

## **Supporting Information**

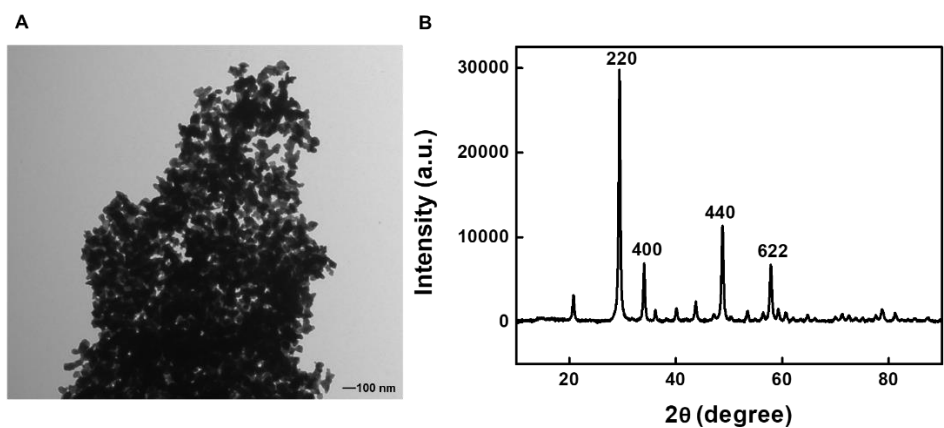
### **Yttrium Oxide as a Strongly Adsorbing but Non-quenching Surface for DNA Oligonucleotides**

