Supplementary Materials

for

Turn-off/turn-on Biosensing of Tetracycline and Ciprofloxacin Antibiotics by Fluorescent Iron Oxide Quantum Dots

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Table S1. Determination results of TCy and CPx in the real sample (n=3)

Antibiotic	Real Samples	Amount found (μM)	Added (μM)	Total found (μM)	Recovery (%)	RSD (%)
TCy	Drinking water	0	1	1.14 ± 0.01	114.33 ± 0.57	0.50
	Honey	0	10	11.77 ± 0.09	117.7± 0.95	0.81
CPx	Drinking water	0	1	1.12 ± 0.03	98.03 ± 0.75	0.76
	Honey	0	10	9.80 ± 0.08	112.67± 2.51	2.23

Figure S1

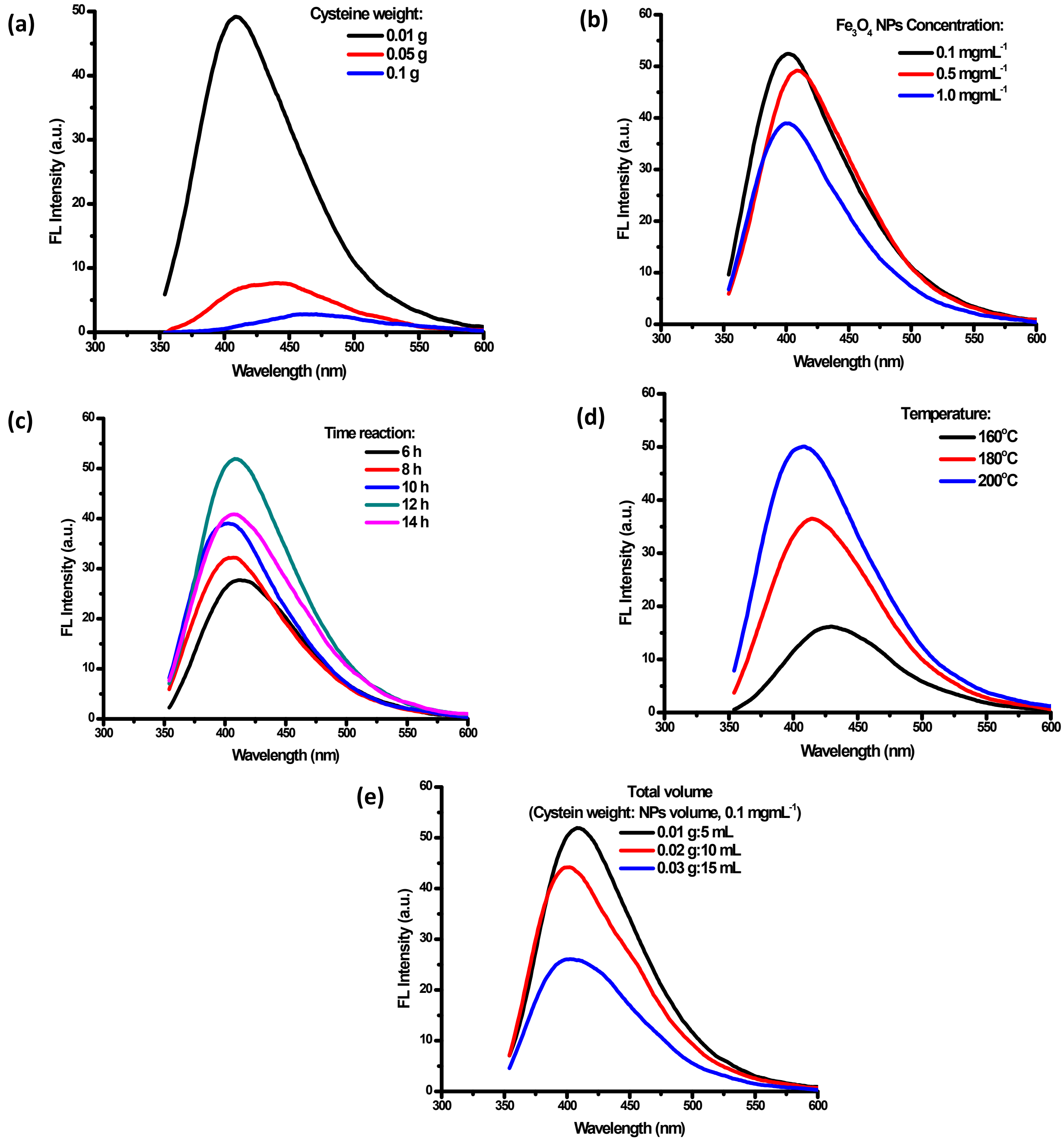


