Supplementary Information

Design of Low-Charge Peptide Sequences for High-Yield Formation of Titania Nanoparticles

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Experimental Information

We designed two series of peptides, including Lac21 group (Lac21, Lac21E, Lac21K, AM1 and AFD4) and P group (P17, P18 and P19). The design of Lac21 group is based on one amphipathic peptide Lac21, which adsorbs at a fluid-fluid interface, therefore, the Lac21 group peptides are designed to be bifunctional, encoding both the emulsifying and mineralisation activity. Peptides R5, Ti2, Lac21, Lac21E and Lac21K, AM1 and AFD4 (MW 2435) were synthesized by GenScript Corporation (Piscataway, NJ); purity was >95% by reversed-phase HPLC. Peptides P17, 18 and 19 were synthesized by Peptide 2.0 (Chantilly, VA); purity was >90% by reversed-phase HPLC. The peptide content of lyophilized samples was determined by quantitative amino acid analysis (Australian Proteome Analysis Facility, Sydney).

For titania formation, peptide solutions were prepared by dissolving in sodium phosphate/citrate buffer of desired pH, then the precursor solution TiBALDH (100 mM) was added, mixed by vortexing and incubated for 20 minutes at room temperature. The precipitate was collected by centrifugation, washed three times with H_2O (1 mL), then three times with methanol. An alternate precipitate recovery approach (a filtration method as described by Smith et al. 2009 [1]) was also tested, and yielded negligible difference in measured precipitate with a very low precipitation activity peptide P18 as compared with centrifugal recovery. Therefore, centrifugation method was employed for the precipitation activity study in this paper.

The specific precipitation activity of each peptide was evaluated with a quantitative colorimetric assay [2]. Briefly, the precipitate was dissolved in a solution (1 mL) of concentrated sulphuric acid and ammonium sulphate. The solution was cooled, poured

into MilliQ water and diluted into a 5 mL calibrated flask with MilliQ water. 1 mL of this solution was combined with 5 mL 2.5% 5-chlorosalicylic acid solution in ethanol, 5 mL 1 M $NaClO_4$ and 15 mL ethanol. pH was adjusted to 3.0 with ammonium hydroxide. Then the solution was mixed thoroughly and transferred to a 50 mL calibrated flask and diluted to the mark with MilliQ water. The absorbance was measured at 355 nm using a UV spectrometer. The specific activity values represent the average of at least three independently prepared samples.

Transmission electron microscopy was conducted with a JEOL 1010 instrument. A drop of suspended precipitate was dried on a carbon-film-coated copper grid.

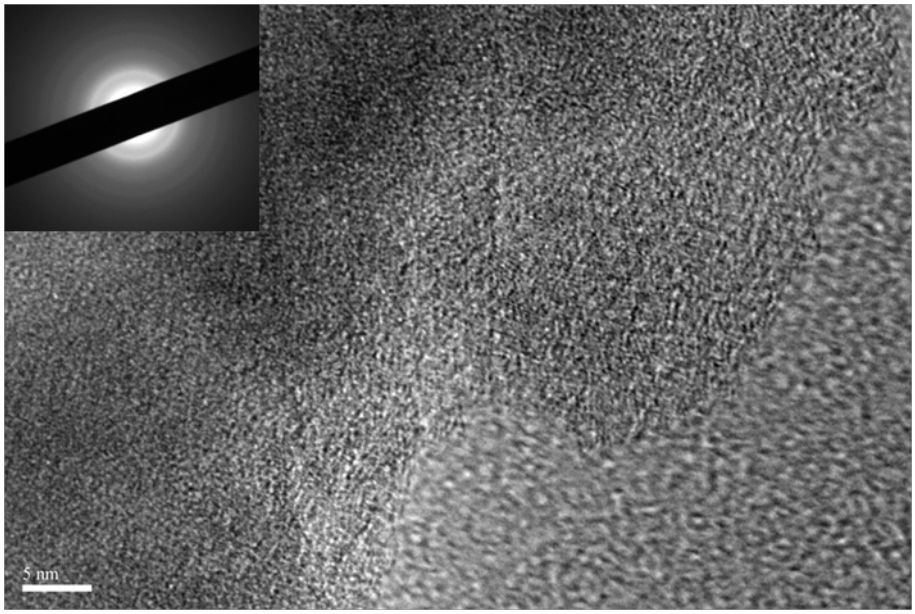

Figure S1 High-resolution transmission electron image and electron diffraction pattern (inset) of a cross-section of AM1-induced titania nanoparticle. Similar results were obtained with the titania induced by the other peptides.

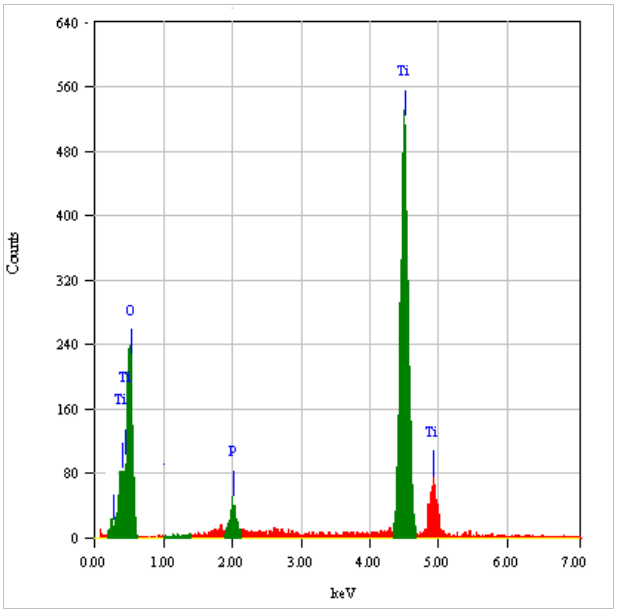

Figure S2 Elemental analysis by energy dispersive X-ray spectroscopy (EDXS) of AM1-induced titania nanoparticles

References

1 G. P. Smith, K. J. Baustian, C. J. Ackerson, D. L. Feldheim, *Journal of Materials Chemistry* **2009**, *19*, 8299.

2 H. Sedaira, K. A. Idriss, M. S. AbdelAziz, *Analyst* **1996**, *121*, 1079.