Electronic Supplementary Material (ESI) for RSC Advances.

Support information

Graphene Quantum Dots Mediated Electron Transfer in DNA Base Pairs

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Table S1. DNA Sequence Used in This Work

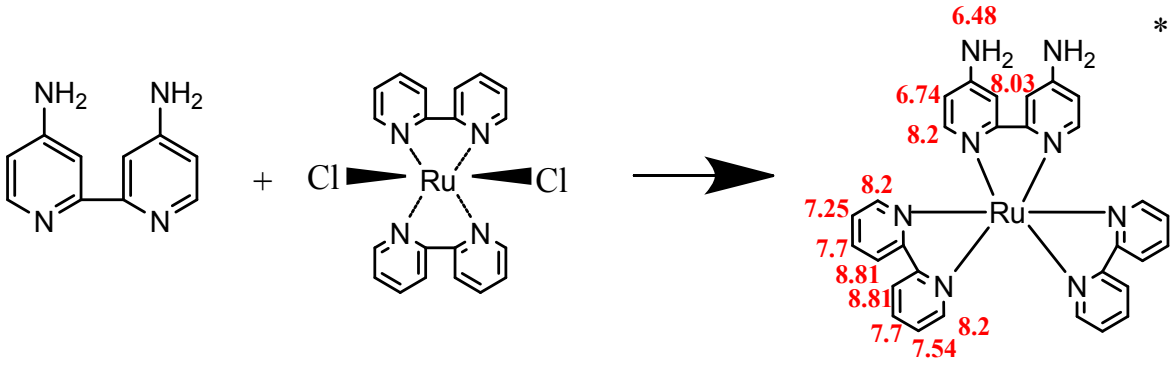
Name	Sequence
ssDNA-1	5' -CTC GGG GGC GCC AGC GGC CCC GGC TGC ATG AGC T***G***C AAG TGC GTG CTG AGC TGA GGA TCC -3'
ssDNA-2	5' -GGA TCC TCA GCT CAG CAC GCA CTT G -3'
ssDNA-3	5' -AGC TCA TGC AGC CGG GGC CGC TGG CGC CCC CGA G -3'
ssDNA-4	5' –GGA TCC TCA GCT CAG CAC GCA CTT G***C***A GCT CAT GCA GCC GGG GCC GCT GGC GCC CCC GAG -3'
ssDNA-5	5' –GGA TCC TCA GCT CAG CAC GCA CTT G***A***A GCT CAT GCA GCC GGG GCC GCT GGC GCC CCC GAG -3'

Abasic-DNA was obtained by hybridized of ssDNA-1, ssDNA-2, and ssDNA-3.

WM-DNA was obtained by hybridized of ssDNA-1 and ssDNA-4.

MM-DNA was obtained by hybridized of ssDNA-1 and ssDNA-5.

Synthesis of $[Ru(bpy)_2(bpy(NH_2)_2)]^{2+}$



* The red numbers labeled in schematic diagram of $[Ru(bpy)_2(bpy(NH_2)_2)]^{2+}$ was correspond to the chemical shift values (δ) of different hydrogen atoms in H NMR.