Figure S1. Synthetic condition of (a) cysteine weight (Fe_3O_4 NPs=0.5 mgmL^{-1}, 5 mL, t=12h, T=200^{o}C). (b) Fe_3O_4 NPs (cysteine weight=0.01 g, t=12 h, T=200^{o}c). (c) reaction time (cysteine weight=0.01 g, Fe_3O_4 NPs=0.1 mgmL^{-1}, 5 mL, T= 200^{o}C). (d) temperature (cysteine weight=0.01 g, Fe_3O_4 NPs=0.1 mgmL^{-1}, 5 mL, t= 12 h). (e) total volume (t=12 h, T=200^{o}C)

Figure S2

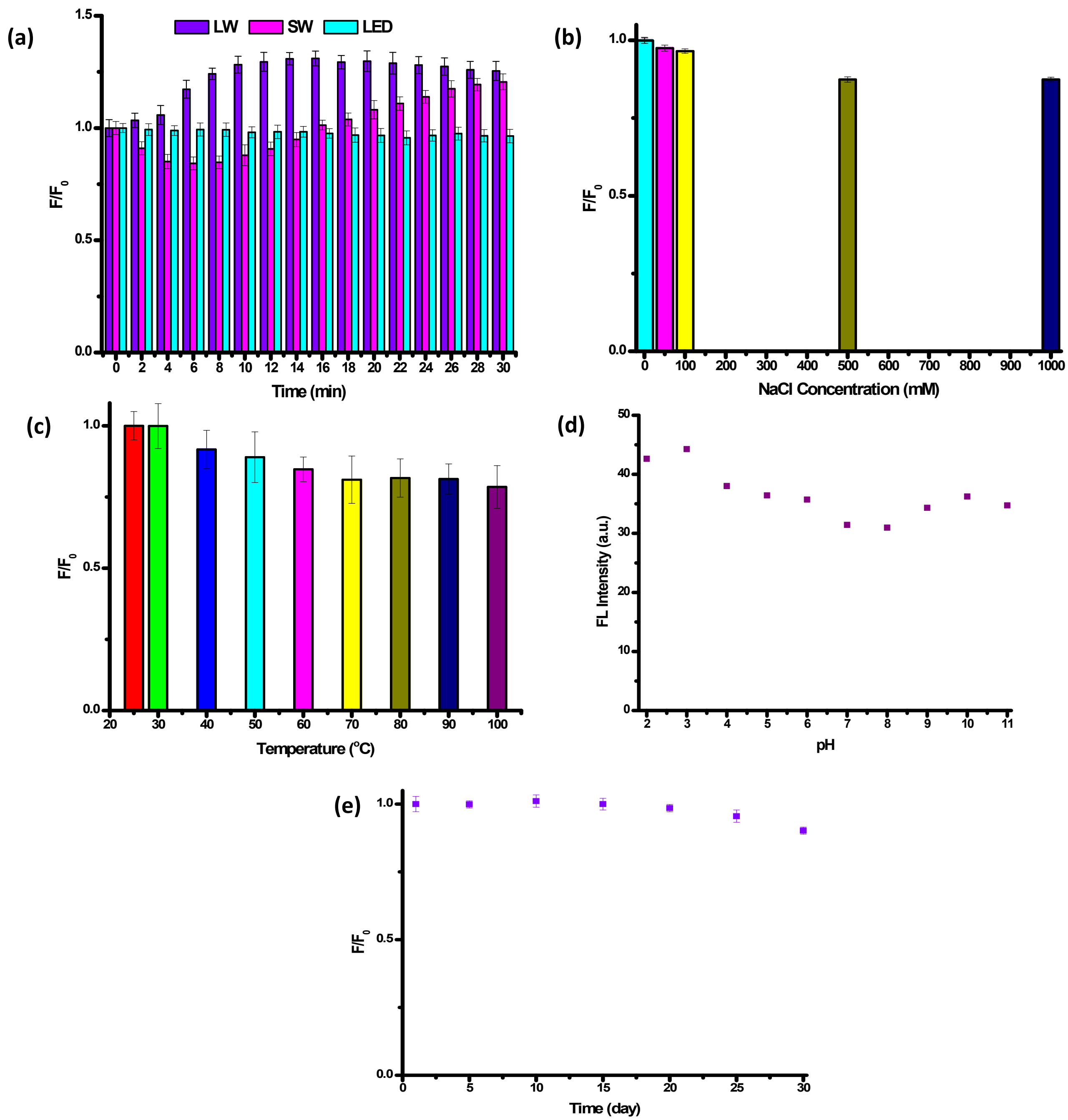


Figure S2. (a) photostability of IO-QDs. (b) the ionic strength of IO-QDs. (d) thermal stability of IO-QDs. (d) pH stability of IO-QDs. (e) long term stability of IO-QDs

