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Nanomaterials at the Biointerface

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1. EDITORIAL

Bioapplication of nanomaterials involves several key processes that occurat the biointerface, such as internalization of nanoparticles by various cells, attachment of nanomaterials onto the bacteria to form granulates, and penetration of nutrient elements on the leaf surface from the nutrient reservoir – nanocrystals. This special issue therefore presents the most recent research development of nanomaterials at the biointerface, as summarized by a multidisciplinary team of international experts in these broad fields.

Biomedical applications of various nanomaterials are intensively investigated in the recent decades. For example, many efforts have been made to develop functional mesoporous silica nanoparticles (MSNs) to enhance the biocompatibility, drug loading efficacy, drug delivery efficiency, drug control releaseproperties and cancer treatment effectiveness. In this issue, Zhang et al. (Tianjin University, China) [1]briefly review the recent progresses in this particular area. Another example is utilization of nanoparticles as biomarkers. So this special issue also includes a mini-review paper by Centeno and Xie (University Technology Malaysia) [2] thatconcisely presents the principle and simulation results of dye molecules' fluorescence enhancement by the nearby nanostructured metals through their coupling effect. Nanomaterials can alsobe used as effective antimicrobial agents. For example, Liu et al. (Curtin University of Technology, Australia) [3] briefly review the recent progress of silver nanoparticles (AgNPs), andin particular, their efforts to modify AgNPs by conjugating antimicrobial cell penetration peptide to selectively bind to microorganism and improve the therapeutic index.

More interestingly, nanomaterialsare increasingly investigated as effective foliar fertilizers to provide micronutrient elements for a longer term. This particularly takes the advantage of nanocrystals'sheet-like morphology as sheet-like crystals have the largest contact area with the leaf and thus strongly stick on the leaf surface,as presented in the research work by Li et al. (The University of Queensland, Australia) [4]. This work has also demonstrated the importance of the suitable solubility of nanocrystals in supplying efficient micronutrient metal ions to correct the crop element deficiency. In connection with this research, Du et al. (The University of Queensland, Australia) [5] comprehensively review the key processes of foliar penetration of nutrient solutes and critical factors affecting the penetration rate of nutrient ions through the cuticular surfaces. In particular, they discuss the effects of leaf surface characteristics and chemical forms of foliar fertilizers on the foliar nutrient uptake in detail and justify a new generation of foliar Zn fertilizer.

This special issue has also included a research paper by Zhou et al. (Shanghai University, China) [6] that examines the interaction of a clay nanomaterial with bacteria and the subsequent effect on the wastewater treatment. The clay nanomaterial –Mg-Al layered double hydroxide (LDH) – adheres onto the bacteria and improves the granular formation, thus enhancing the COD removal efficacy from the wastewater.

We would like to thank all the contributors to this special issue and wish that this special issue willbe helpful for the future research on nanomaterials at the biointerface.

2. REFERENCES

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