CYSS
CataLight Young Scientist Symposium
synthesis • theory • characterization • application

Photocatalytic synthesis of aromatic aldehydes using immobilized graphite-like carbon nitride

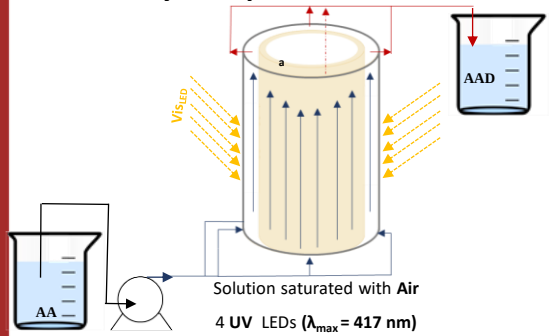
Joana C. Lopes, Maria J. Sampaio, Joaquim L. Faria, Cláudia G. Silva

Laboratory of Separation and Reaction Engineering – Laboratory of Catalysis and Materials (LSRE-LCM), Faculdade de Engenharia, Universidade do Porto
joanacl@fe.up.pt ORCID: 0000-0003-4254-7074

Introduction

Photocatalytic synthesis processes can operate under mild conditions, reducing the volume and the toxicity of the generated residues. The possibility of being activated by low energy consumption radiation sources like Light-Emitting Diodes (LEDs) contributes to reducing energy costs. For these reasons, heterogeneous photocatalytic reactions have gained high relevance. Namely, in fine chemical synthesis, concerning process intensification and safety in many applications. Photocatalyst immobilization facilitates reuse, avoid costs related to separation and permits work under continuous operation. **In this work graphite-like carbon nitride nanosheets (GCN-TS) were immobilized on polyester fabrics (PES) pre-treated with HNO3 with concentration ranging from 0.2 to 5.0% v/v. The resulting materials were tested in the photocatalytic oxidation of anisyl alcohol (AA) into anisaldehyde (AAD).**

Photocatalytic Experiments



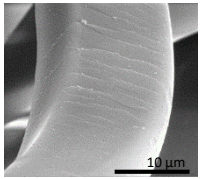
Solution saturated with **Air**

4 **UV** LEDs **(λ_{max} = 417 nm)**

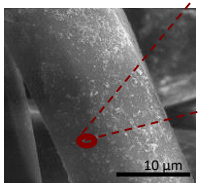
$[AA]_0$ = 0.5 mM

a - xCN-PES fabrics (x= concentration of HNO_3)

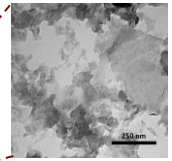
Materials Characterization



Polyester fiber modified with 1%v/v HNO_3



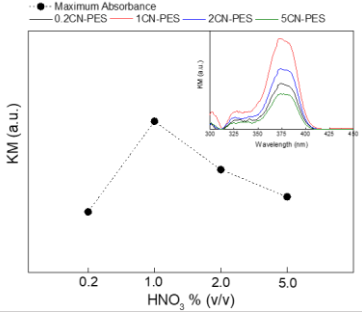
GCN-TS coated PES modified with 1% v/v HNO_3 (1PES-CN)



GCN-TS
Exfoliated carbon nitride material after an ultrasonic treatment in water.

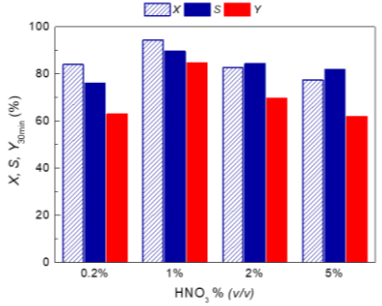
The SEM images reveal that the photocatalyst was **uniformly deposited on the supports.**

- The acid modification will **improve the wettability** of PES, consequently the **adhesion** of GCN-TS on its surface.



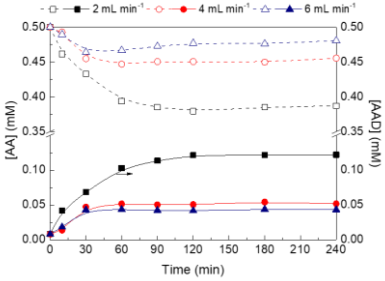
Diffuse reflectance UV-Vis spectra at ca. 375 nm, shows **highest intensity for 1CN-PES**, suggesting greater amount of GCN-TS particles deposited on PES surface.

Photocatalytic Results



The maximum **yields** obtained in batch mode system followed the order **1% v/v HNO_3 > 2% v/v HNO_3 > 0.2% v/v HNO_3 > 5% v/v HNO_3.**

1CN-PES support present **higher contact area between the catalyst and the AA molecules,** and consequently the highest photocatalytic activity.



Continuous mode operation:

- A stationary state was reached after 90 min of irradiation.
- 1CN-PES sample presents **high stability and the performance was maintained constant.**

Conclusions

- **HNO_3 pre-treatment** of PES fabrics **improves the immobilization of GCN-TS.**
- xCN-PES coated materials revealed high efficiency and stability for AAD synthesis under visible light radiation.

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