Synthesis and Characterization of Carbon Nitride for Oxidation of Nitrite Ions under UV Irradiation

Siti Maryam Jasman[1], Hendrik O. Lintang[2], Leny Yuliati[2*]
[1]*Department of Chemistry, Faculty of Science, Universiti Teknologi Malaysia, 81310 UTM Johor Bahru, Johor, Malaysia*
[2] *Centre for Sustainable Nanomaterials, Ibnu Sina Institute for Scientific and Industrial Research, Universiti Teknologi Malaysia, 81310 UTM Johor Bahru, Johor, Malaysia*
***Corresponding author: leny@ibnusina.utm.my**

ABSTRACT

Nitrite ion (NO_2^-) is an important targeted analyte that is widely exists in environment and industry, and can cause serious hazards to human health. In this work, metal-free carbon nitride photocatalyst was accomplished for oxidation of NO_2^- under UV light irradiation. The carbon nitride was successfully synthesized through a thermal polymerization technique by using urea as the precursor. X-ray diffractometer (XRD), Fourier transform infra red (FTIR), diffuse reflectance UV-visible (DR UV-Vis), and fluoresence spectrocopies were used to analyze the prepared material. The XRD pattern showed two diffraction peaks at 2θ of 13.10 and 27.3° which were corresponding to the in-planar repeating units and graphitic structure, respectively. The FTIR spectrum for carbon nitride shows four important bands namely ν(N-H), ν(C=O), ν(C-N heterocyclic) and ν(1,3,5-triazine). From the DR UV-Vis spectra, it shows the presence of π-π* and n-π* electronic transitions, which were attributed from the C=N, C=O and C-N chromophores. In addition, only one emission peak was observed at 455 nm from the fluorescence spectrum. The performance of the carbon nitride was then investigated as the heterogeneous catalyst for oxidation of NO_2^- under UV light irradiation for 1 hour. The percentage conversion of NO_2^- to NO_3^- was determined to be 15%, indicating that the carbon nitride can act as a potential heterogeneous photocatalyst for the oxidation process.

| Carbon nitride | Photocatalyst | Nitrite | Oxidation | UV irradiation |

Study on Quenching Effect of Nitrite Ions on Zinc Oxide Modified By Polyvinylpyrrolidone

Ing Hua Tang[1], Siti Zarina Mohd So'ad[1], Hendrik O. Lintang[2], Leny Yuliati[2*]
[1] *Department of Chemistry, Faculty of Science, Universiti Teknologi Malaysia, 81310 UTM Johor Bahru, Johor, Malaysia,*
[2] *Centre for Sustainable Nanomaterials, Ibnu Sina Institute for Scientific and Industrial Research, Universiti Teknologi Malaysia, 81310 UTM Johor Bahru, Johor, Malaysia*
***Corresponding author: leny@ibnusina.utm.my**

ABSTRACT

Zinc oxide (ZnO) is appeared to be an attractive material for application for multidisciplinary fields, owing to its unique physical and chemical properties. In this study, ZnO was synthesized using the co-precipitation method, where the zinc acetate was used as the precursor. The ZnO was further modified by adding different amounts of polyvinylpyrrolidone (PVP) via simple physical mixing method to obtain ZnO-PVP composites. The ZnO and the ZnO-PVP composites were characterized using Fourier transform infrared (FTIR), diffuse reflectance ultraviolet-visible (DR UV-Vis), and fluorescence spectroscopy. The FTIR spectra detected the presence of ZnO group and the functional groups from the PVP. The PVP peaks become more apparent with the increase of the PVP amount. From the DR UV-Vis spectra, no significant change was observed after modification with the PVP, and all composites showed similar broad absorption band to that of the ZnO. The fluorescence spectra showed that the addition of PVP decreased the emission intensity and red shifted the peak wavelength, indicating certain interactions between the ZnO and the added PVP. Quenching study was investigated in the presence of nitrite ions (NO_2^-) with various concentrations (2-10 μM). A linear Stern-Volmer plot was observed and the highest quenching constant rate (K_{SV}) was obtained on the ZnO-PVP sample with PVP content of 0.1 wt%. This study demonstrated that the addition of the PVP on the ZnO improved the interaction between the ZnO and the NO_2^-, which will be one of the important factors for sensing and catalytic applications for detection and conversion of NO_2^-.

| Zinc oxide | Polyvinylpyrrolidone | Quenching study | Fluorescence | Nitrite ion |