

Title: Real-time rheology of actively growing bacteria

Author(s): Portela, R. ^[1,2], Almeida, P. L. ^[3,4], Patrício, P. ^[3,5]; Cidade, T. ^[4,6]; Sobral, R. G. ^[1], Leal, C. R. ^[3,4]

Source: Physical Review E **Volume:** 87

Article Number: 030701 **DOI:** 10.1103/PhysRevE.87.030701 **Published:** Mar 12 2013

Document Type: Article

Language: English

Abstract: The population growth of a *Staphylococcus aureus* culture, an active colloidal system of spherical cells, was followed by rheological measurements, under steady-state and oscillatory shear flows. We observed a rich viscoelastic behavior as a consequence of the bacteria activity, namely, of their multiplication and density-dependent aggregation properties. In the early stages of growth (lag and exponential phases), the viscosity increases by about a factor of 20, presenting several drops and full recoveries. This allows us to evoke the existence of a percolation phenomenon. Remarkably, as the bacteria reach their late phase of development, in which the population stabilizes, the viscosity returns close to its initial value. Most probably, this is caused by a change in the bacteria physiological activity and in particular, by the decrease of their adhesion properties. The viscous and elastic moduli exhibit power-law behaviors compatible with the "soft glassy materials" model, whose exponents are dependent on the bacteria growth stage. DOI: 10.1103/PhysRevE.87.030701.

Keywords Plus: Staphylococcus-Aureus; Pseudomonas-Aeruginosa; AGR; Detachment; Mechanisms; Expression; Insights; Biofilms; Distinct

Reprint Address: Portela, R (reprint author) - Univ Nova Lisboa, Fac Ciencias & Tecnol, Ctr Recursos Microbiol, P-2829516 Caparica, Portugal

Addresses:

[1] Univ Nova Lisboa, Fac Ciencias & Tecnol, Ctr Recursos Microbiol, P-2829516 Caparica, Portugal

[2] Univ Nova Lisboa, ITQB, Genet Mol Lab, P-2780 Oeiras, Portugal

[3] ISEL, P-1959007 Lisbon, Portugal

[4] Univ Nova Lisboa, Fac Ciencias & Tecnol, CENIMAT I3N, P-2829516 Caparica, Portugal

[5] Univ Lisbon, Ctr Fis Teor & Computac, P-1649003 Lisbon, Portugal

[6] Univ Nova Lisboa, Fac Ciencias & Tecnol, Dept Ciencia Mat, P-2829516 Caparica, Portugal

E-mail Addresses: rgs@fct.unl.pt; cleal@adf.isel.pt

Funding:

Funding Agency	Grant Number
FCT (Portugal)	PEst-OE/FIS/UI0618/2011 PEst-C/CTM/LA0025/2011 PEst-OE/BIA/UI0457/2011 PTDC/BIA/MIC/101375/2008

Publisher: Amer Physical Soc

Publisher Address: One Physics Ellipse, College PK, MD 20740-3844 USA

ISSN: 1539-3755

Citation: PORTELA, R.; ALMEIDA, P. L.; PATRÍCIO, P.; CIDADE, T.; SOBRAL, R. G.; LEAL, C. R. - Real-time rheology of actively growing bacteria. Physical Review E. ISSN 1539-3755. Vol. 87 (2013).