

On the Mathematical Modelling of EPS Production by a Thermophilic Bacterium

Nadja Radchenkova¹, Margarita Kambourova¹, Spasen Vassilev¹,
Rene Alt², Svetoslav Markov³

¹ Institute of Microbiology, Bulgarian Academy of Sciences

² Laboratoire d'Informatique de Paris 6, UPMC, CRNS UMR7606.

³ Inst. for Mathematics and Informatics, BAS

Keywords: EPS production, thermophilic bacterium, numerical simulations

An increasing interest towards microbial exopolysaccharides (EPSs) is determined by the wide variety of their properties as a result of diversity in their composition. Thermophilic microorganisms suggest non pathogenic products, appropriated for application in food industry, pharmacy and cosmetics. They offer also short fermentation processes, better mass transfer, decreased viscosity of synthesized polymer and of the corresponding culture liquid. Only a few EPS-secreting thermophilic bacteria were isolated [2]. In the current work we report on the mathematical modeling of the fermentation processes based on experimental results for EPS production by a thermophilic bacterium, *Aeribacillus pallidus* 418, isolated from Rupi basin, South-West Bulgaria. An investigation on the influence of agitation and aeration on the bacterial growth and EPS synthesis revealed high mass transfer dependence of the polymer production. The polymer production is associated to growth. Microbial and substrate dynamics are described by means of systems of ODEs. Two possible dynamical models based on ideas from [1] are proposed and numerical simulations are presented.

Acknowledgements. The authors are grateful to the National Fund for Scientific Research, Bulgaria for financial support of this work (Contract DTK 02/46).

References

- [1] Alt, R., S. Markov, Theoretical and computational studies of some bioreactor models, *Computers and Mathematics with Applications* 64 (2012), 350–360.
- [2] Nicolaus, B., M. Kambourova, E.T. Oner, Exopolysaccharides from extremophiles: from fundamentals to biotechnology, *Environ. Technol.*, 31 (2010), 1145–1158.