

Photocatalytic Degradation of Pharmaceuticals over Titania-, Titania/Carbon- and TCPP-Sensitized Catalysts

Ph.D. Seminar 1

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Pharmaceuticals in surface water, waste water and drinking water are dangerous and hence are of great concern. In 1990's India saw > 95 % white-backed vulture deaths due to kidney failure caused by diclofenac poisoning which is a non-steroidal anti-inflammatory drug.¹ There are hundreds of drugs detected in environment, and its long-term effects are not known? Conventional waste water treatment plants are not equipped to deal with pharmaceutical pollution, hence advanced oxidation process are being explored including ozonisation, fenton, photo-fenton, etc. However, these processes are homogenous, non-green, less-efficient and has practical limitations. In 1972, Fujishima and Honda² reported photocatalytic water splitting reaction over TiO₂ under UV-light irradiation. This started great interest in TiO₂ photocatalysis for solar fuels and environmental applications.³ However, TiO₂ has intrinsic limitations due to: i) high $e-h$ recombination rate competing with interfacial charge transfer; ii) low surface area; iii) limited light absorption (only under UV). Hence, there is a need for designing better TiO₂ material and understand parameters such as surface area, particle size, crystallinity, defects, surface -OH groups, etc. which control its photocatalytic activity. The limitation of low surface area can, however, be overcome with nanocrystalline or ordered porous TiO₂ but the problem of high $e-h$ recombination still persists. Alternatively, TiO₂/Carbon composite⁴ with chemically bonded interface are promising for this purpose, wherein carbon with high charge mobility and its high surface area can provide dual advantage of efficient charge separation and high adsorption capacity which are key for photocatalysis. Another problem of TiO₂ is its inability to utilize visible-light, which can be addressed by functionalizing TiO₂ with molecules such as tetra(4-carboxyphenyl)porphyrin (TCPP), a chlorophyll synonym, for efficient visible light photocatalytic degradation of pharmaceuticals.⁵ In this presentation, the various issues relating to titania photocatalysis will be addressed.

References

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Guide

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