# MODELING GLUCOSE UPTAKE BY ASPERGILLUS NIGER GROWING ON A SOLID SUBSTRATE

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**Introduction.** *Aspergillus niger* (*Aniger*) is the main producer of citric acid by submerged culture, but few research has been devoted to the study of its metabolism, coupling experiments to the use of structured models. One of the key aspects in the model is to assess the mechanism by which Aniger assimilates glucose from the external medium that can describe the observations, and could lead to the knowledge of those factors that cause the accumulation of citric acid in the fungi, which is of most relevance for arriving at an optimal production process.

**Methods.** The model includes, in a reduced form, the pathways for glicolysis (EMP) and pentose-phosphate (PPP) in the cytosol compartment, where biomass synthesis also takes place, and these is linked through mitocondrial transmembrane transport with the Krebs cycle (TCA). Enzyme regulation in EMP and TCA is also considered due to low or high levels of citrate and ATP. The kinetics considers 71 metabolites, 18 cofactors and 2 species in the gas-phase, and also accounts for the simultaneous production of cofactors like ATP, $NAD^+$ y $NADP^+$ during growth. Because growth takes place on a solid substrate in a Petri dish, the structured model couples growth kinetics to mass diffusion in both the solid substrate and the gas-phase. Two different mechanisms for glucose uptake are analyzed and compared, and they are: 1) pasive diffusion through the external wall membrane (model 0), and 2) facilitated diffusion by ATP consumption at the external wall membrane (model 1) with the simultaneous production of Glucose 6 Phosphate. The simulations considered that glucose is the only carbon source and the concentration in the agar plate was 25 g/L. The excreted products to the agar plate are, among others, citric acid, glycerol and oxalic acid.

**Results.** Predictions of biomass growth, citric acid production and the evolution of ATP and $NADPH_2$ for both modes of glucose uptake are compared in figures 1a and 1b. It can be observed that both models predict similar diauxic behaviour, however model 1 predicts a 45 % more citric acid being excreted to the agar plate, and this is, in no doubt linked to the profiles shown in figure 1b.

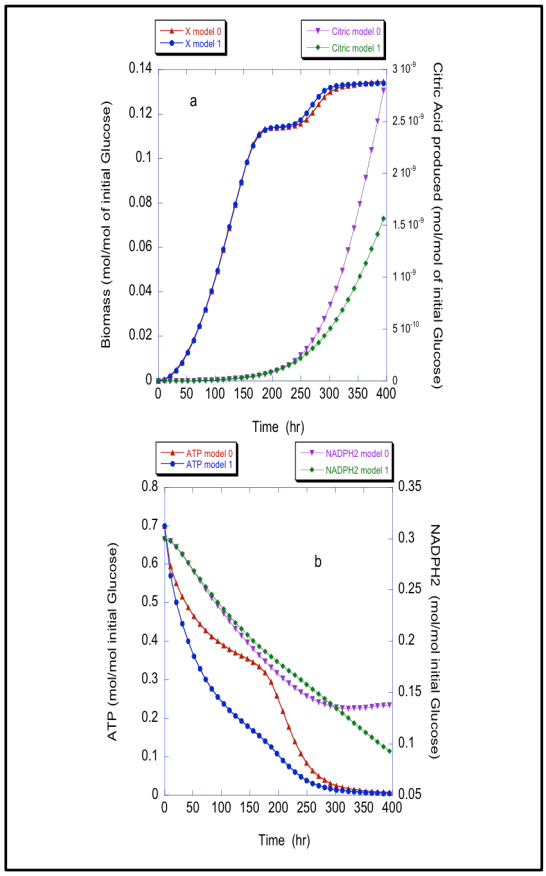


**Fig.1a & 1b** These figures show the dynamics of biomass growth on the agar plate together with the production of citric acid, and the changes in ATP and NADH2 in time, for models 0 and 1.

**Conclusions.** The above results show that a more experimental and modeling work has to be performed in order to assess the mechanism by which *Aniger* uptakes glucose from a solid or liquid medium, as it has been shown by the different predictions of the above models.