Electronic Supplementary Material (ESI) for Journal of Materials Chemistry B.

Supporting information

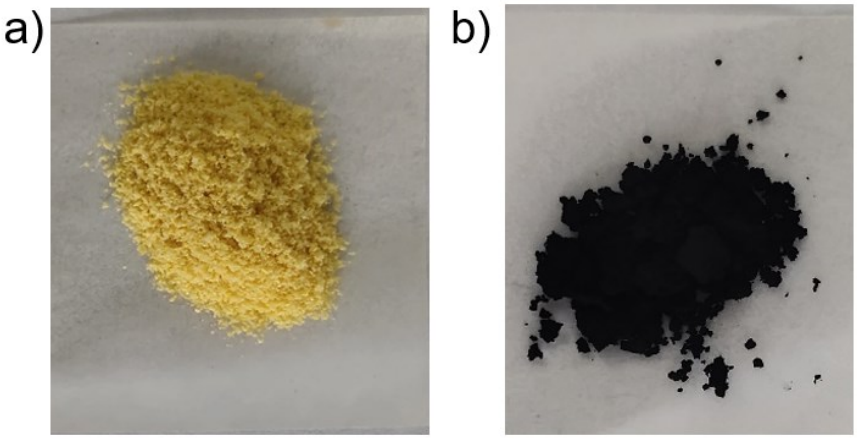

Figure S1. The pictures for a) zein and b) C-zein that prepared by carbonizing zein under 900 °C.

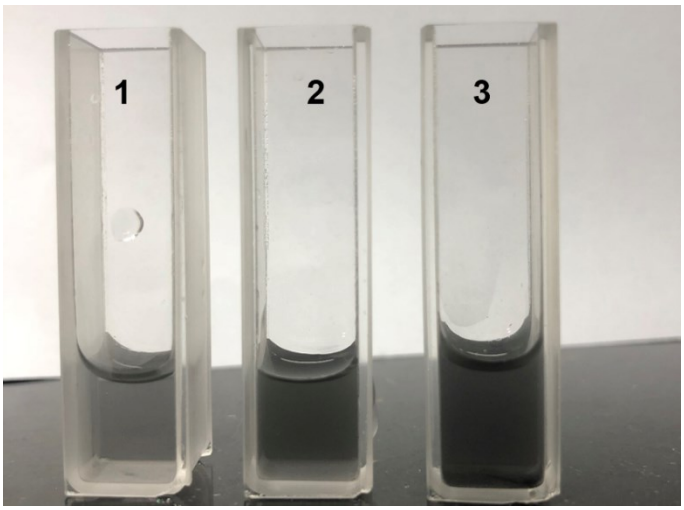

Figure S2. The dispersity of C-Zein-900 in water after milling and sonication treatments: 1) 50 μg mL^{-1}; 2) 100 μg mL^{-1}; 3) 200 μg mL^{-1}.

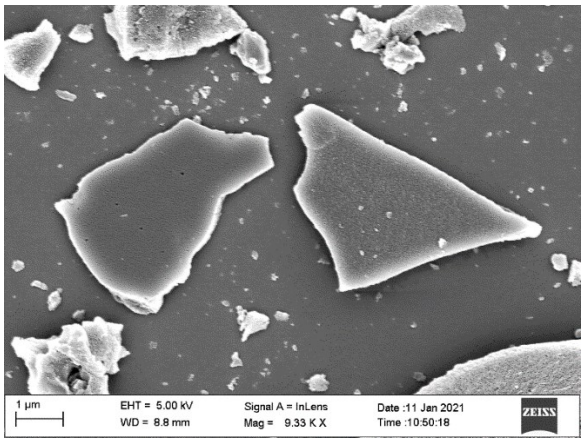

Figure S3. SEM image of C-Zein-900.

