

Dual Effect of Photocatalysis and Photo-Fenton for the Removal of Pharmaceutical Effluent

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Abstract—A novel concept of coupling of photocatalysis and photo-Fenton process at the same place and same time has been studied for the treatment of pharmaceutical wastewater. For the commercialization purpose support material composed of clay, foundry sand, fly ash, fuller's earth has been developed. Foundry sand and fly ash being an alternative source of iron help in the photo-Fenton process to take place which gets leached out in the acidic conditions. Further, a layer of TiO₂ was also prepared for the photocatalytic process to take place. Hence, both these processes have been executed at the same place and same time producing hydroxyl radicals in plenty which helps in the degradation of the pollutants at a faster pace. The possible reason for the improved degradation efficiency in case of the dual process was the generation of hydroxyl radicals in abundance from both processes i.e. photocatalysis and photo-Fenton going on simultaneously within the same treatment unit. For the treatment of the real pharmaceutical wastewater packed bed reactor have been employed with handling volume of 5L. The reactor was operated at a fixed flow rate of 0.05 Lmin⁻¹ with the addition of an optimized dose of H₂O₂ i.e. 1155 mgL⁻¹ and catalyst dose equivalent to 100% area of each reactor bed covered with composite beads. 82% removal was observed after 4 hours to treatment. 35% of synergy was observed as compared to the photocatalysis and photo-Fenton process. Various characterizations were performed for the confirmation of the dual process.