# Supporting information

# Self-Assembled Catalytic DNA Nanostructures for Synthesis of Para-Directed Polyaniline

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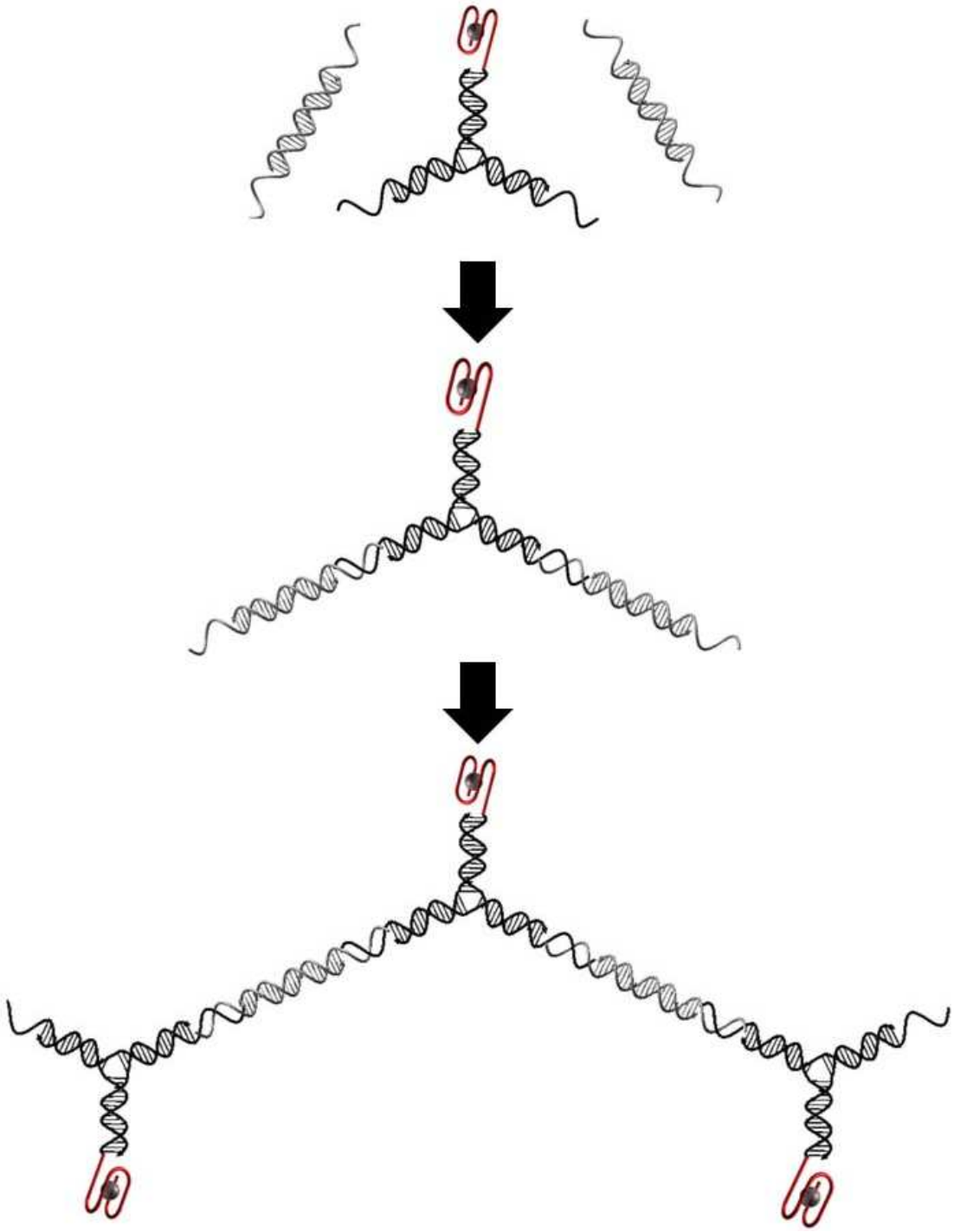
Sequences composing template **(1), (2) or (3).** Red sequence represents the DNAzyme.