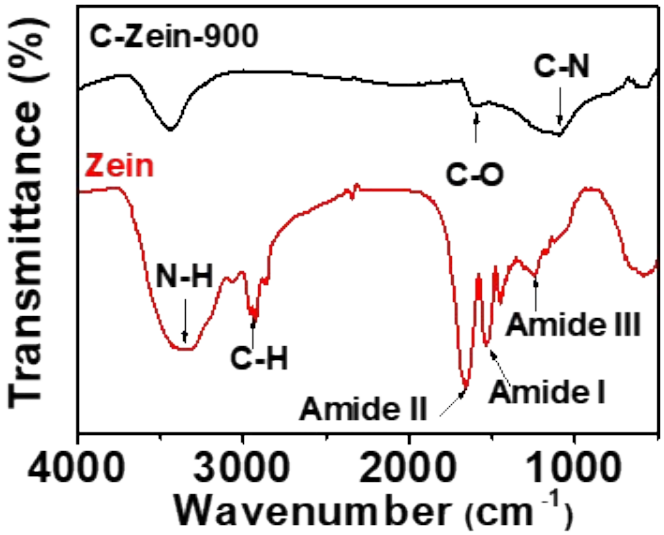

Figure S4. FTIR spectra of zein and C-Zein-900.

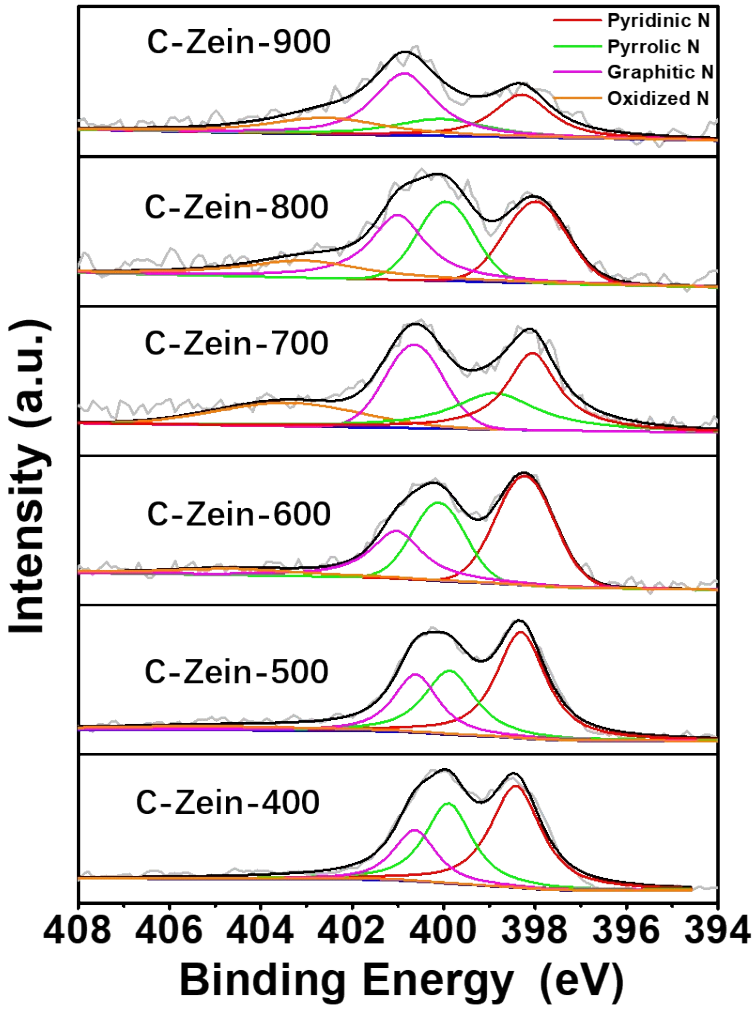

Figure S5. XPS survey spectra of a series of C-Zein samples through different heat treatments.

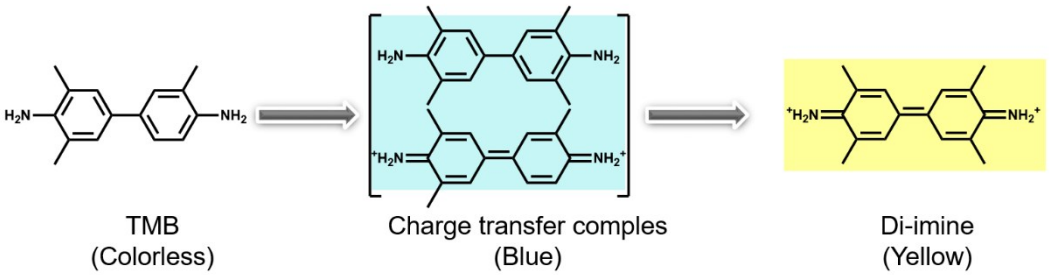

Figure S6. Scheme illustration of the oxidation pathways of TMB.

