

Study of Removal Efficiency of Rhodamine B Dye from Industrial Waste Water with Different Energy Sources Using TiO₂ Photocatalyst

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Various hazardous chemicals discharged to the environment without proper treatments are responsible for whispered pollution. Economical treatment of these hazardous industrial wastes is in high demand in waste treatment sector. Fabric dyes are one of such visible pollutants that are very difficult to treat. In this study, photodegradation processes of Rhodamine B dye in real effluent that was discharged from a fabric dye plant are investigated using various light sources and TiO₂ photocatalyst. The UV visible spectrum of the effluent that contains Rhodamine B dye was used to monitor the degradation process. The effect of four different light sources such as sunlight, UV C light, LED blue and LED cool white light were investigated. Physical conditions such as amount of photocatalyst, exposure time, and mass transfer effect were investigated for the kinetics of removal of Rhodamine B. LED blue and LED cool white light show very small effect for this removal process even at high intensities. Sunlight and UV-C light were found to be very effective for the degradation of Rhodamine B dye in fabric plant effluent. The degradation rate of Rhodamine B under sunlight in the presence of TiO₂ photocatalyst found to be significantly higher than that for UV C light. However, both light sources are found to be practically usable. Under the sun light, not only Rhodamine B dye but also most of the other chemicals in the effluent were almost entirely eliminated. When sunlight was employed, the degradation rate was highly fluctuated with the change of intensity of sun light. The mass transfer effect is identified as crucial factor for the removal kinetics. Under the agitation, UV-C light also shows removal rate comparable with that of sunlight. Therefore, though less effective than sunlight, UV-C light has higher potential using in industrial applications with proper wavelength, agitation rate and intensity tune up. The pilot plant is under construction in a fabric dye plant based on the outcome of this study.

Keywords: Photocatalyst; Degradation; UV light; Rhodamine B; Dyes