| | |
|---|---|
| Template (**1**) | **CATGCCGGTATTTAAAGCCT TT CGAAGATATCGTGGTTCGAG** |
| | **CTCGAACCACGATATCTTCG TT ATAACAGCTGCTGCAGCTCG** |
| | **GGGTAGGGCGGGTTGGG CGAGCTGCAGCAGCTGTTAT TT AGGCTTTAAATACCGGCATG** |
| Template (**2**) | **TCATCGATCCAGATACGGAACTGCATC CATGCCGGTATTTAAAGCCT TT CGAAGATATCGTGGTTCGAG** |
| | **GTACATAGGCATCGACCTAAGATGACA CTCGAACCACGATATCTTCG TT ATAACAGCTGCTGCAGCTCG** |
| | **GGGTAGGGCGGGTTGGG CGAGCTGCAGCAGCTGTTATTT AGGCTTTAAATACCGGCATG** |
| | **GATGCAGTTCCGTATCTGGATCGATGA GCTCGACACTTCACGAGGTC TGTACACG** |
| | **GATGCAGTTCCGTATCTGGATCGATGA CGTGTACAGACCTCGTGAAGTGTCGAGC** |
| Template (**3**) | **TCATCGATCCAGATACGGAACTGCATC CATGCCGGTATTTAAAGCCT TT CGAAGATATCGTGGTTCGAG** |
| | **GTACATAGGCATCGACCTAAGATGACA CTCGAACCACGATATCTTCG TT ATAACAGCTGCTGCAGCTCG** |
| | **GGGTAGGGCGGGTTGGG CGAGCTGCAGCAGCTGTTATTT AGGCTTTAAATACCGGCATG** |
| | **GATGCAGTTCCGTATCTGGATCGATGA GCTCGACACTTCACGAGGTC TGTACACG** |
| | **GATGCAGTTCCGTATCTGGATCGATGA CGTGTACAGACCTCGTGAAGTGTCGAGC** |
| | **TGTCATCTTAGGTCGATGCCTATGTAC GCACATGTCTGGAGCACTTCACAGCTCG** |
| | **TGTCATCTTAGGTCGATGCCTATGTAC CGAGCTGTGAAGTGCTCCAGACATGTGC** |
| Template (**4**) | **GGGTAGGGCGGGTTGGG CGAGCTACAGCATCTGTTAT TT AGGCTTTAAATACCGGCATG** |
| Template (**5**) | **GGGTAGGGCGGGTTGGG** |