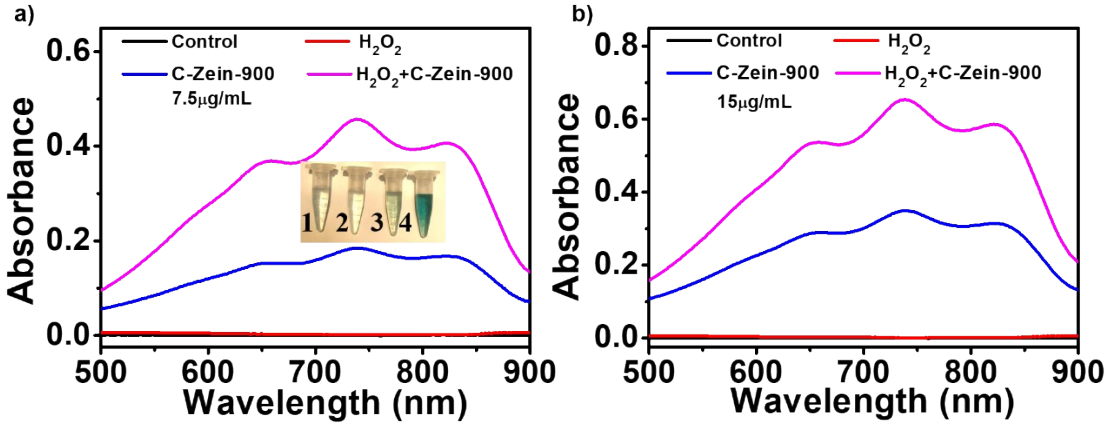

Figure S7. a) UV-vis spectra of ABTS solutions under different conditions: 1) control, 2) H_2O_2 alone, 3) only 7.5 μg/mL C-Zein-900, 4) both 7.5 μg/mL C-Zein-900 and 20 mM H_2O_2. Insert showed the color change of different samples. b) UV-vis spectra of ABTS solutions under different conditions: 1) control, 2) H_2O_2 alone, 3) only 15 μg/mL C-Zein-900, 4) both 15 μg/mL C-Zein-900 and 20 mM H_2O_2.

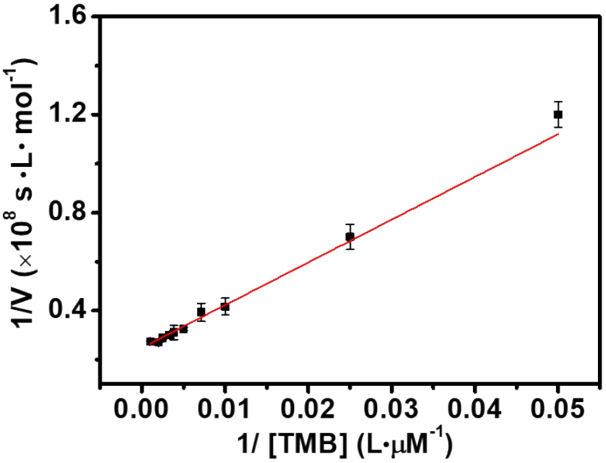

Figure S8. Kinetics for the oxidase-mimicking activity of C-Zein-900 with different concentrations of TMB.

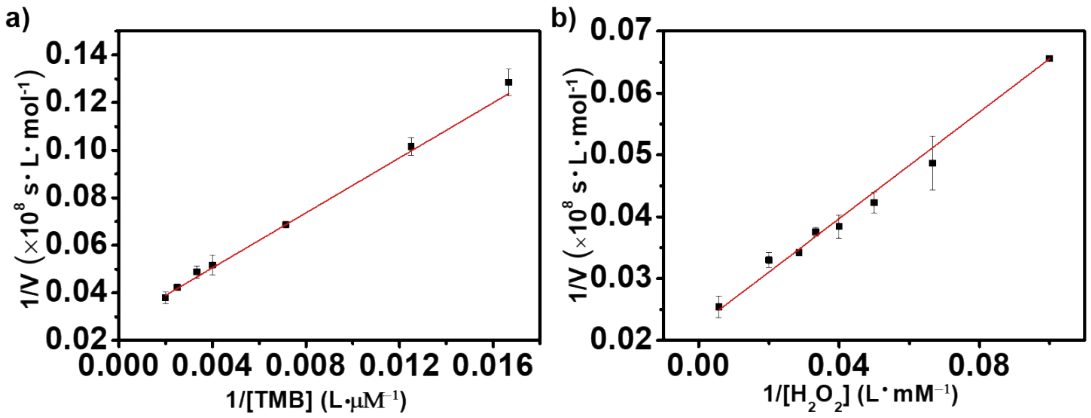

Figure S9. Kinetics for the peroxidase-mimicking activity of C-Zein-900 with different concentrations of a) TMB and b) H_2O_2.

