THE EDUCATION UNIVERSITY OF HONG KONG
FACULTY OF LIBERAL ARTS AND SOCIAL SCIENCES

Research Output/Impact Prize for the Dean's Research Fund 2017-18

Brief Introduction of Awardee's
Research Publication/Study and Future Research Development

Awardee (Dept):	Dr. Ho Wing Kei, Associate Professor (SES)
Publication Title:	Hybridization of Rutile TiO2 (rTiO2) with g-C3N4 quantum dots (CN QDs): An Efficient Visible-light-driven Z-scheme Hybridized Photocatalyst

A. *Briefly introduce your research publication/study for which you have received the prize.*

This summary describes the impact of a refereed research article titled "Hybridization of Rutile TiO2 (rTiO2) with g-C3N4 quantum dots (CN QDs): An Efficient Visible-light-driven Z-scheme Hybridized Photocatalyst" published in the international journal Applied Catalysis B: Environmental in July 2017. Applied Catalysis B: Environmental is a world-class journal with a JCR impact factor of 9.446 in 2017. It ranks 1 out of 49 in the Environmental Engineering, 3 out of 135 (top 2.2%) in Chemical Engineering in JCR ranking. The journal also ranks within top 3% in SJR journal ranking in ALL subject area (778 out of 28606, top 2.72 %); Chemistry Engineering (18 out of 705, top 2.55%) as well as Environmental Science (33 out of 1355, top 2.43%) in 2016. This journal article has 67 citations by other since published in March, 2017.

Over the past few decades, atmospheric nitrogen oxide (NOx) concentrations have greatly increased because of the growing number of automobiles and growing industrial activities. The emission of NOx induces the formation of toxic smog, acid rain, and PM2.5, causing serious respiratory problems. Nowadays, flue gas treatment for NOx control are actually available and can be categorised into three areas: selective non-catalytic reduction (SNCR), selective catalytic reduction (SCR),and combined SO2/NOx control systems. Nevertheless, all these methods suffered from high temperature applied, secondary pollution emission and low efficiency. The strong kinetic and thermodynamic limitations make a suitable solution difficult. Thus, it is highly required to explore an effective route to removing NOx at facile and mild conditions.

Photocatalytic technology with decent characteristics and ideal photocatalytic performance were regarded as ideal and potential solution and have become one of the most popular research domains because it demonstrates great capability to address serious energy and environmental crisis without secondary pollution. Graphite-C_3N_4 (CN) is known as an attractive promising candidate for visible-light-driven photocatalyst owing to its exceptional photochemical stability and high photocatalytic efficiency. However, the photocatalytic performance of CN is poor due to the low specific surface area, which results in limited numbers of active sites and low efficiency. Therefore, enhancing the photocatalytic efficiency of C_3N_4 remains a challenge to date.

In the present study, we developed a one-pot strategy to prepare graphite carbon nitride (CN) quantum dots (QDs) modified rutile TiO_2 (rTiO_2) hybrid (CN-QDs-rTiO_2), CN- QDs/rTiO_2 hybrids. This strategy aims not only to address the drawbacks of anatase TiO_2 with low visible-light-driven photocatalytic activity but also to reduce charge carrier recombination rate by semiconductor coupling. For the first time, the effect of nominal molar ratios of CN-QDs to rTiO_2 on the structure and photocatalytic activity of QDs-rTiO_2 composite was systematically studied. CN-QDs-rTiO_2 hybrid was successfully fabricated by a simple mixing-calcination approach. After modification of rTiO_2 with CN-QDs, both the reactivity of visible-light-induced photodegradation of organic dye and photooxidation of NOx were significantly improved. This study shows that the enhanced photocatalytic activity of QDs-rTiO_2 hybrid could be attributed to the synergistic effects of increased optical property and effective separation and transfer of photo-generated charges. •OH radicals quenching experiments support a Z-scheme degradation mechanism for CN-QDs-rTiO_2 hybrids. This work makes the application of CN-QDs-rTiO_2 composite possible both in wastewater treatment and air purification under sunlight irradiation.

B. How you used/will use your prize and perhaps its usefulness to your research development?

The fund would be used to hire research staff to obtain preliminary experimental results for the application of a new GRF.

C. Expected research outcomes/outputs/impacts arising from this prize.

The data collected from this fund will support the development of a GRF proposal.