The Effect of pH on Dye Degradation by Titanium (IV) Dioxide Nanoparticles

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Current chemical and physical processes to treat wastewater containing dyes have high costs and are contradictory because they produce more pollution during the process. Titanium (IV) dioxide (TiO_2) photocatalysis uses light to create oxidizing radicals that can break down organic pollutants; although it is more environmentally friendly, this takes too long to be a viable commercial option. Other studies have investigated the effects of pH on the reaction rate but their results are not inclusive. This study used methylene blue, a basic/cationic dye; methyl orange, an acidic/anionic dye; and TiO_2 nanoparticles to examine degradation at pHs of 4, 5, 8 and 9 using the dye's absorbance over time. As pH increased, degradation of methylene blue was found to increases, and as pH decreased, degradation of methyl orange was found to increase. These findings can be expanded to basic and acidic dyes because of the relationship between surface charge and pH. Furthermore, photoreactors could also use pH, which is easily adjusted, to break down dyes quicker based on the dyes' acidity/alkalinity.