Figure S3

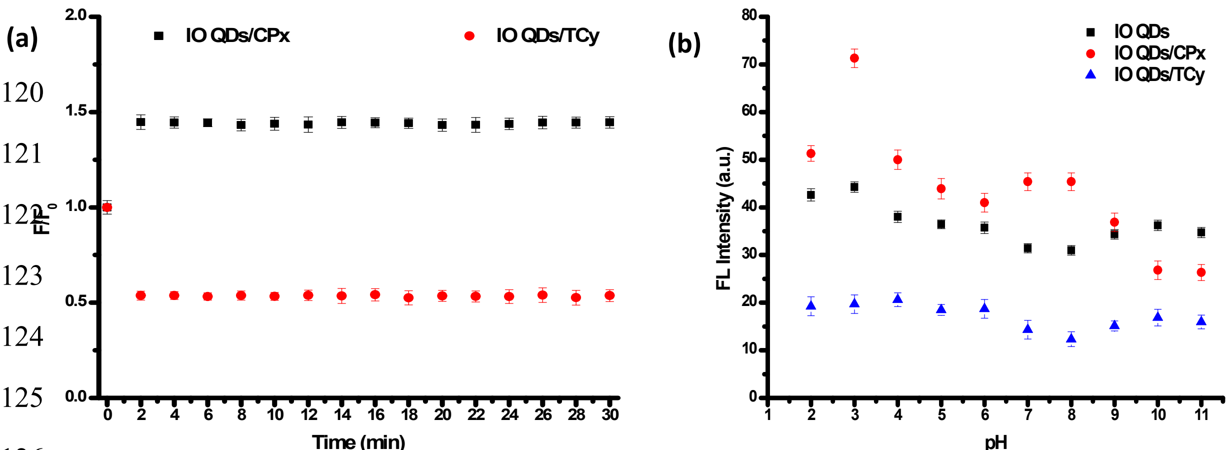
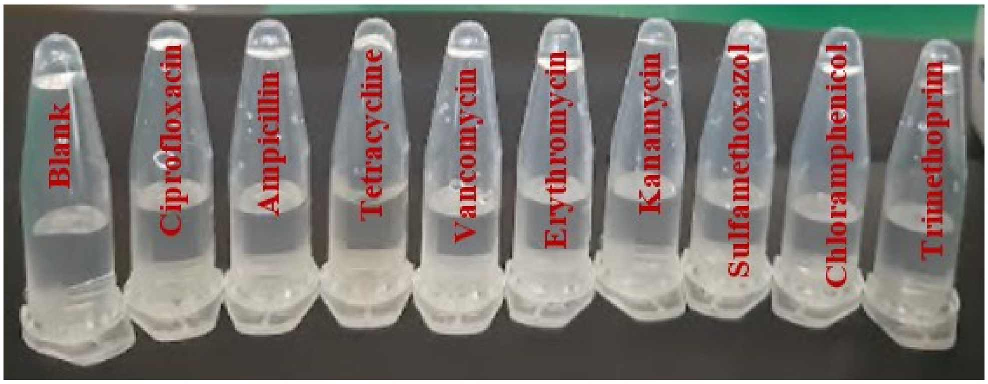


Figure S3. Effect of (a) time reaction (0-30 min) after adding TCy and CPx at a concentration of 500 µM, respectively. (b) pH value (2-11) of IO-QDs, IO-QDs/CPx, and IO-QDs/TCy system on fluorescence intensity at a concentration of 500 µM.

Figure S4

(a)



(b)

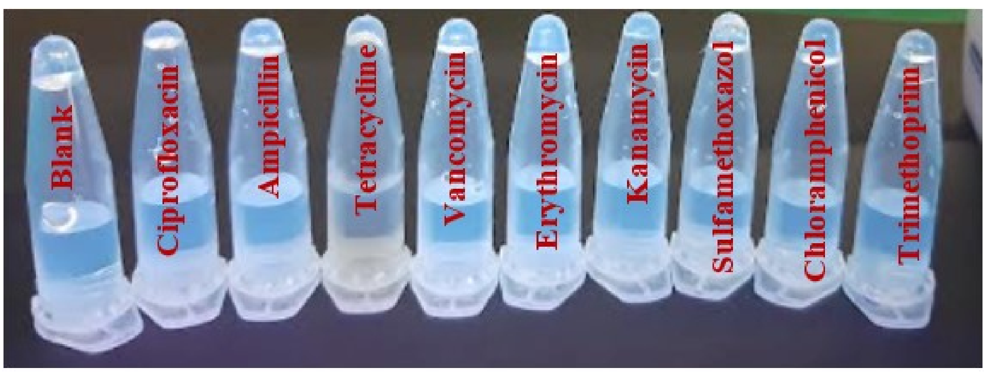


Figure S4. IO-QDs solution in the absence and presence of various antibiotics at 200 μM under (a) daylight. (b) UV light (λ=365 nm)

