**سمینار هفتگی ماده چگال نرم**

# Mathematical model of plasma-therapy effect on bacterial growth focusing on glycolysis pathway


## Samira Ranjba

***Physics department of Arak University and PLASMANT group of University of Antwerp, Belgium***



**Abstract**

Antibiotic resistance is one of the world's most urgent public health problems. Due to its antibacterial properties, cold atmospheric plasma (CAP) may serve as an alternative method to antibiotics. It is claimed that oxidative stress caused by CAP is the main reason of bacteria inactivation. To model in detail the interaction between bacteria and reactive species, we have extended the model introduced by Marr, i.e., a set of coupled ordinary differential equations based on protein production, to include the effect of plasma, using the Treanor distribution function (cold atmospheric plasma distribution function). The purpose of this study is not to describe rigorously all the biochemical processes occurring in a cell, but only the main ones. We added a term to one of the equations to describe protein damage and consequently bacterial death. The effect of exposure time and multi-step treatment are also discussed. Subsequently, using COBRA Toolbox we computationally investigated the effect of plasma-induced oxidation on various glycolysis metabolites, by monitoring the production of the biomass. We observed that in addition to the significant reduction in biomass production, the rate of some reactions has increased. These reactions produce anti-oxidant products, showing the bacterial defense mechanism to escape the oxidative damage. Nevertheless, the simulations show that the plasma-induced oxidation effect is much stronger than the defense mechanism, causing killing of the bacteria.


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