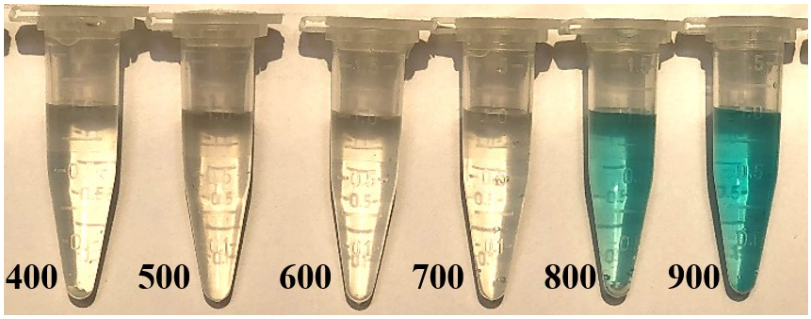

Figure S10. The color change of TMB solution after reaction with a series of C-Zein samples through different heat treatments.

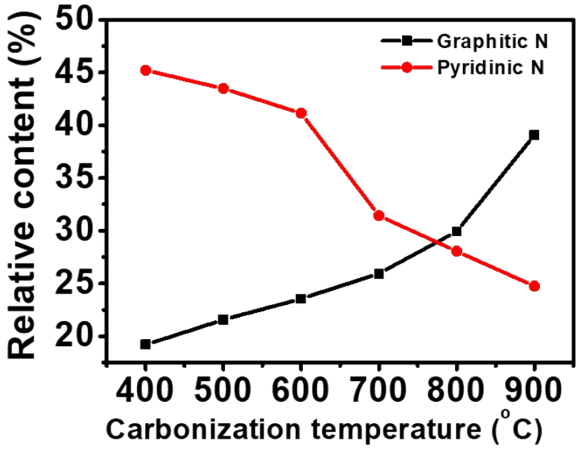

Figure S11. The relative content of different types of N in various C-Zein samples prepared through different heat treatments, calculated from XPS survey spectra.

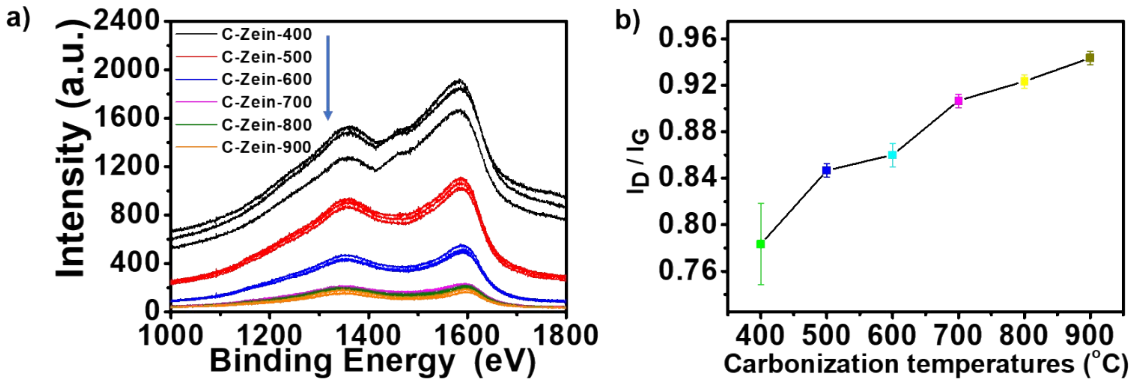

Figure S12. a) Raman spectra and b) the intensity ratios of D band and G band (I_D/I_G) for a series of C-Zein samples through different heat treatments.

