIN), a steroid-like drug, used as molecular model, at glassy carbon electrode (GCE) over pH 1-14, using phosphate-buffered saline and ammonium formiate as supporting electrolytes. Both compounds exhibited complex voltametric profiles with multiple redox peaks. Analysis of log (Ip) vs log (v) (scan rate) slope values between 0.5 and 1.0, indicating that the processes are neither purely adsorptive nor purely diffusional. Instead, they follow a mixed mass transport regime [1], with simultaneous diffusional and adsorptive contributions. Due to this hybrid nature, classical Randles-Sevcik predictions are inadequate for accurately determining fundamental mechanism parameters [2], such as the number of electrons transferred and nature of each process. A Mixed Mass Transport Equation was developed in order to incorporate both transport components into peak current calculations, and the electrochemical mechanism of the hormones was proposed.

Acknowledgments:

CNPq, CAPES, FAPESP

References:.

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