Supporting information

Synthesis of organic-inorganic hybrid microcapsules through *in situ* generating an inorganic layer on an adhesive layer with mineralization-inducing capability

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Supplemental experimental details about the thermal denaturation kinetic (according to previous literatures)[R1-R3]

The thermal denaturation constants (k_d, h^{-1}) were calculated according to Equation. (1):

$$A_{cat} / A_{cat,0} = exp(-k_d t) \quad (1)$$

The half-life ($t_{1/2}$, h) value was calculated according to Equation (2):

$$t_{1/2} = ln2 / k_d \quad (2)$$

The activation energy (E_d, kJ) was calculated according to the Equation (3):

$$ln\, k_d = -E_d / RT + ln\, C \quad (3)$$

The E_d was determined by the Equation (4):

$$Slope = -E_d / R \quad (4)$$

The change in enthalpy (ΔH^0, $kJ\ mol^{-1}$) was determined by the Equation (5)[R3]:

$$\Delta H^0 = E_d - RT \quad (5)$$

where A_{cat} was the CAT activity after incubation for a specific time at a specific temperature, $A_{cat,0}$ was the CAT activity before incubation, t was the incubation time (h), R was the gas constant (8.3145 J mol^{-1} K^{-1}) and T was the corresponding absolute temperature (K).

References:

[R1] Hong Wu, Yanpeng Liang, Jiafu Shi, Xiaoli Wang, Dong Yang, Zhongyi Jiang, Enhanced stability of catalase covalently immobilized on functionalized titania submicrospheres, *Materials Science and Engineering: C*, 2013, *33*, 1438-1445.

[R2] Domink L. Jurgen-Lohmann, Raymond L. Legge, Immobilization of bovine catalase in sol-gels, *Enzyme and Microbial Technology*, 2006, *39*, 626-633.

[R3] Ajay Pal, Farhath Khanum, Covalent immobilization of xylanase on glutaraldehyde activated alginate beads using response surface methodology: Characterization of immobilized enzyme, *Process Biochemistry*, 2011, *46*, 1315-1322.

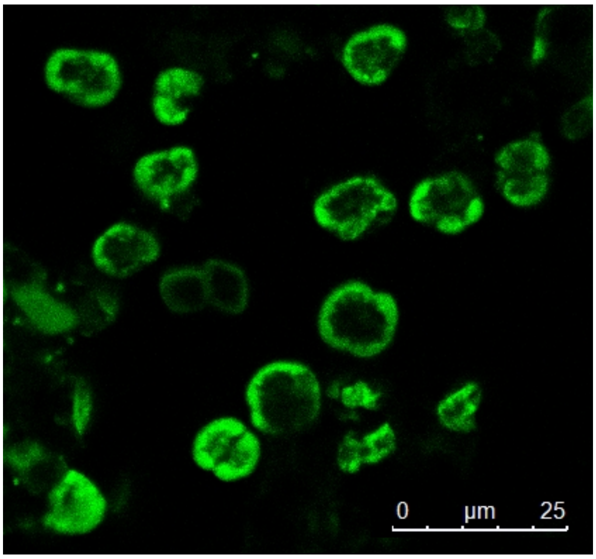

Figure S1. The CLSM image of the CAT-encapsulated (PDA-PEI)/titania hybrid microcapsules. (Notably, CAT was labelled with FITC.)

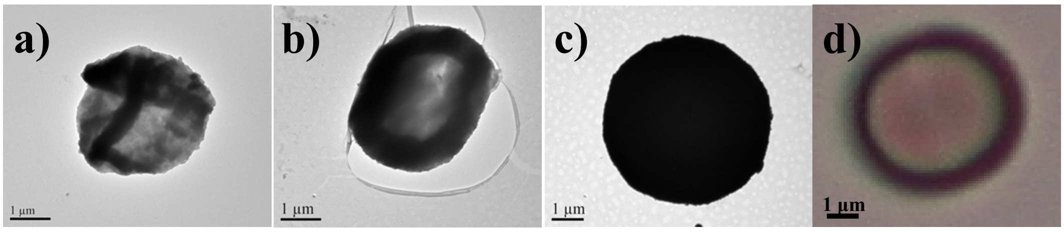

Figure S2. SEM images of the a) (PDA-PEI)/titania-1, b) (PDA-PEI)/titania-2 and c) (PDA-PEI)/titania-3 hybrid microcapsules; d) optical microscopy image of the (PDA-PEI)/titania-3 hybrid microcapsules.

To acquire the wall thickness of the (PDA-PEI)/titania-1, (PDA-PEI)/titania-2 and (PDA-PEI)/titania-3 hybrid microcapsules, the TEM and optical microscopy were conducted. As shown in **Figure S2a and S2b**, hollow structure could be clearly distinguished from both two TEM images, which indicated the average wall thickness of the (PDA-PEI)/titania-1 and (PDA-PEI)/titania-2 hybrid microcapsules were ~178 and ~481 nm, respectively. Unfortunately, the wall thickness of the (PDA-PEI)/titania-3 hybrid microcapsules cannot be acquired from **Figure S2c** mainly owing to the much larger wall thickness of the microcapsules. Therefore, optical microscopy image of the (PDA-PEI)/titania-3 hybrid microcapsules were obtained, from which an average wall thickness of ~710 nm could be observed (**Figure S2d**). Notably, the average wall thickness for each microcapsule was calculated through counting at least 30 microcapsules.

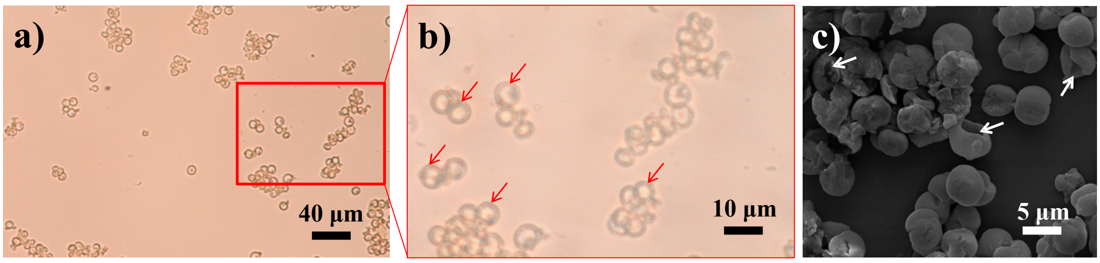

Figure S3. a) Optical image and b) high-resolution optical image of the (PDA-PEI)/titania-3 hybrid microcapsules synthesized from 10 mg mL^{-1} of PEI solution, c) SEM image of the (PDA-PEI)/titania-3 hybrid microcapsules after manually ground.