

## The use of moderate electric fields (MEF) to increase the biomass production and reduce the lag phase of a fermentative process

Inês A. Castro, António Augusto Vicente, José António Teixeira

Centre of Biological Engineering, Universidade do Minho, Braga, Portugal

The use of moderate electric fields to assist fermentations has not been exhaustively investigated but some results on this subject point out to promising results either on enhancing metabolite production or on lag phase reduction. The use of MEF in recombinant strains has never been studied and the increased industrial use of modified strains to produce medicines or food ingredients makes this a relevant issue. The possibility of further optimization of the fermentative processes in place or new industrial applications using this technology opens a wide range of economical and social advantages. The main objectives of this work were to address the effects of MEF on the lag phase and biomass yield and consequently on primary metabolite production, namely  $\beta$ -galactosidase on a recombinant *Saccharomyces cerevisiae* strain expressing *lacA* gene (coding for  $\beta$ -galactosidase) of *Aspergillus niger* under ADHI promotor and terminator. This strain has been selected due to its high ethanol and  $\beta$ -galactosidase productivities and also because continuous fermentative processes can be carried out due to its excellent flocculation capability. Batch culture experiments were performed at optimal growth conditions in synthetic medium under aerobic conditions. Two stainless steel electrodes were placed symmetrically inside the bioreactor and the electric field was varied from 0 to 2 V.cm<sup>-1</sup>. The biomass production expressed in g.L<sup>-1</sup> increased linearly with the applied electric field in the range of 0 to 2.0 V.cm<sup>-1</sup>. Lag phase almost disappeared when using higher voltages. Improved transport through the cell flocs and improved transport through the cell membrane due to pore formation or activation of transport proteins may explain this behaviour but this is yet to be proved. In conclusion, the use of MEF is a new parameter that can be manipulated to optimize fermentative processes namely the ones in which the biomass production is an important parameter (e.g. SCP, antibiotics).