Figure S5

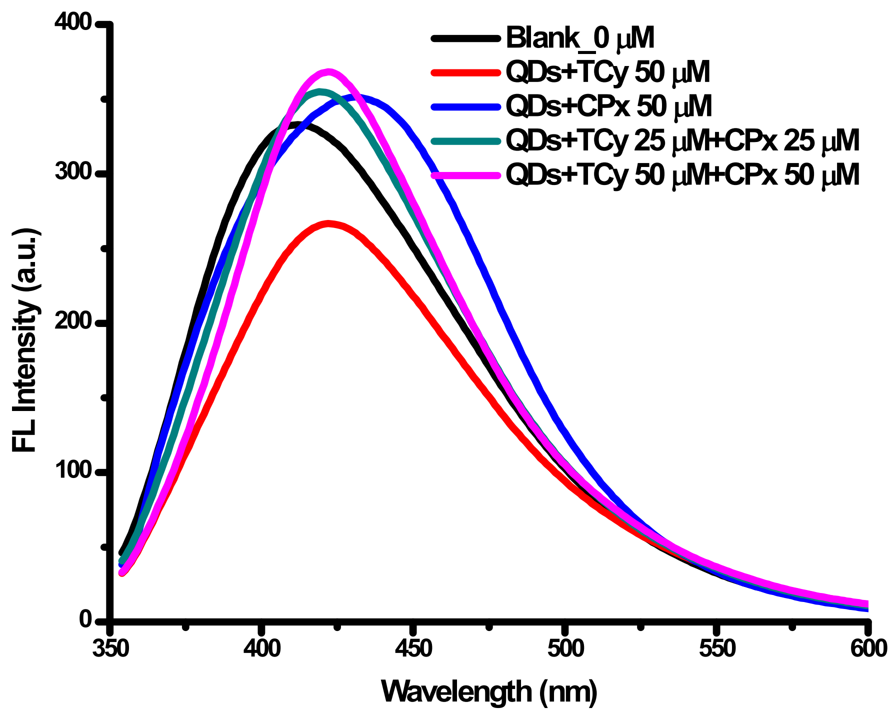


Figure S5. Spectra of IO-QDs probe with TCy, CPx, and TCy/CPx mixture, respectively

