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Theory of End-Labeled Free Solution Electrophoresis: Using Branched Polymeric Labels with ssDNA SORIN NEDELCU, MARTIN KENWARD, LAURETTE MCCORMICK, GARY W. SLATER, University of Ottawa —
End-Labeled Free Solution Electrophoresis allows one to sequence DNA molecules without the need for a sieving matrix. As the name suggests, a label is attached to the DNA molecules in order to overcome their free-draining property by changing the balance between the friction and the electrophoretic forces. Recent experimental results have shown that the friction coefficient of short branched labels increase linearly with their total molecular weight, thus suggesting a new strategy to design labels for long ssDNA read lengths. In our work, we study the use of branched labels for this purpose using two different approaches. First, we use an exact analytical theory that neglects excluded volume interactions, and conclude that the friction coefficients increase almost linearly with molecular weight, with strong correction factors that increase rapidly with the length of the label. We then examine the same problem using extensive Molecular Dynamics simulations. Our results indicate that the correction factor is smaller than predicted by the analytical theory, and that the linear regime observed experimentally can extend to fairly large molecular weights.

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