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Adhesion of a Cylindrical Bacterium in the Presence of DLVO Potential JIAYI SHI, SINAN MUFTU, APRIL GU, KAI-TAK WAN, Northeastern university — A single cigar shape bacterium attaches to a rigid substrate (e.g. sand surface). In the presence of electrostatic double layers and van der Waals attraction according to the Derjaguin-Landau-Verwey-Overbeek (DLVO) theory, the bacterium glycoprotein shell deforms and may settle in either the primary or secondary energy minimum depending on whether it has sufficient energy to overcome the repulsive energy barrier. The adhesion-detachment mechanics is derived using a computational approach, and the followings are obtained: (i) relation between the applied load and contact area with the substrate, (ii) deformed profile at equilibrium, (iii) mechanical stress distribution in the shell, (iv) critical compressive load to force the shell going from secondary energy minimum to primary, and (v) "pull-off" forces to detach the shell from substrate. The model leads to better understanding of bacteria adhesion-aggregation-transportation, and has significant relevance to environmental and medical sciences.

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