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Saami Ahmed, Mahima Kaushik, Swati Chaudhary, Shrikant Kukreti

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Structural polymorphism of a Cytosine-rich DNA Sequence forming i-motif structure: Exploring pH based biosensors

Saami Ahmed[a], Mahima Kaushik[b], Swati Chaudhary[a], Shrikant Kukreti[a]*

[a]Nucleic Acids Research Lab, Department of Chemistry, University of Delhi, Delhi-110007

[b]Cluster Innovation Center, University of Delhi, Delhi-110007

E-mail: skukreti@chemistry.du.ac.in; kukretishrikant@yahoo.com

Corresponding Author:
Prof. Shrikant Kukreti
Department of Chemistry,
University of Delhi, Delhi, India

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Abstract

Sequence recognition and conformational polymorphism enable DNA to emerge out as a substantial tool in fabricating the devices within nano-dimensions. These DNA associated nano devices work on the principle of conformational switches, which can be facilitated by many factors like sequence of DNA/ RNA strand, change in pH or temperature, enzyme or ligand interactions etc. Thus, controlling these DNA conformational changes to acquire the desired function is significant for evolving DNA hybridization biosensor, used in genetic screening and molecular diagnosis. For exploring this conformational switching ability of cytosine-rich DNA oligonucleotides as a function of pH for their potential usage as biosensors, this study has been designed. A C-rich stretch of DNA sequence (5'-TCCCCCAATTAATTCCCCCA-3'; SG20c) has been investigated using UV-Thermal denaturation, poly-acrylamide gel electrophoresis and CD spectroscopy. The SG20c sequence is shown to adopt various topologies of i-motif structure at low pH. This pH dependent transition of SG20c from unstructured single strand to unimolecular and bimolecular i-motif structures can further be exploited for its utilization as switching on/ off pH-based biosensors.