Development of nanostructured photocatalytic coatings for anti-bioadhesion and self-cleaning of residual bacterial cells

Yuan Li, Y. Frank Cheng

PII: S1385-8947(18)30015-9
DOI: https://doi.org/10.1016/j.cej.2018.01.015
Reference: CEJ 18335

To appear in: *Chemical Engineering Journal*

Received Date: 11 October 2017
Revised Date: 31 December 2017
Accepted Date: 2 January 2018

Please cite this article as: Y. Li, Y.F. Cheng, Development of nanostructured photocatalytic coatings for anti-bioadhesion and self-cleaning of residual bacterial cells, *Chemical Engineering Journal* (2018), doi: https://doi.org/10.1016/j.cej.2018.01.015

Development of nanostructured photocatalytic coatings for anti-bioadhesion and self-cleaning of residual bacterial cells

Yuan Li, Y. Frank Cheng*

Department of Mechanical & Manufacturing Engineering, University of Calgary, Calgary, Alberta, T2N 1N4, Canada.

ABSTRACT

In this work, nanostructured oxide coatings with photocatalytic activity were prepared by anodization, Zn acetate (ZnAc) modification and/or annealing, enabling high-performance anti-bioadhesion and self-cleaning of residual bacterial cells and biofilm upon sunlight irradiation and/or H_2O_2 treatment. The morphology, surface roughness, composition and semiconducting properties of the nano-coatings were characterized by atomic force microscopy, Raman spectroscopy and ultraviolet (UV)-visible diffuse reflectance spectroscopy. The anti-adhesion of the coatings to *P. aeruginosa* bacteria was measured by a confocal laser scanning microscope, and their electrochemical stability was evaluated by open-circuit potential and linear polarization resistance measurements in a chloride solution. The results demonstrate that, compared to the prepared anodized, annealed and 1-time ZnAc modified nano-coatings, the 2-time ZnAc modified nano-coating containing photocatalytic $ZnFe_2O_4$ achieves the best anti-bioadhesion performance and self-cleaning of residual bacterial cells and biofilm, while maintaining a high electrochemical stability. The nano-coating achieves 99.6% of anti-bioadhesion under sunlight irradiation relative to bare steel. The treatment of 1 h UV irradiation and 0.02 mM H_2O_2 allows

* Corresponding author.
Email address: fcheng@ucalgary.ca (Y. Frank Cheng)