**Schematic assembly process of template (3)**



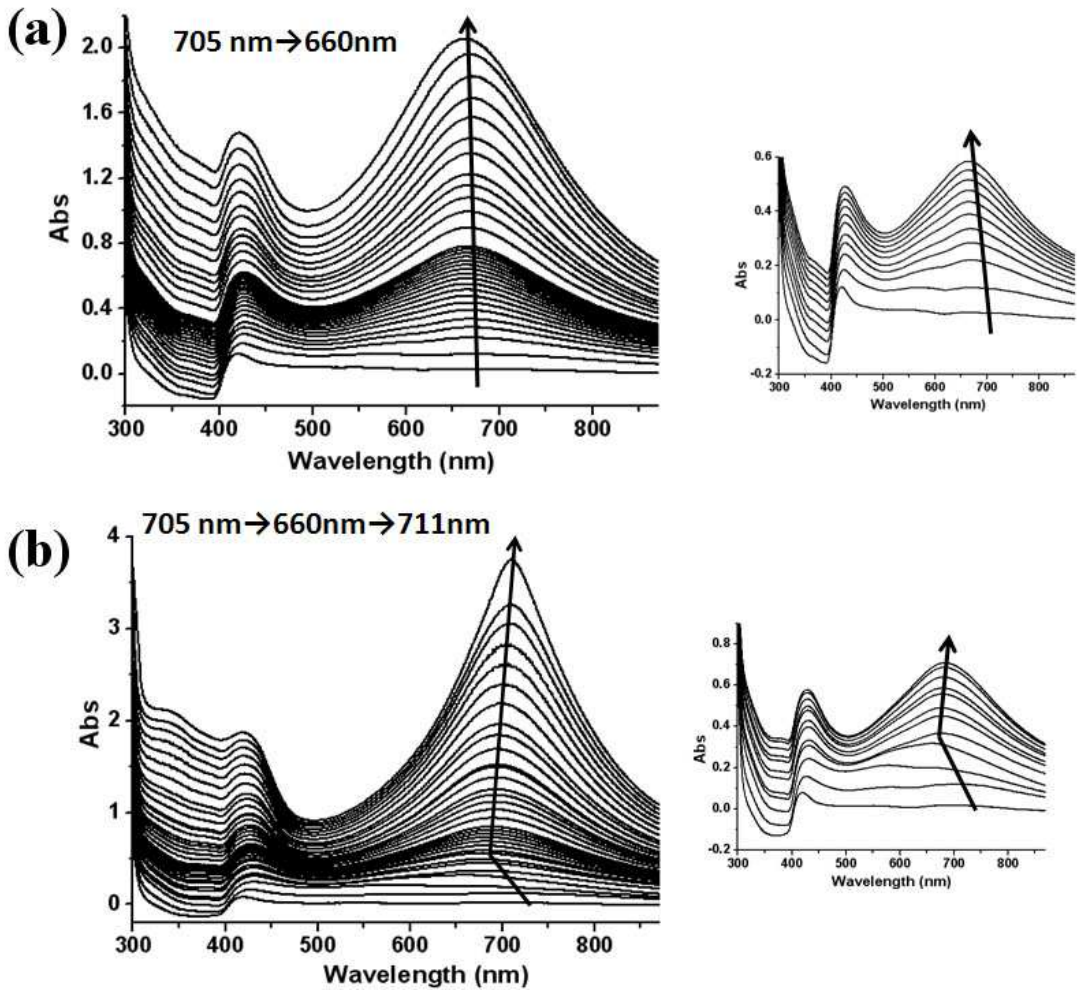



Figure S1 Kinetics of PANI growth on template **(1)** (a) and template **(3)** (b) respectively. During the process of (a), The PANI characteristic polaron absorption bands at ca. 420 nm and 705 nm, appears in the initial stage, and light green color was observed for the reaction solution. As the reaction proceeds, the bands in the range of 705-400 nm are intensified. Moreover, a blue shift was observed for the absorption from 705 nm to 665 nm, probably due to the formation of branched structures and less interaction between the resultant PANI and DNA backbone. After ca. 14 h, the absorption reaches a saturated value, followed by the precipitation of the green products. The saturated absorbance is attributed to the covering of negatively charged DNA backbone by PANI. Therefore, the further growth of PANI is prohibited.

During the process of (b), the blue shift and subsequent red shift are observed. The right figures in (a) and (b) represents the spectra of initial stage of growth.

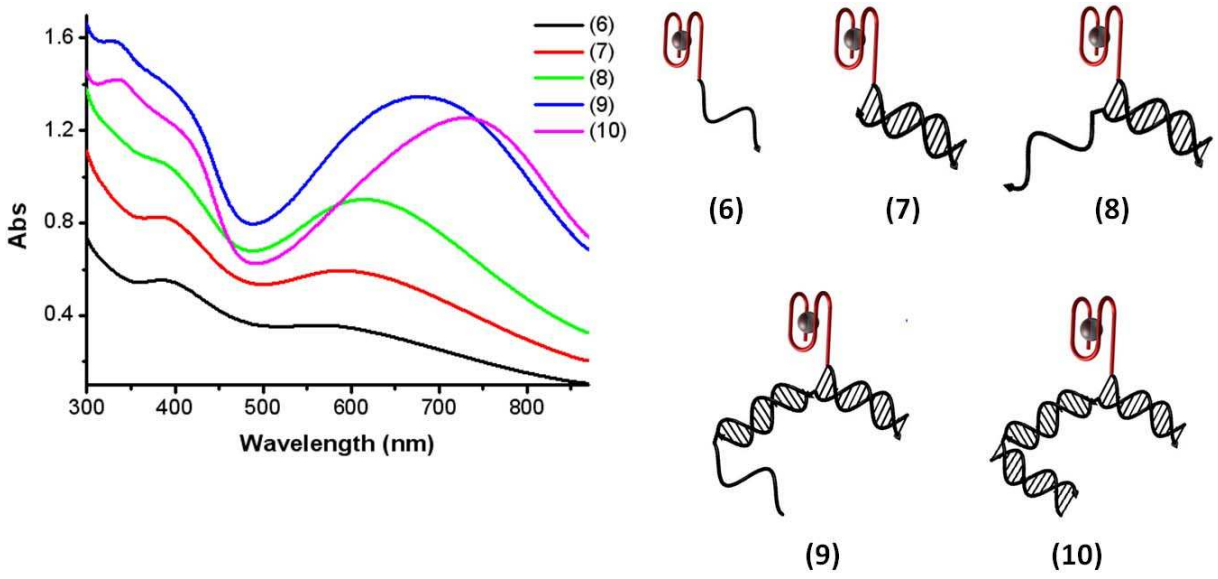



Figure S2: Effect of the template configurations on the UV-vis spectra of PANI. From template **(6)** to **(10)**, the duplex around the DNAzyme site increases, indicating the increase of charge density. Correspondingly, at neutral pH, PANI becomes more doped. This indicates the manipulation of the configurations of DNA assembly can control the resultant molecular structure of PANI.