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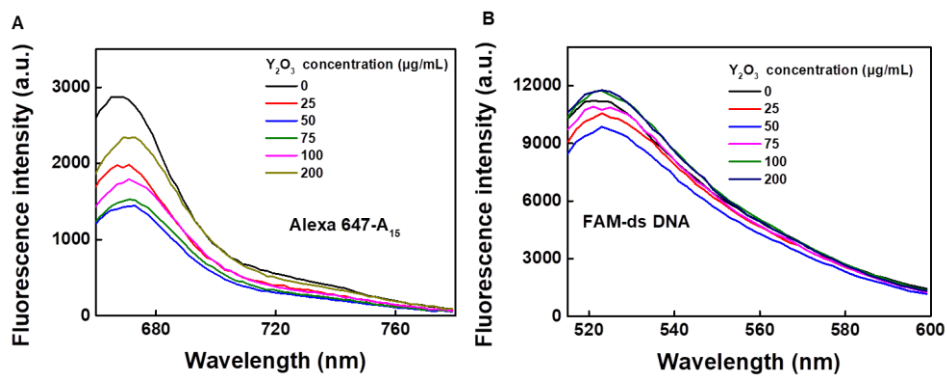
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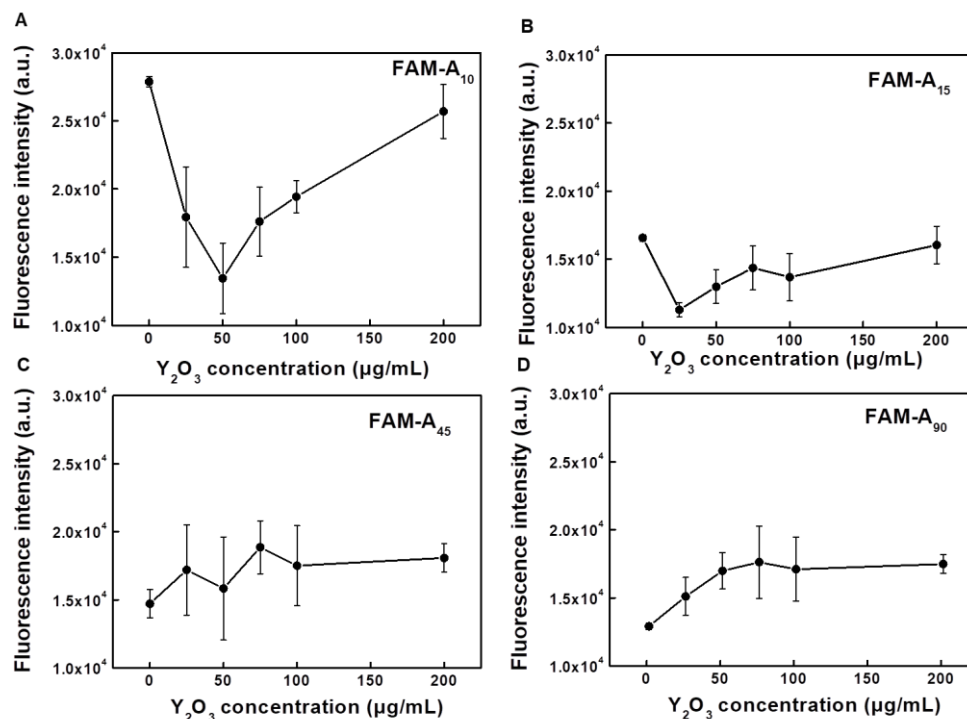
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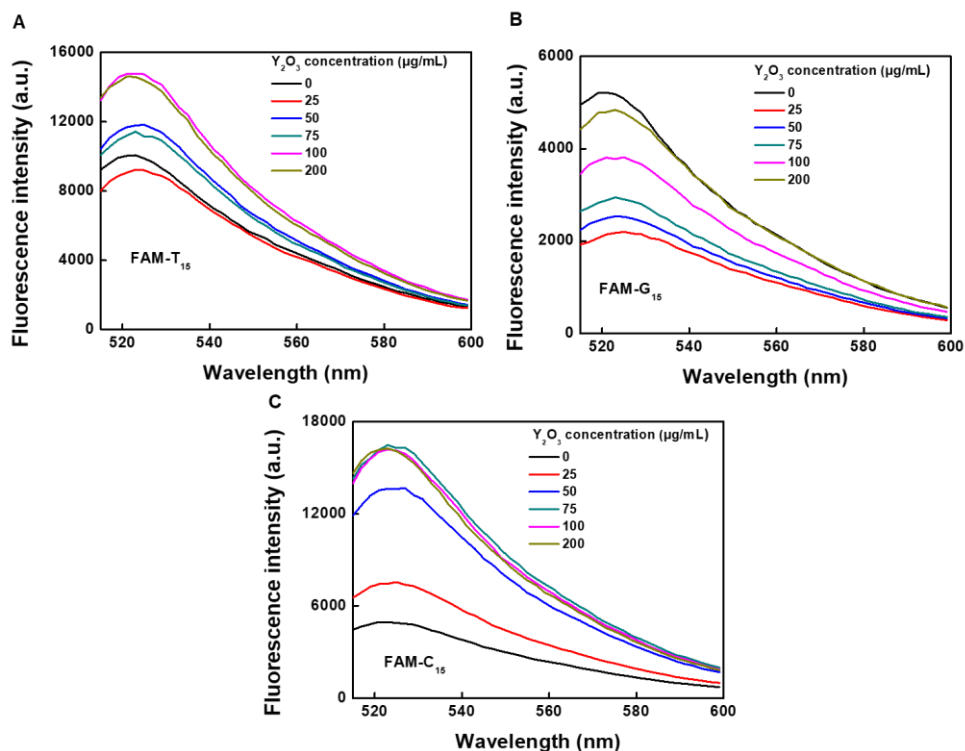
**Figure S1** (A) A TEM micrograph, and (B) XRD pattern of the  $\text{Y}_2\text{O}_3$  nanoparticles used in this work.



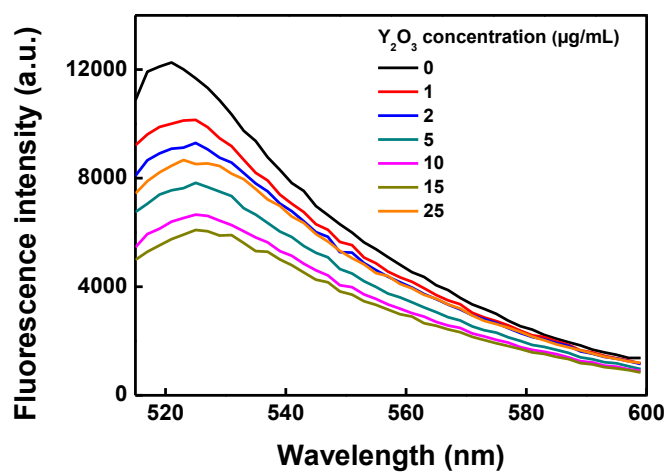
**Figure S2** Fluorescence spectra of (A) Alexa 647- $\text{A}_{15}$  and (B) FAM-ds DNA at different concentrations of  $\text{Y}_2\text{O}_3$  at pH 7.6 (HEPES, 10 mM).



