Accepted Manuscript

Understanding looping kinetics of a long polymer molecule in solution. Exact solution for delta function sink model

Moumita Ganguly, Anirudhha Chakraborty

PII: S0378-4371(17)30404-1
DOI: http://dx.doi.org/10.1016/j.physa.2017.04.083
Reference: PHYSA 18185

To appear in: *Physica A*

Received date: 10 September 2016

Please cite this article as: M. Ganguly, A. Chakraborty, Understanding looping kinetics of a long polymer molecule in solution. Exact solution for delta function sink model, *Physica A* (2017), http://dx.doi.org/10.1016/j.physa.2017.04.083

Understanding looping kinetics of a long polymer molecule in solution. Exact solution for delta function sink model

Moumita Ganguly[1,*]

Indian Institute of Technology Mandi, Kamand, Himachal Pradesh - 175005, India.

Anirudhha Chakraborty

Indian Institute of Technology Mandi, Kamand, Himachal Pradesh - 175005, India.

Abstract

A diffusion theory for intramolecular reactions of polymer chain in dilute solution is formulated. We give a detailed analytical expression for calculation of rate of polymer looping in solution. The physical problem of looping can be modeled mathematically with the use of a Smoluchowski-like equation with a Dirac delta function sink of finite strength. The solution of this equation is expressed in terms of Laplace Transform of the Green's function for end-to-end motion of the polymer in absence of the sink. We have defined two different rate constants, the long term rate constant and the average rate constant. The average rate constant and long term rate constant varies with several parameters such as length of the polymer (N), bond length (b) and the relaxation time τ_R. The long term rate constant is independent of the initial probability distribution.

Keywords: Polymer; Sink; Analytical; Green's function; Looping

1. Introduction

Understanding the kinetics of loop formation of long chain polymer molecules has been an interesting research field both, to experimentalists [1, 2, 3, 4] and

*Corresponding author

Email address: mouganguly09@gmail.com (Moumita Ganguly)

[1]Phone:-+91-1905-267145, Fax: +91-1905-237945