Sequences composing the templates (6)-(10). Red sequence represents the DNAzyme.

**(6)**: GGGTAGGGCGGGTTGGG CGAGCTACAGCATCTGTTGG

**(7)** GGGTAGGGCGGGTTGGG CGAGCTACAGCATCTGTTGG
CCAACAGATGCTGTAGCTCG

**(8)** GGGTAGGGCGGGTTGGG CGAGCTACAGCATCTGTTGG
CCAACAGATGCTGTAGCTCG ACTCAATGCCTGACGTTCCA

**(9)** GGGTAGGGCGGGTTGGG CGAGCTACAGCATCTGTTGG
CCAACAGATGCTGTAGCTCG ACTCAATGCCTGACGTTCCA
TGGAACGTCAGGCATTGAGT GTACGATAGCGCGATCTACC

**(10)** GGGTAGGGCGGGTTGGG CGAGCTACAGCATCTGTTGG
CCAACAGATGCTGTAGCTCG ACTCAATGCCTGACGTTCCA
TGGAACGTCAGGCATTGAGT GTACGATAGCGCGATCTACC
GGTAGATCGCGCTATCGTAC

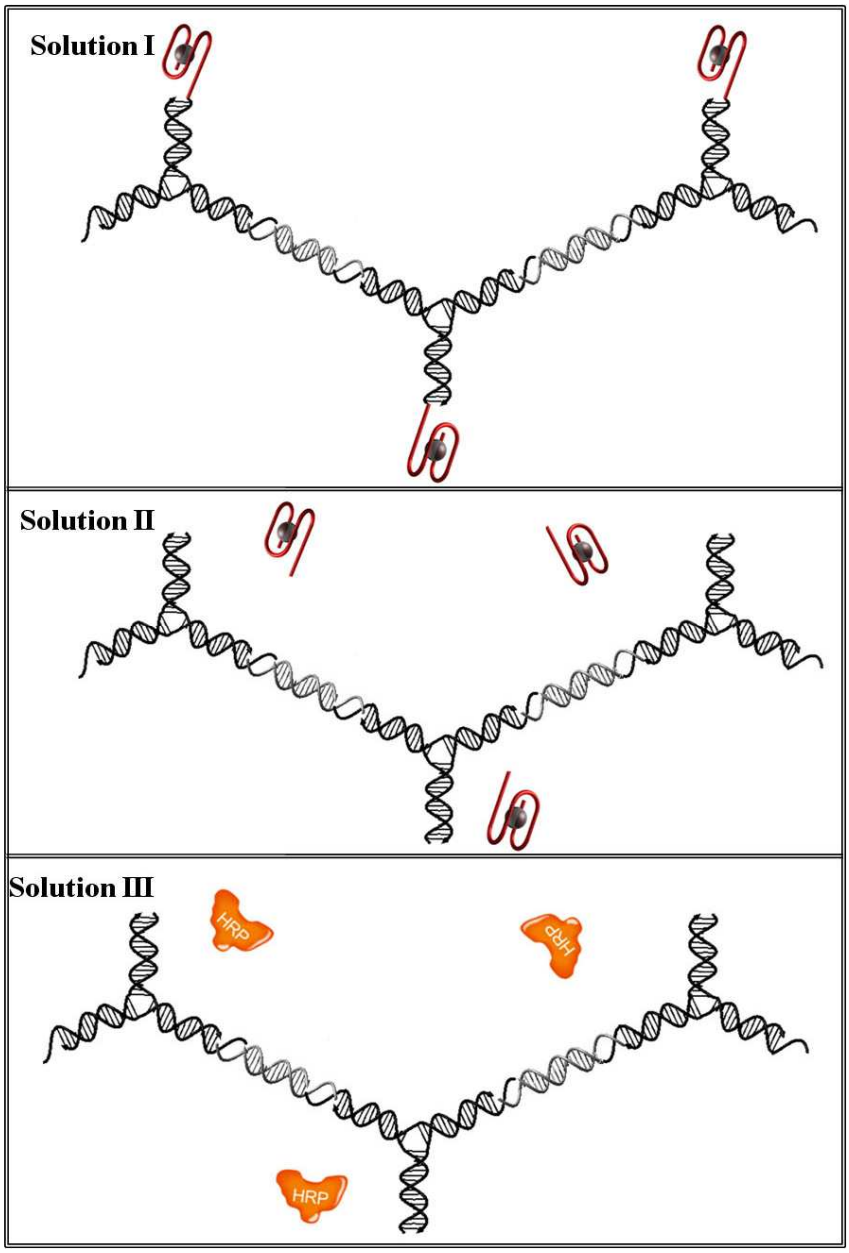



Figure S3. In solution I, DNAzyme is assembled to the template. In solution II, DNAzyme is separated from the template. In solution III, HRP, instead of DNAzyme, coexists with template. Spectroscopic results show that only solution I, emeraldine form of PANI is formed and in solution II and III, branched PANI is generated.

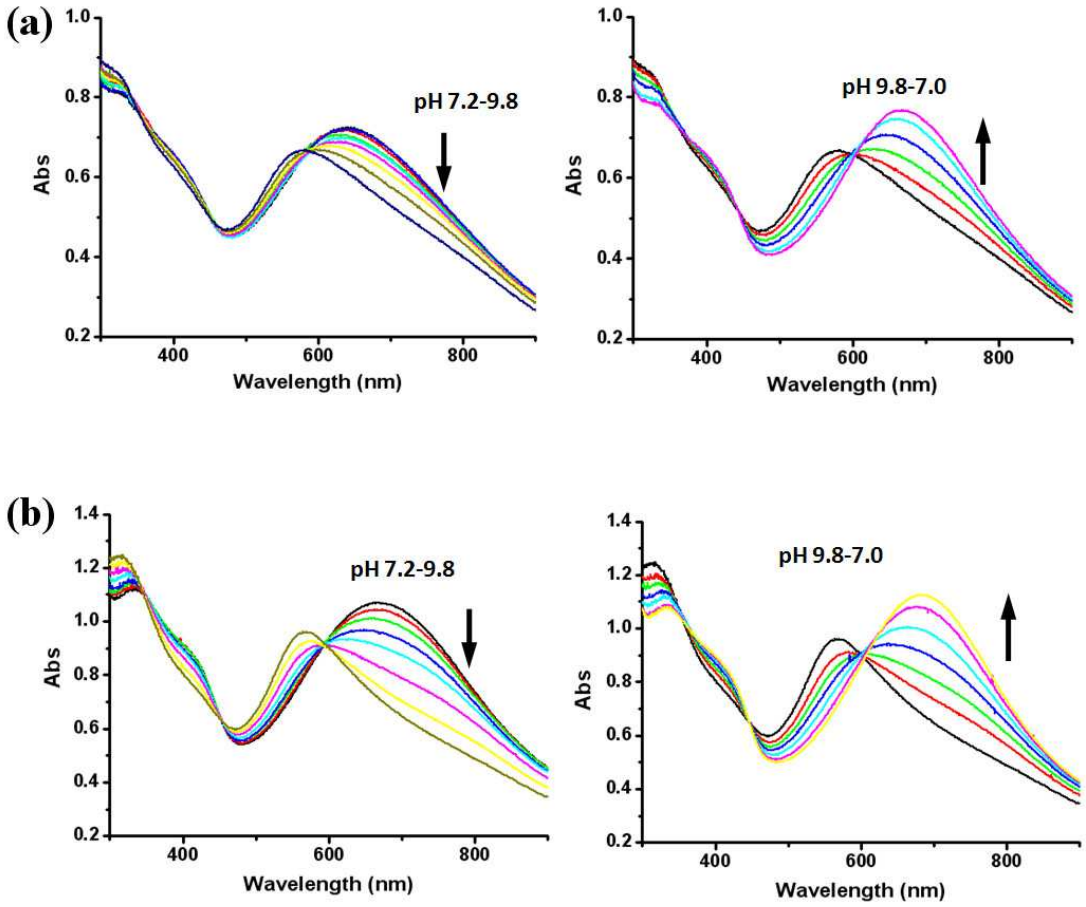



Figure S4. Stepwise dedoping and redoping of PANI synthesized on template **(1)** (a) and **(2)** (b).