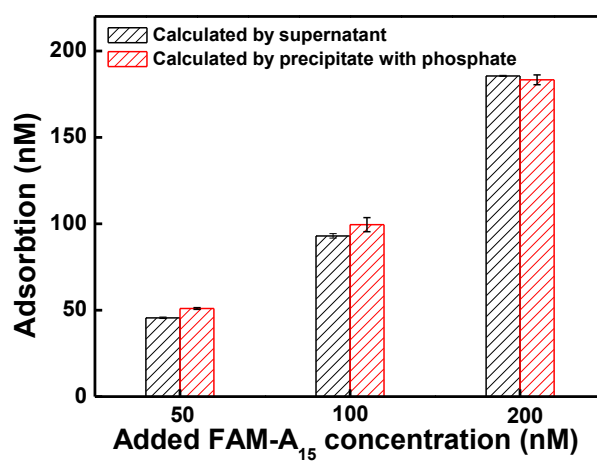
**Figure S3** Comparisons of fluorescence intensity of FAM labeled poly-A DNA sequences (20 nM) with different lengths at different concentrations of  $Y_2O_3$  ( $\lambda_{em} = 520$  nm) at pH 7.6 (HEPES, 10 mM).



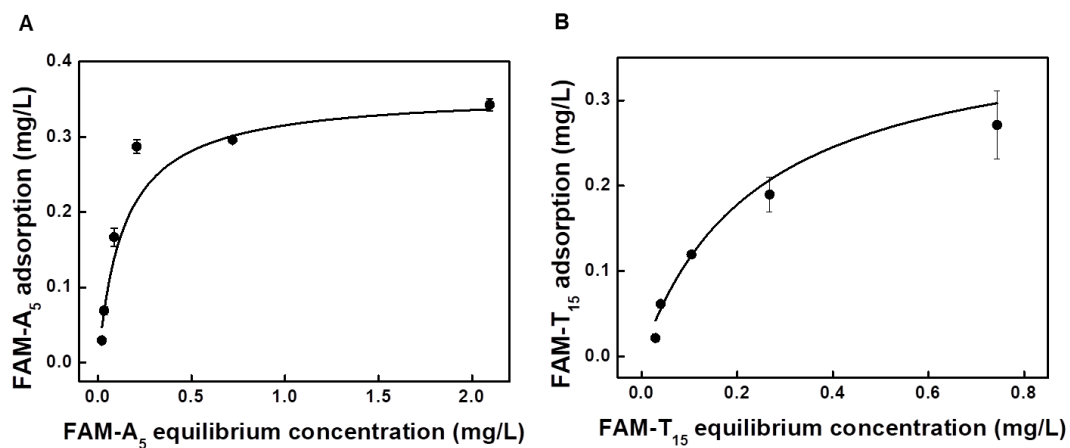
**Figure S4** Fluorescence spectra of 20 nM (A) FAM-T<sub>15</sub> (B) FAM-G<sub>15</sub> (C) FAM-C<sub>15</sub> with the addition of different concentrations of  $Y_2O_3$  at pH 7.6 (HEPES, 10 mM).



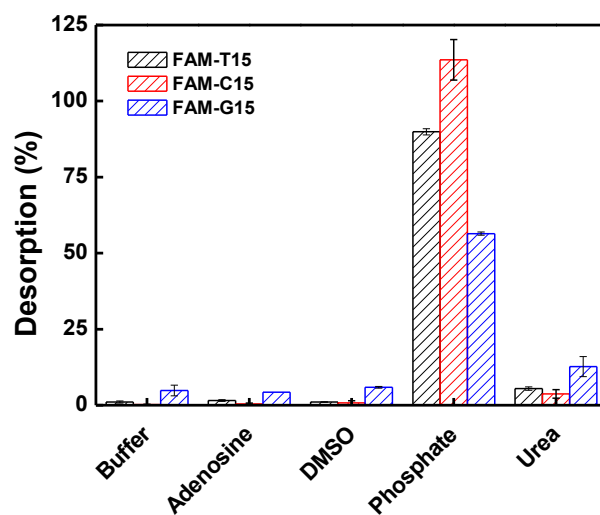
**Figure S5** Fluorescence spectra of 20 nM FAM-A<sub>15</sub> in the presence of low concentrations of Y<sub>2</sub>O<sub>3</sub> at pH 7.6 (HEPES, 10 mM). Most quenching was observed with 15 µg/mL Y<sub>2</sub>O<sub>3</sub>.