Figure S6

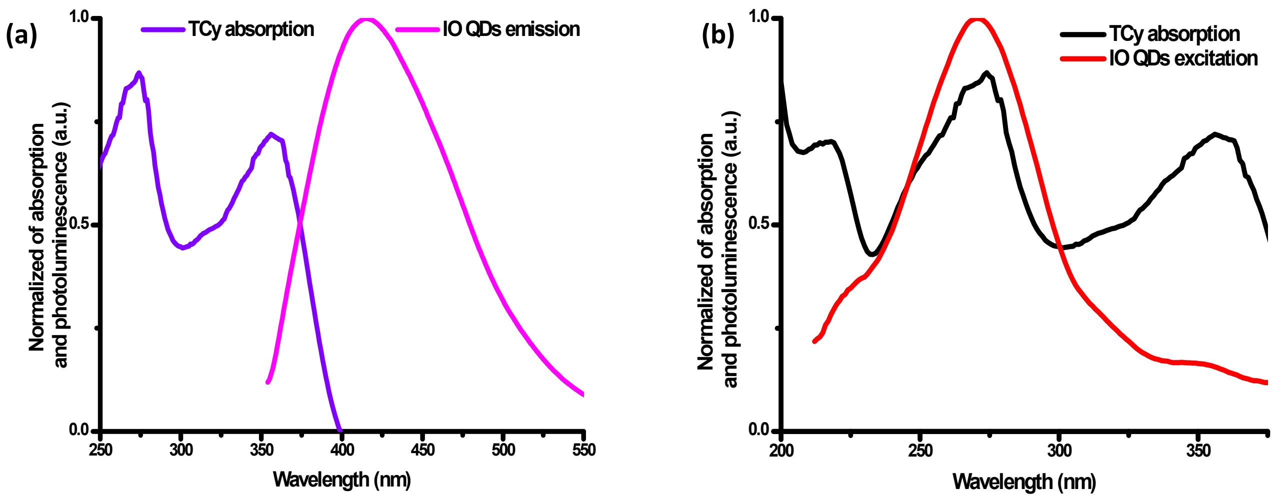


Figure S6. Spectral overlap in (a) FRET. (b) IFE

Figure S7

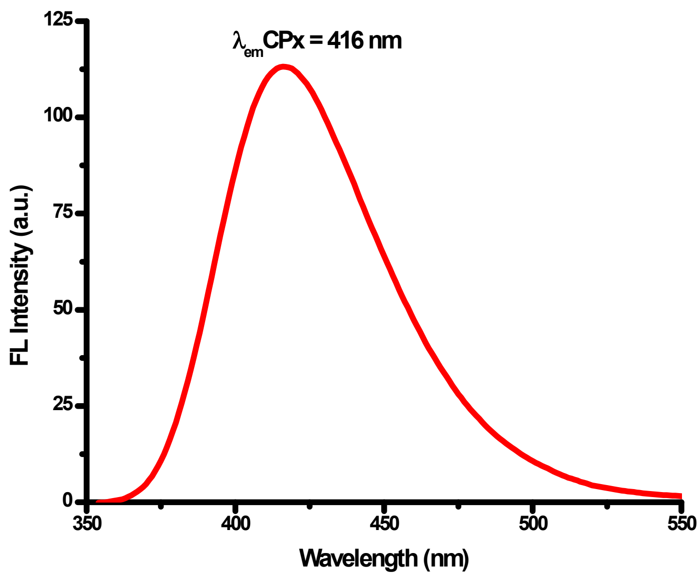


Figure S7. The fluorescence spectrum of ciprofloxacin at an excitation wavelength of 330 nm

Förster resonance energy transfer (FRET) calculation

Förster distance (R_0) was calculated using the formula [1]:

$$R_0=0.02108(k^2\phi_D\eta^{-4}J)^{1/6} \quad \textbf{(1)}$$

Where R_0 is the Förster distance (in nm), k^2 denotes dipole orientation factor (2/3) [2], ϕ_D denotes fluorescence quantum yield of IO QDs, η denotes the refractive index of the solvent, and *J* denotes the overlap integral ($nm^4\ M^{-1}\ cm^{-1}$).

Overlap integral (*J)* was calculated [1]:

$$J = \int_0^{\infty} FD\ (\lambda)\varepsilon A(\lambda)\ \lambda 4\ d\lambda \quad \textbf{(2)}$$

Energy transfer efficiency (E) was calculated as follows [1]:

$$E = 1 - \frac{\tau DA}{\tau D} = 1 - \frac{IDA}{ID} \quad \textbf{(3)}$$

Where E refers to energy transfer efficiency, τDA and τD refer to the fluorescence lifetime of IO QDs in the presence and absence of TCy, respectively.

Donor-acceptor distance (r) was estimated by engaging the formula [1]:

$$E = \frac{1}{[1 + (\frac{r}{R0})6]} \quad \textbf{(4)}$$

Stern-Volmer plot

The quenching efficiency represents the Stern-Volmer quenching constant (K_{SV}) which can be calculated as follow [3]:

$$F_0/F = K_{sv}[Q] + 1 \quad \textbf{(5)}$$

where F and F_0 denote the fluorescence intensity of the IO QDs in the presence and absence TCy, K_{SV} denotes the Stern-Volmer quenching constant, and Q denotes the concentration of TCy.

The quenching rate constant was calculated according to the equation as follows [4]:

$$K_{SV} = K_q\tau_0 \quad \textbf{(6)}$$

K_q is the quenching rate constant, and τ_0 is the fluorescence lifetime of IO QDs.

References:

1. Hildebrandt, I.M.a.N., *FRET - Förster Resonance Energy Transfer_ From Theory to Applications*. 2014: Wiley-VCH.
2. Chou, K.F. and A.M. Dennis, *Forster Resonance Energy Transfer between Quantum Dot Donors and Quantum Dot Acceptors.* Sensors (Basel), 2015. **15**(6): p. 13288-325.
3. Khawla, M., et al., *ZnS quantum dots as fluorescence sensor for quantitative detection of tetracycline.* Optical Materials, 2022. **125**: p. 112103.
4. Waghmare, M.N., et al., *Functionalized Alpha-lactalbumin Conjugated with Gold Nanoparticle for Targeted Drug Delivery.* ChemistrySelect, 2020. **5**(6): p. 2035-2049.