H NMR of $[Ru(bpy)_2(bpy(NH_2)_2)]^{2+}$

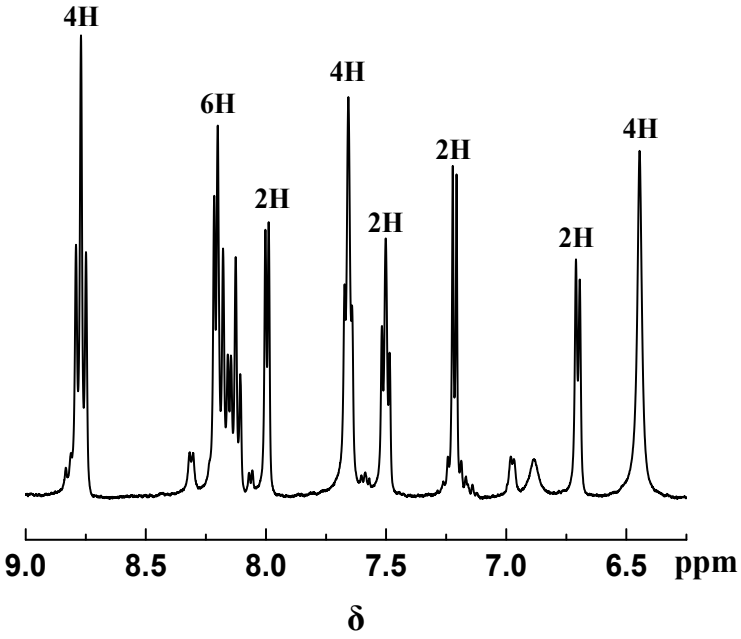


Fig. S-1. H NMR of $[Ru(bpy)_2(bpy(NH_2)_2)]^{2+}$

Fig.S-1 demonstrated the H NMR characterization of resulted $[Ru(bpy)_2(bpy(NH_2)_2)]^{2+}$. The detailed content was given below:

^{1}H NMR [400MHz,C_3D_6O]: δ=8.81 (t, J=8.32 Hz, 4 H,), 8.2 (m, 6 H), 8.03 (d, J=5.4 Hz, 2 H),6.48 (s, 4 H), 6.74(d, J=6.27 Hz, 2 H), 7.25 (d, J=6.4, 2 H,), 7.54 (t, J=6.4 Hz, 2 H), 7.70 (t, J=6.2 Hz, 4 H)

There are 4, 6, 2, 4, 2, 2, 2, 4 hydrogen atoms resonating at 8.81, 8.2, 8.03, 7.7, 7.54, 7.25, 6.74, 6.48 ppm, respectively, which was consistent with the expected number and the type of different hydrogen atoms existed in $[Ru(bpy)_2(bpy(NH_2)_2)]^{2+}$. Therefore, the H NMR data indicated the successful synthesis of $[Ru(bpy)_2(bpy(NH_2)_2)]^{2+}$.

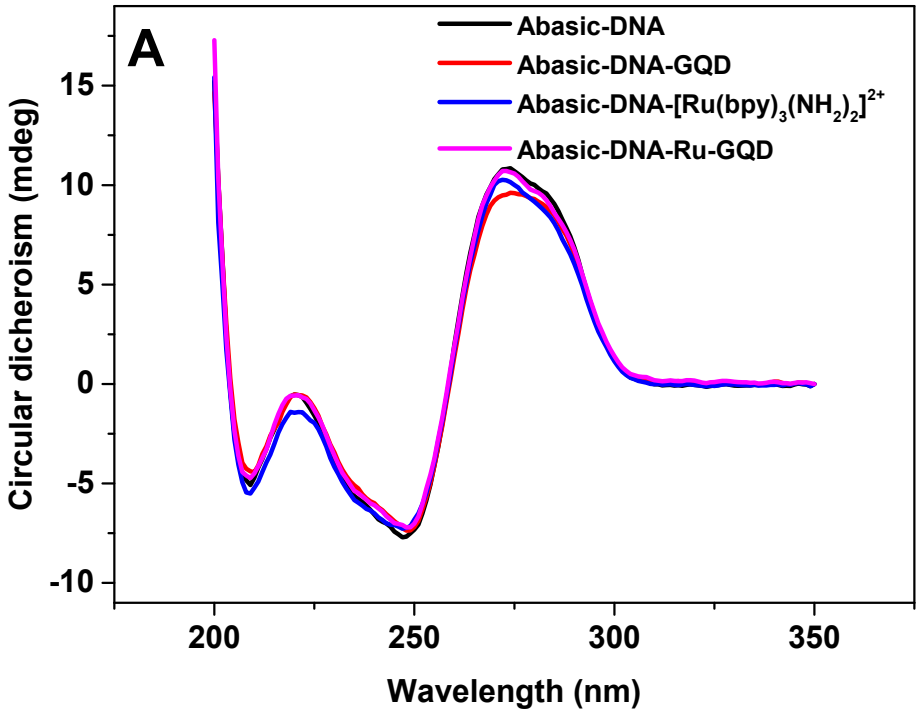


Fig.S-2 CD spectra of the Abasic-DNA and Abasic-DNA-Ru-GQD.

