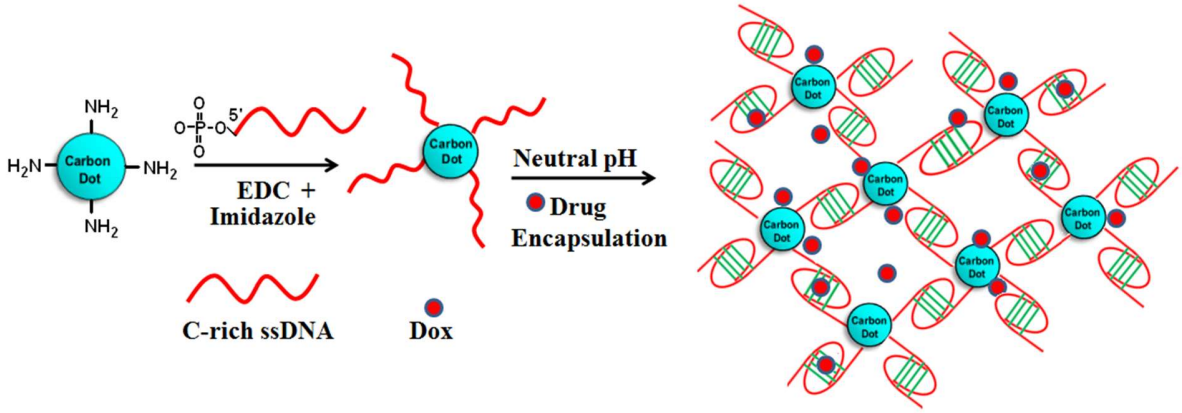
Carbon Dots Assisted Formation of DNA Hydrogel for Sustained Release of Drug

For targeted and sustained release of drug a DNA-Carbon dot hydrogel is constructed. Amine functionalized carbon dots (CDs) were conjugated to 5'-phosphate termini of Cytosine (C) rich ssDNA by phosphoramidate linkage. As a prototype, chemotherapeutic drug Doxorubicin (Dox) was loaded and enclosed in hydrogel that acts as a container for sustained release of the drug. Apart from acting as the cross linker for network formation, CDs also participate in encapsulating the drug by electrostatic interaction along with DNA. Moreover, photophysical properties of CD potentially enable tracking of hydrogel dissolution and drug cargo loading in hydrogel.



Scheme 1: Scheme for conjugation of C-rich ssDNA to CDs and hydrogel formation at neutral pH for Dox encapsulation.

The visually detectable sol-gel transition of CD-DNA hybrid hydrogel was achieved by varying the pH of the solution from alkaline to neutral. The *in vitro* time and pH dependent release profile of the drug from hydrogel was studied. While hydrogel was found to be stable for a month at normal physiological pH, complete dissolution and sustained release of the drug molecules were achieved over 10-11 days in acidic pH that is relevant to tumor microenvironment. The cell viability assay performed on HeLa cells shows their effective slow killing in presence of the Dox loaded hybrid hydrogel owing to favorable acidic pH for hydrogel disruption.

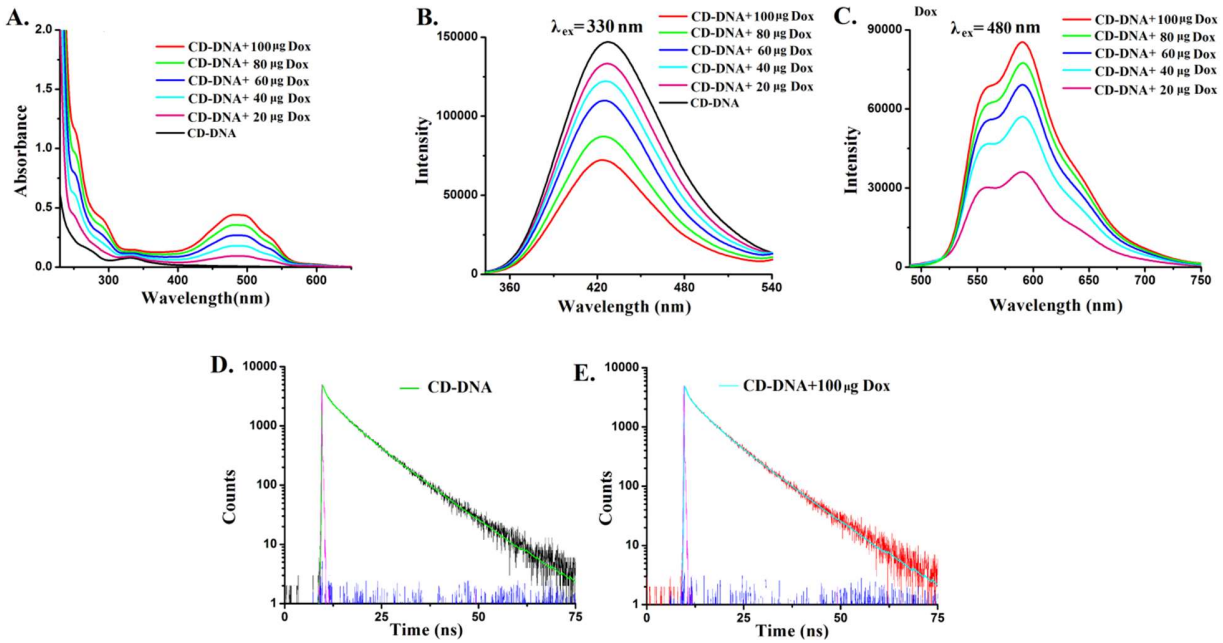


Fig. 1 A. UV-visible absorbance spectra **B.** Steady-state fluorescence spectra at λex = 330 nm **C.** Fluorescence spectra at λex = 480 nm of CD-DNA conjugate solution on addition of Dox. **D.**Time-resolved fluorescence decay of CD-DNA conjugate and **E.**Time-resolved fluorescence decay of Dox containing CD-DNA conjugate.

The conjugation of CD with DNA presents an economic and environment friendly way to create pH responsive hybrid hydrogel for drug delivery applications.