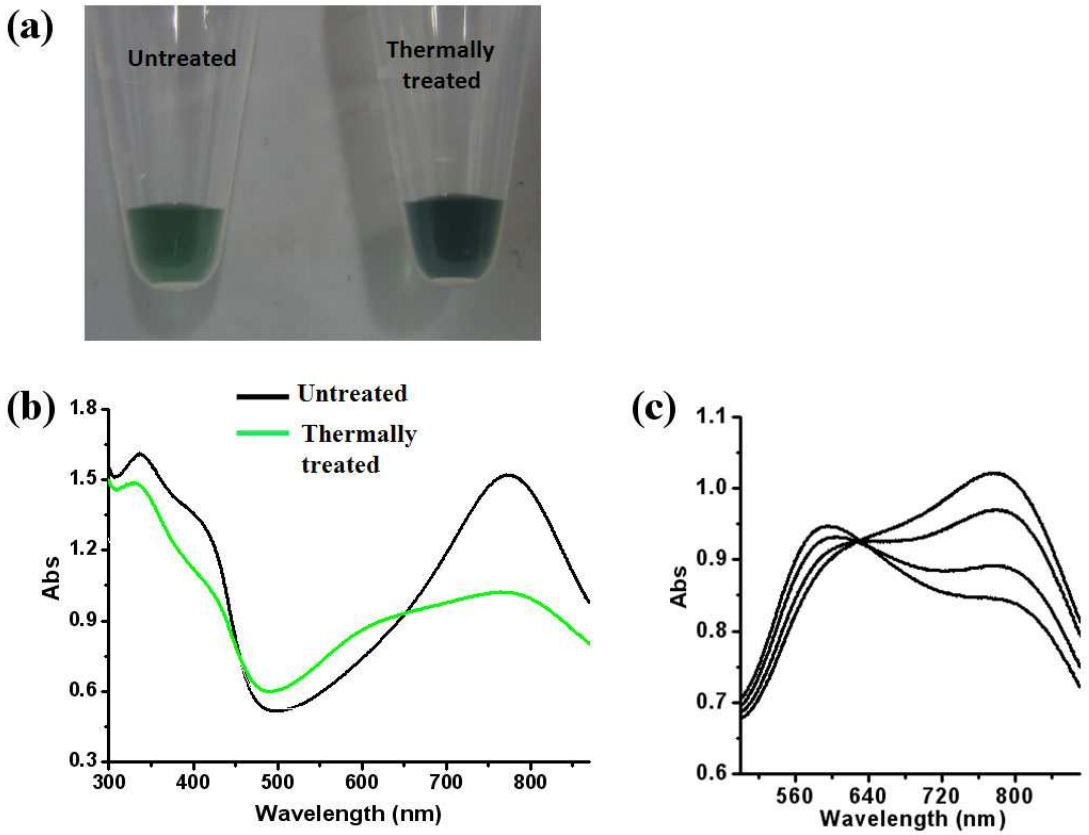



Figure S5. (a) Color change after the PANI/**(3)** was thermally treated. (b) The corresponding UV-vis spectra. After PANI/(3) was annealed, the spectrum (green) is similar to the intermediate state of PANI dedoping (c). This suggests the interaction between PANI and DNA was changed, leading to the change of the doping state of PANI.

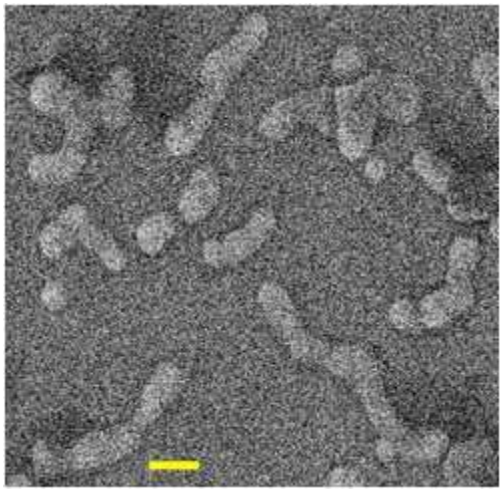


Figure S6. SEM image of PANI synthesized on template (3). This not only demonstrates that PANI nanowire was generated by DNA nanoassemblies, but also indirectly indicates the conductivity of PANI. Scale bar: 200nm