STATIONARITY ANALYSIS OF CHRONOPOTENTIOMETRIC TIME SERIES FROM BILAYER LIPID MEMBRANE SUBJECTED TO ELECTROPORATION

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An analysis of chronopotentiometric measurements performed on bilayer membranes (BLM) is presented. Egg yolk phosphatidylcholine bilayer membranes in 2 M KCl were treated with a constant-intensity DC current, and the output voltage was measured at a sampling frequency of 625 Hz. For low current values no electroporation took place and after a short period of voltage exponential rise a constant value of the voltage was established. By contrast, for higher current intensities a sudden decrease in voltage could be observed. It was followed by voltage oscillations. This effect reveals a pore formation. Provided the current is below a certain value membrane breakdown is a reversible process. The stationarity of time series obtained from voltage oscillations was analysed. We investigated whether the process is really nonstationary as expected, if any method can be found to stationarize it, and if there is any dependence between stationarity level and current intensity. The analysis proved a nonstationary nature of the series caused by a trend of stochastic type and a minor periodicity of 50 Hz. A component of 190 Hz was also detected. The classical decomposition model with a differencing filter of order 1 and step 13 was employed to remove the trend and the periodicity. The stationarity level of the detrended series, in relation to membrane lifetime and current intensity, was tested by the reverse arrangements test. The behaviour of the autocorrelation and partial autocorrelation functions, which might suggest or reject certain stochastic models, was also analysed.