Steady-State Substrate and Product Concentrations for Non-Michaelis-Menten Kinetics in an Amperometric Biosensor – Hyperbolic Function and Padé Approximants Method

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A theoretical model is presented for an amperometric biosensor with inhibition of the substrate. This model is based on the non-stationary diffusion equations which contains a non-linear term connected to the enzymatic reaction of non-Michaelis-Menten kinetics. This paper describes the analytical representation of concentrations for steady-state conditions and for all parameter values. Hyperbolic function and Padé approximants method are used to evaluate the analytical expressions of concentration of substrate, product, substrate flux and current. A comparison of our estimated analytical results with the numerical simulation and previous analytical results available is provided. This observed a good agreement.

Keywords: Mathematical modeling; Non-linear equation; Hyperbolic function method; Padé approximants method; Amperometric biosensor; Non-Michaelis-Menten kinetics; Substrate Inhibition; Steady-state.

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