# Photocatalytic Turnover Number for Nanoporous Carbon-based Remediation of Polluted Water

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**Palabras Clave:** Turnover number, Graphene, Polluted water.

In this work, the classical metal- and semiconductor-based and metal-free carbon-based photocatalysis will be presented. Examples from our group [1,2] will show the influence of the pore size distribution and surface chemistry of nanoporous carbon-based materials in aqueous-phase photocatalytic reactions related with polluted water remediation. The potential of the confining pore effect of nanoporous carbons and the intrinsically photochemical activity of heteroatom-containing surface functional groups. Chemicals will be also revised and discussed.

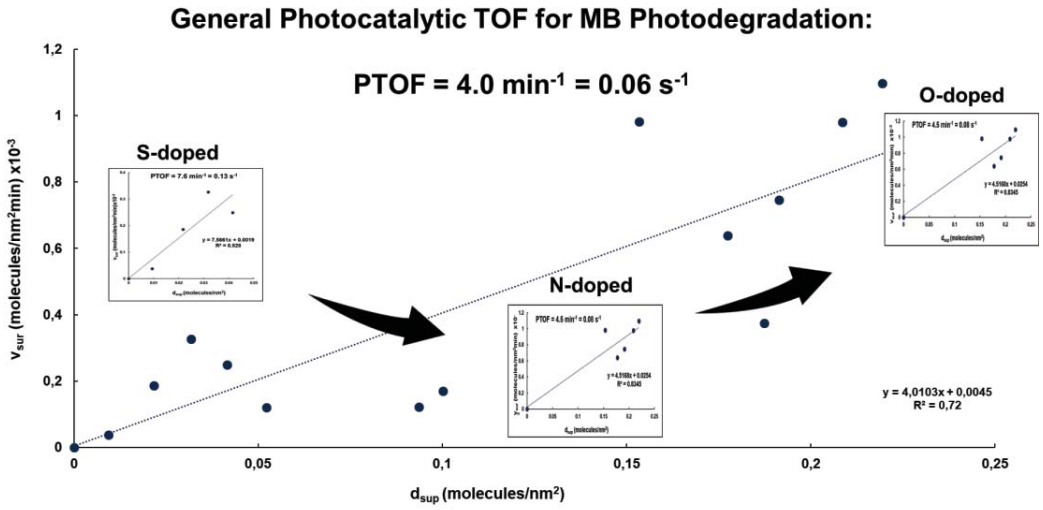


**Figura 1.** General photocatalytic turnover frequency for methylene blue photodegradation as a function of the heteroatom.

It is concluded that for a correct description of the active sites in metal-free and semiconductor-free photocatalytic reactions, that new definition is required to correctly report the photocatalytic turnover number (TON) and turnover frequency (TOF) in terms of the textural and surface properties. Based on the surface density of adsorbed molecules, our group have reported [1-5] a global surface reaction-rate constant that corresponds to a new definition of the TON to stablish the photocatalytic activity of metal-free carbon-based photocatalysts (**Figure 1**). This new kinetic parameter would permit to normalize the photocatalytic activity as a photocatalytic TOF, here denoted as PTOF, which is highly dependent of the pore

size distributions and chemical surface groups of nanoporous carbons and the formation of interfacial phases.

## Referencias


1. Fernández de Cordoba, M.C., Matos, J., Montaña, R., Poon, P.S., Lanfredi, S., Praxedes, F.R., Hernández-Garrido, J.C., Calvino, J.J., Rodríguez-Aguado, E., Rodríguez-Castellón, E., Ania C.O (2019) Sunlight photoactivity of rice husks-derived biogenic silica. Catalysis Today **328**,125-135.
2. Matos, J., Ocares-Riquelme, J., Poon, P.S., Montaña, R., García, X., Campos, K., Hernández-Garrido, J.C., Titirici M.M (2019). C-doped anatase $TiO_2$: Adsorption kinetics and photocatalytic degradation of methylene blue and phenol, and correlations with DFT estimations. J. Colloid Inter. Science **547**, 14-29.
3. Bandosz, T.J., Policicchio, A., Florent, M., Li, W., Poon P.S., Matos J (2020) Solar light-driven photocatalytic degradation of phenol on S-doped nanoporous carbons: The Role of functional groups in governing activity and selectivity. Carbon **156**, 10-23.
4. Matos, J., Arcibar-Orozco, J., Poon, P.S., Pecchi, G., Rangel-Mendez J.R (2020) Influence of phosphorous upon the formation of DMPO-•OH and POBN-$O_2^{\bullet -}$ spin-trapping adducts in carbon-supported P-promoted Fe-based photocatalysts. J. Photochem. Photobiol. A: Chem. **391**,112362.
5. Ania, C.O., Armstrong, P.A., Bandosz, T.J., Beguin, F., Carvalho, A.P., Celzard, A., Frackowiak, E., Gilarranz, M.A., László, K., Matos, J., Pereira M.F.R (2020) Engaging nanoporous carbons in "Beyond Adsorption" applications: Characterization, challenges and performance. Carbon. **164**, 69-84.


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