Polyacrylamide gel electrophoresis detection of DNA

Approximately 10 mL of gel solution is needed to cast each gel. The final concentration of each gel is 20% (w/v) acrylamide (29:1), 1× TBE buffer, 0.7% (w/v) ammonium persulfate, and 0.065% (w/v) TEMED. Immediately after the incorporation of the ammonium persulfate and TEMED, the gel solution is mixed and poured directly between the glass plates. A 10-tooth comb is placed between the

plates and two additional spring clamps are used to hold the comb tightly against the back plate. The plate sandwich with gel solution is then kept at room temperature for about 40 min to allow gel polymerization. DNA samples are loaded with a standard pipette, loading volume can be up to 5 μL. Electrophoresis is performed at approximately 40 V for 8 h.

Synthesis of $[Ru(bpy)_2(bpy(NH_2)_2)\text{-}GQD]^{2+}$

$[Ru(bpy)_2(bpy(NH2)_2)\text{-}GQD]^{2+}$ complex was used to investigate the interaction relationship between GQDs and DNA. Therefore, the ratio of $[Ru(bpy)_2(bpy(NH_2)_2)]^{2+}$ to GQDs has a great influence on subsequent studies. Therefore, the ratio of $[Ru(bpy)_2(bpy(NH_2)_2)]^{2+}$ and GQDs in the synthetic process was optimized (as shown in Figure S-3). As can be seen the UV absorption peak of GQDs and $[Ru(bpy)_2(bpy(NH_2)_2)]^{2+}$ was same intensity when the ratio of them is 1:5(CGQDs=0.083μg/mL).

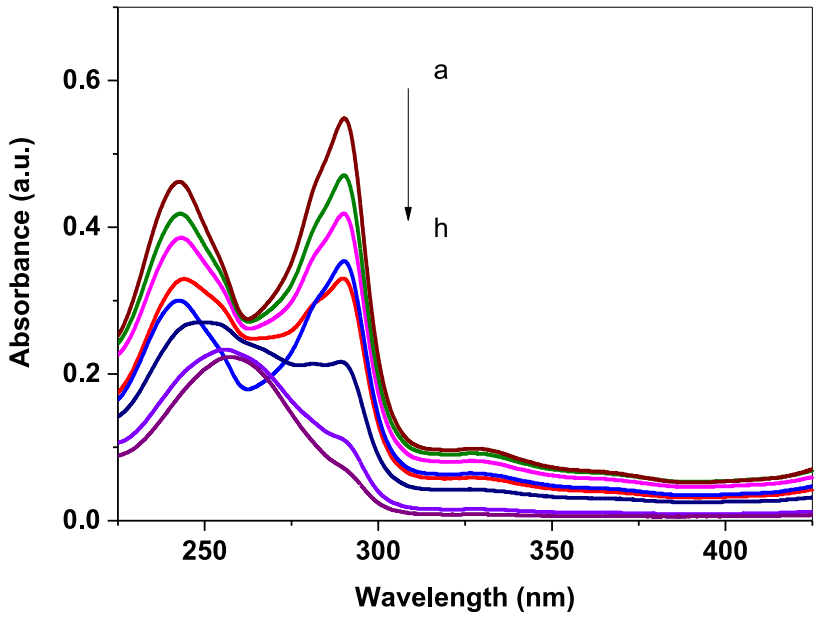


Fig.S3 Ultraviolet-visible absorption spectrum of $[Ru(bpy)_2(bpy(NH_2)_2)]^{2+}$ with difference concentration of GQDs from (a) to (h)(0、0.09、0.017、0.033、0.5、0.067、0.083、0.091μg/mL).