Sustainable production of imines using carbon nitride as photocatalyst under visible LED irradiation

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

Laboratory of Separation and Reaction Engineering – Laboratory of Catalysis and Materials (LSRE-LCM), Department of Chemical Engineering, Faculty of Engineering, University of Porto, Rua Dr Roberto Frias s/n, 4200-465 Porto, Portugal

* *joanacl@fe.up.pt*

Imines or Schiff bases are extensively used as indispensable intermediates in the synthesis of biological N-containing compounds and valuable compounds in agrochemicals, dyes, pharmaceuticals, and polymers. The traditional imine synthesis generally involves the condensation of amines and reactive aldehyde (or ketones), often requiring hazardous oxidizing agents, corrosive chemicals, and heating. Alternatively, photocatalytic processes can generate imines (and other organics) under relatively mild conditions, without using hazardous redox agents, activated by sunlight or artificial irradiation sources with low energy consumption.

In the present work, a metal-free carbon nitride (GCN) was synthesized by thermal polymerization as the base material for producing photocatalysts. Following controlled thermal exfoliation, the photocatalyst GCN-T was obtained[1]. The photocatalyst was tested in the conversion of benzylamine (BA) to N-benzylidenebenzylamine (BI). The synthesis proceeded in a batch reactor using 417 nm activation from visible LEDs. The performance of GCN-T was compared to the initial bulk material and benchmark TiO_2-P25. Compared to P25, it displays a similar photoactivity but superior selectivity to the final imine on the 45 min run of reaction (Figure 1). To understand the photocatalytic pathway of this heterogeneous oxidative coupling of amines to the corresponding imines, different reaction conditions will be explored.

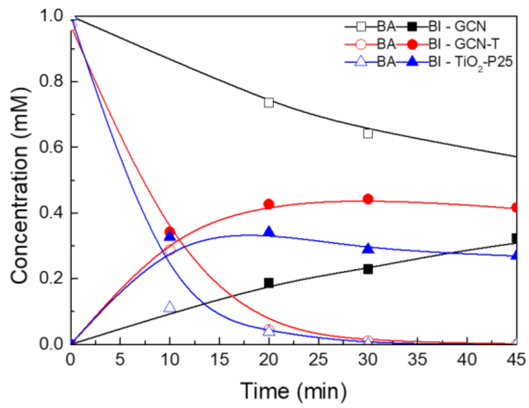

Figure 1. *Concentration profiles of benzylamine (BA) and N-benzylidenebenzylamine (BI) using GCN, GCN-T and titanium dioxide (TiO_2) as catalysts.*

References

[1] J. C. Lopes, M. J. Sampaio, R. A. Fernandes, M. J. Lima, J. L. Faria, C. G.Silva, Catalysis Today 2020, 357, 32-38.