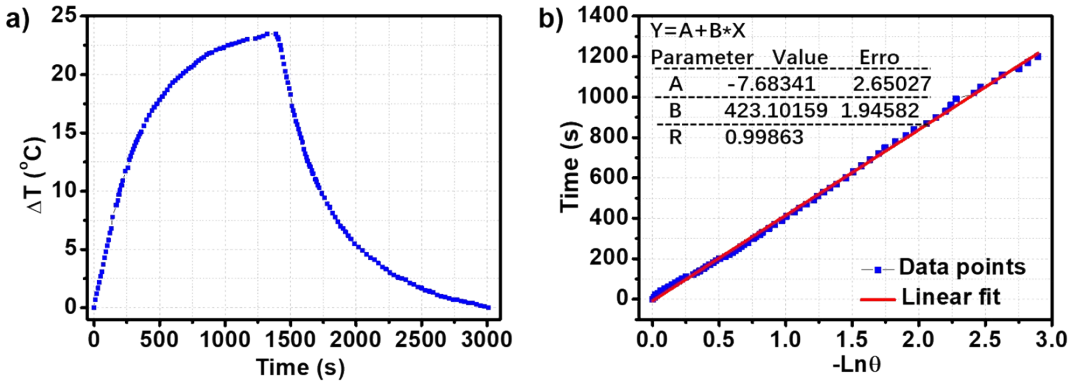

Figure S13. a) Temperature changes of C-Zein-900 solution under 808-nm laser irradiation (2 W cm^{-2}) and the laser was turned off after irradiation for 1390 s. b) The linear time data from the cooling period (after 1390 s) versus the negative natural logarithm of the driving force temperature derived from the cooling stage of NIR laser off. (hA was derived around 0.0099).

Table S1. The comparison of kinetic parameters (Michaelis-Menten constant K_m, the maximum reaction rate V_{max}) in C-Zein-900 and other systems by using TMB as the substrate for oxidase-like catalysis.

Samples (E)	[E] (mg mL^{-1})	Substrate	K_m (mM)	V_{max} (M s^{-1})
C-Zein-900	1.5×10^{-2}	TMB	7.00×10^{-2}	4.02×10^{-8}
N-PCNSs-3[1]	2.5×10^{-2}	TMB	8.40×10^{-2}	4.20×10^{-9}
CSF-900[2]	5.0×10^{-2}	TMB	7.13×10^{-1}	9.54×10^{-9}

Table S2. The comparison of kinetic parameters (Michaelis-Menten constant K_m, the maximum reaction rate V_{max}) of C-Zein-900 and other systems by using TMB and H_2O_2 as the substrate for

peroxidase-like catalysis.

Samples (E)	[E] (mg mL^{-1})	Substrate	K_m (mM)	V_{max} (M s^{-1})
C-Zein-900	1.5×10^{-2}	TMB	0.21	3.64×10^{-7}
C-Zein-900	1.5×10^{-2}	H_2O_2	19.20	4.45×10^{-7}
N-PCNSs-3[1]	2.5×10^{-2}	TMB	0.05	1.26×10^{-7}
N-PCNSs-3[1]	2.5×10^{-2}	H_2O_2	130	3.25×10^{-7}
CSF-900[2]	5.0×10^{-2}	TMB	0.065	1.82×10^{-8}
CSF-900[2]	5.0×10^{-2}	H_2O_2	134	1.81×10^{-7}
AKCN[3]	5.0×10^{-1}	TMB	0.60	4.22×10^{-8}
AKCN[3]	5.0×10^{-1}	H_2O_2	0.79	6.78×10^{-8}
GNC900[4]	4.0×10^{-1}	TMB	0.23	2.53×10^{-7}
GNC900[4]	4.0×10^{-1}	H_2O_2	28.3	7.63×10^{-7}
HRP[5]	5.0×10^{-12}	TMB	0.17	4.18×10^{-7}
HRP[5]	5.0×10^{-12}	H_2O_2	10.9	5.85×10^{-7}

Table S3. The comparison of η values of different materials.

Samples (E)	Photothermal conversion efficiency (η)
C-Zein-900	61.9%
Black TiO_2 nanoparticles[6]	40.8%
Gold nanorod[7]	22%
Dopamine-melanin colloidal nanospheres[7]	40%
Carbonized tofu[8]	87.26%
carbon nanodots[9]	53.2%

Table S4. The IC_{50} value of HeLa cells under different treatment conditions.

	NIR	C-Zein	C-Zein+H_2O_2	C-Zein+NIR	C-Zein+H_2O_2+NIR
pH=6	-	963.6 mg mL^{-1}	2.277 mg mL^{-1}	1.163 mg mL^{-1}	0.5496 mg mL^{-1}
pH=7.4	-	-	72.62 mg mL^{-1}	109.0 mg mL^{-1}	1.152 mg mL^{-1}

References

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