Title: Real-time rheology of actively growing bacteria

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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.

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