Biofilms under hydrodynamic stress.

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Biofilms are communities of microorganisms which excrete an extracellular polymeric matrix. We present experimental data of biofilm population growth [1] at different times in different growing conditions. In particular, stirring of culture medium greatly enhances biofilm growth. Bacterial population dynamics can be satisfactorily modelled by a simple population dynamics model with reasonable assumptions. Using the model we can approximately explain the different growth behavior observed in shaking versus static conditions. We have additionally developed numerical simulations to study biofilm development where bacteria interact via an effective depletion force produced by excreted polymers.
Once the bacteria attach to the surface or interface they produce a gluey extracellular polymeric network (termed EPS) composed basically by polysaccharides and proteins. Bacteria then are embedded in this extracellular network or matrix (ECM). As an analogy to a typical problem in soft matter physics: the rigid bacteria can be seen as active colloids, whereas the extracellular matrix as a cross-linked polymer gel [2]. This approach is useful for understanding the structure, mechanics, and dynamics of the biofilm. Since, the mechanics of well-defined soft materials can provide insight into the mechanics of biofilms and, in particular, the viscoelasticity.

References:

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