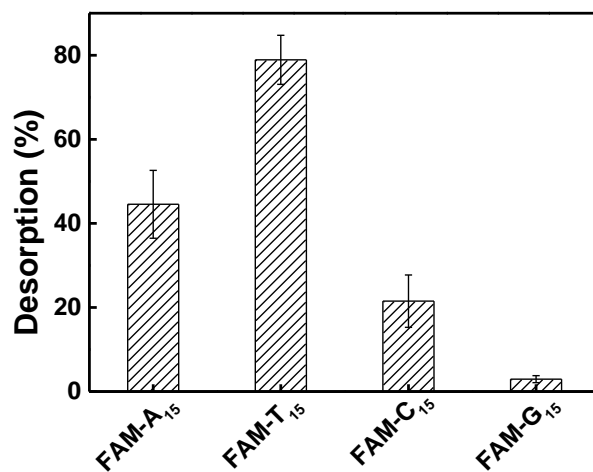
**Figure S6** A comparison of adsorbed DNA calculated by measuring DNA in the supernatant or released DNA from the precipitate.



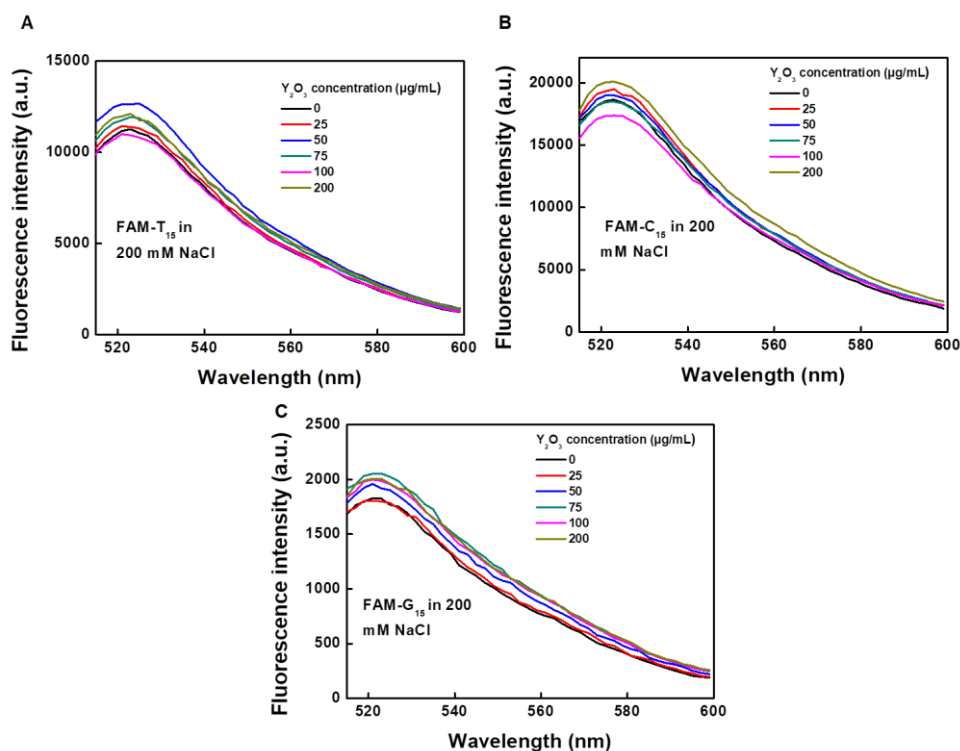
**Figure S7** The adsorption isotherm of (A) FAM-A<sub>5</sub> and (B) FAM-T<sub>15</sub> on Y<sub>2</sub>O<sub>3</sub> (50 µg/mL) at pH 7.6 (HEPES, 10 mM).



