P-082 | **Mechanical properties of yeast cell growth dynamics within hydrogels**
Bugarski B. [1][#][*]**, Nedovic V.**[2]**, Pajic-Lijakovic I.**[1]**, Manojlovic V.**[1]**, Plavsic M.**[1]

[1] TMF, Univesity of Belgrade, Serbia, Belgrade [2] AF, Univesity of Belgrade, Zemun, Serbia
[#][*]Contact email. branko@tmf.bg.ac.rs

INTRODUCTION

Mathematical model is developed to estimate the mechanism of change the volumetric state of cells under local compression induced by cell growth within matrix. The compression induces the generation of the energetic/volumetric fields. The energetic/volumetric fields are caused by the discrete actions of cells on one side and the feedback restrictive action of stiff Ca-alginate network on the other. It induces discontinuous stress transmission through cell cytoskeleton.

MATERIALS AND METHODS

The 2% w/w Na-alginate solution was prepared by dissolving 10 g of sodium alginate powder (Sigma medium viscosity) into 500 ml of distilled water. The brewer's yeast (*Saccharomyces uvarum*) was cultivated at 25 ∘C in sterile medium of 11% w/w extract in shake flask. Polymer/cell suspension was formed by mixing of 100 ml of Na-alginate solution with 25 ml of thick brewer's yeast suspension at room temperature. Spherical droplets were formed by extrusion of Na-alginate/yeast cell suspension into 1% CaCl2 solution, as described by Bugarski (2007).

RESULTS AND DISCUSSION

The volumetric state of cells is formulated thermodynamically by including the discontinuous nature of the phenomenon. The discontinuous nature of the volumetric field is quantified using the "volumetric" quants. The action of the volumetric field induces cell excitation. Excited different cells absorbs the volumetric quants deforms and changes its volumetric state. It migrates through the narrow channels between the surrounding cells and the parts of hydrogel upward occupy less crowded regions (Bugarski 2010). During the migration cell emits the volumetric quants and changes its volumetric state up to unexcited one. We consider the growth of cells (cell subsystem) within Ca-alginate hydrogel (matrix subsystem) in the microbead. The changes of volumetric states of cells are elucidated within two regimes. Such changes induce the suppression of cell growth.
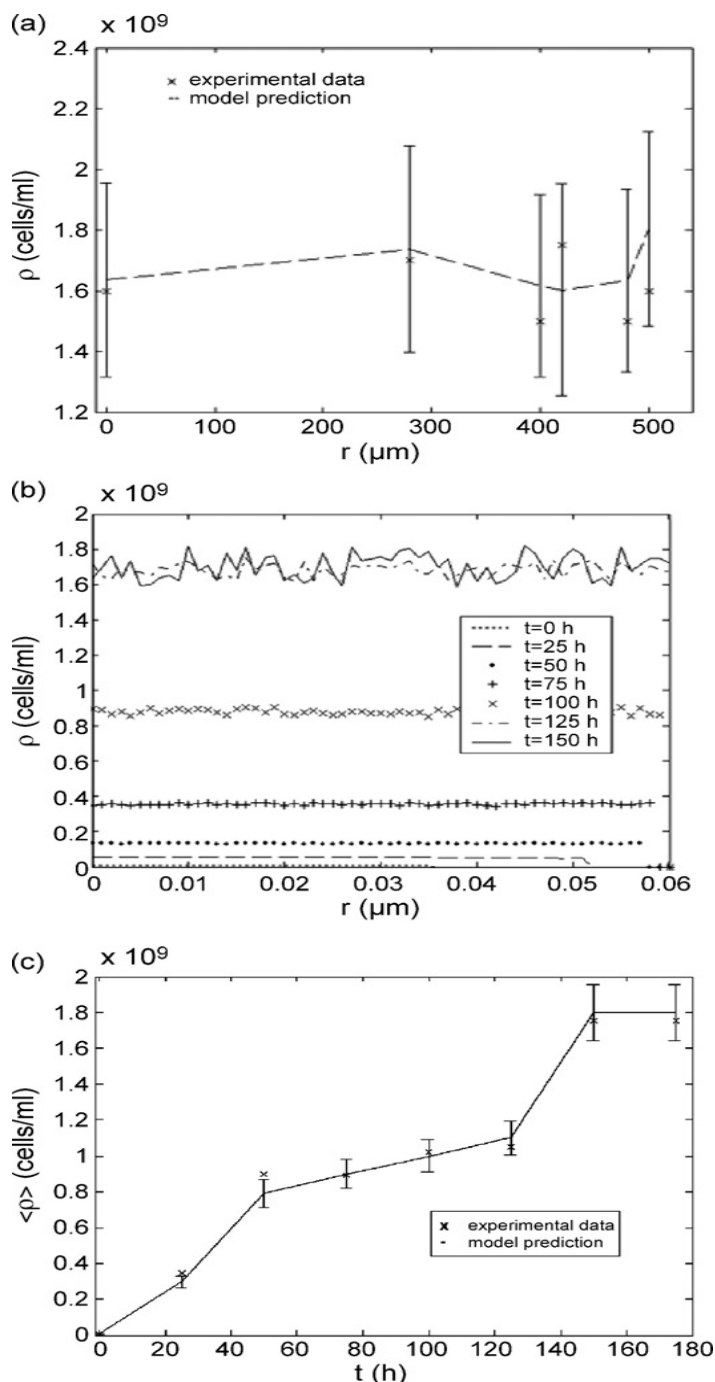

Figure 1: The experimental data and model predictions: (a) comparison of the experimental data and model prediction values for the local yeast cell concentration profiles within microbead after 150 h of bioreactor cultivation; (b) model prediction values calculated for the local yeast cell concentration profiles within microbead after 0, 25, 50, 75, 100 and 150 h of bioreactor cultivation; (c) comparison of the experimental data and model prediction comparison of the experimental data and model prediction values.

CONCLUSIONS

The analysis of the various kind of interactions between hydrogel subsystem and yeast cell subsystem was based on experimentally obtained intra-bead cell concentration profile after reaching the equilibrium state when number of cells stop to increase (after 150 h), as well as, the total yeast cell concentration and microbead volume as function of time. The cell concentration profile determined after 150 h of cultivation (Fig 1). This calculation is in accordance with model assumption and boundary conditions. This mathematical model can be useful for further optimization of microbead design in order to achieve higher intra-bead cell concentrations.

REFERENCES

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