Effect of oxidation with HNO_3 on the heterogeneous Fenton-like catalytic properties of g-C_3N_4

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Metal-free catalysts have been considered an alternative to traditional metal-based compounds [1]. Due to its advantages, such as the multiple superficial functionalities [2], the g-C_3N_4 is a great candidate for the development of new catalysts that are more efficient and aligned with the concept of sustainability. We recently showed that g-C_3N_4, prepared in an open atmosphere, can promote the formation of •OH in the presence of H_2O_2 (heterogeneous Fenton) [3]. In this work we investigate the effect of oxidation of g-C_3N_4 with HNO_3. The g-C_3N_4 was synthesized by polycondensation of melamine and the material obtained was subjected to acid treatment with HNO_3 in concentrations of 1, 3 and 5M for 2h at 80 °C. All samples were characterized by different techniques, including DRX, FTIR and SEM. The catalytic activity was evaluated through the discoloration of the indigo carmine dye (10 mg/L) in the presence of 15 mg of g-C_3N_4 and 25 µL of H_2O_2. The investigation of the catalytic activity showed that the sample g-C_3N_4-3M showed the best rate of discoloration, degrading 34% of the dye after 90 minutes of reaction. While the sample without acid treatment showed an efficiency of 20%. These results suggest that functional groups oxygenated with intermediate NOx, C-OH and/or N-OH, may be responsible for the H_2O_2 reduction reaction forming •OH. The results presented showed that the heterogeneous Fenton-like catalytic properties of g-C_3N_4 were enhanced. However, precise control of reaction conditions is necessary to obtain a material with a high concentration of these functional groups with intermediate NOx.

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References:

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