Photocatalytic H_2O_2 production over g-C_3N_4 Nanostructures Utilizing Modified Cyanuric Acid-Melamine Complex as Precursor

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The anthraquinone method and a direct production with H_2 and O_2 as the conventional methods for H_2O_2 production are suffering from several unavoidable challenges such as abundant energy and organic solvents consumption and potential explosion hazard of the mixture of oxygen and hydrogen. Photocatalytic H_2O_2 production has been recently introduced as an energy-saving, environment-friendly, facile, and safe method in this regard. Among different materials used as photocatalyst, graphitic carbon nitride (g-C_3N_4) as an organic metal-free photocatalyst has been widely investigated over the past few years. Despite the advantages, pristine g-C_3N_4 possesses poor photocatalytic activity due to the low specific surface area and easy recombination of photo-induced electrons and holes. Although, various strategies have been developed to overcome these weaknesses, scientific attempts are still made to improve the photocatalytic activity of g-C_3N_4-based photocatalysts. Starting materials used as synthesis precursors have exhibited a significant impact on the physical, optical, and electronic properties of the obtained g-C_3N_4. Commonly, some triazine derivatives such as melamine are utilized as starting substances for g-C_3N_4 preparation. However, utilization of supramolecular structures, especially cyanuric acid-melamine (CM) complex as starting materials has attracted researchers' attention in recent years. In this study, we have investigated the utilization of cyanuric acid-melamine complex (CM) modified by KH_2PO_4 as a starting material in order to improve the robustness of the starting material and provide a dopant source for synthesis of phosphorous and potassium co-doped g-C_3N_4. The as-prepared catalyst exhibited an enhancement in visible light photocatalytic H_2O_2 production than pristine melamine and CM-complex based g-C_3N_4 samples. The experimental results indicated an improved H_2O_2 production of 208 µM under 1 h visible light irradiation as compared with that of the bulk (71 µM) and the pristine nanostructured sample (137 µM).

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