Abstract Submitted
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Modeling the enhancement of the swimming speed of flagellated bacteria in polymer solutions[1] JAY X. TANG, Brown University, XUEJUN ZHANG, Institute of Theoretical Physics, Chinese Academy of Science, FANGFU YE, Institute of Physics, Chinese Academy of Science, WILLIAM KLIMPERT, ROBERT PELCOVITS, Brown University — The swimming speed of many species of flagellated bacteria initially increases and then decreases as a function of the viscosity of the medium, which is varied by the addition of high molecular weight polymers. An earlier model accounts for such a peaked distribution (Magariyama Kudo, Biophys J, 2012), but it was recently shown to give rise to incorrect predictions for the cell body rotation rate (Martinez et al., PNAS, 2014). The authors of the latter work suggested that low-molecular weight impurities from the added polymers account for the peaked speed-viscosity curves in some cases. We measured the swimming speed of a uni-flagellated bacterium,caulobacter crescentus, in solutions of a number of polymers of several different sizes. Our findings confirm the peaked speed-viscosity curve for each of several distinct polymers added, suggesting that the general behavior is highly unlikely due to impurities. We propose a modification of the models used by the previous investigators in order to better explain our new experimental results. We have also performed numerical calculations based on the modified model to show that it properly accounts for the experimental results.

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