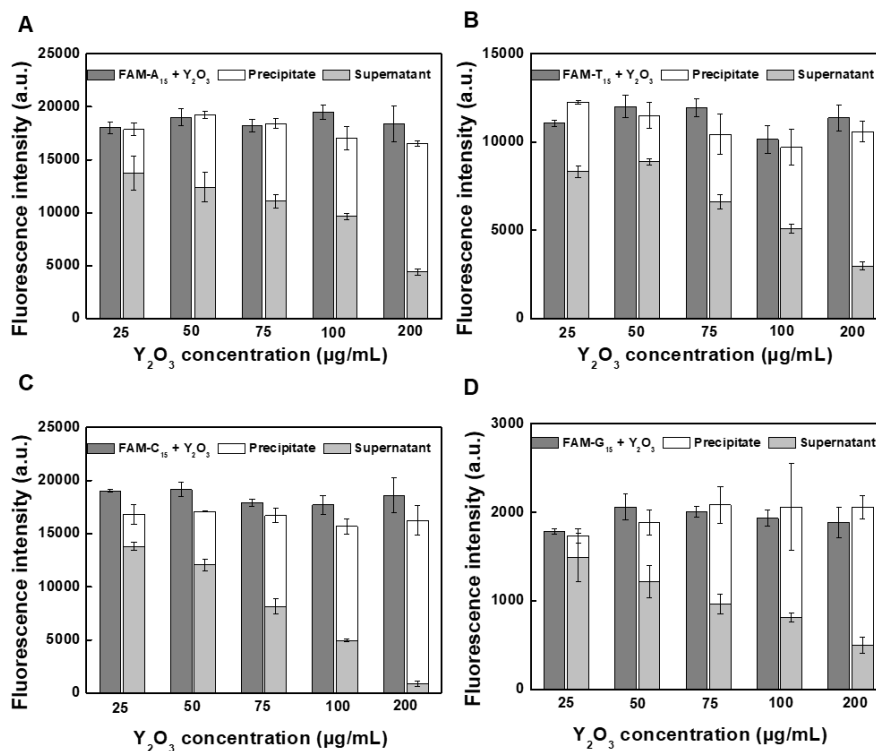
**Figure S8** The desorption percentage of FAM-T<sub>15</sub>, FAM-C<sub>15</sub> and FAM-G<sub>15</sub> from Y<sub>2</sub>O<sub>3</sub> (200 µg/mL) after adding buffer, and the buffer with 1 mM adenosine, 5 mM phosphate, 4 M urea, or 50% DMSO at pH 7.6 (HEPES, 10 mM).



**Figure S9** The desorption percentage of FAM-A<sub>15</sub>, FAM-T<sub>15</sub>, FAM-C<sub>15</sub> and FAM-G<sub>15</sub> from Y<sub>2</sub>O<sub>3</sub> (200 µg/mL) after adding 100 µM phosphate at pH 7.6 (HEPES, 10 mM).

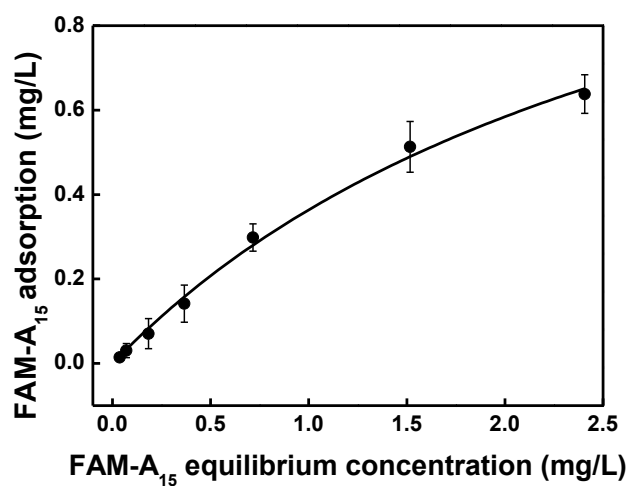


**Figure S10** Fluorescence spectra of (A) FAM-T<sub>15</sub> (B) FAM-C<sub>15</sub> (C) FAM-G<sub>15</sub> at different concentrations of Y<sub>2</sub>O<sub>3</sub> in high salt buffer (NaCl, 200 mM) at pH 7.6 (HEPES, 10 mM).



**Figure S11** A comparison of the fluorescence intensity of the FAM-DNA ((A) FAM-A<sub>15</sub>; (B) FAM-T<sub>15</sub>; (C) FAM-C<sub>15</sub>; (D) FAM-G<sub>15</sub>) at different concentrations of Y<sub>2</sub>O<sub>3</sub> in high salt buffer (NaCl, 200 mM) at pH 7.6 (HEPES, 10 mM).

FAM-T<sub>15</sub> (C) FAM-C<sub>15</sub>; (D) FAM-G<sub>15</sub>) and Y<sub>2</sub>O<sub>3</sub> mixture before and after centrifugation in high salt buffer (NaCl, 200 mM) at pH 7.6 (HEPES, 10 mM). The sum of the re-dispersed precipitates and the supernatants was a constant value indicating no quenching. Interestingly, most efficient adsorption was observed with FAM-C<sub>15</sub> in this high salt buffer, consistent with its strong adsorption affinity on many surfaces.



**Figure S12** Adsorption isotherm of Y<sub>2</sub>O<sub>3</sub> (50 µg/mL) for FAM-A<sub>15</sub> in 200 mM NaCl at pH 7.6 (HEPES, 10 mM).