MINERALIZATION STUDY OF THE REACTIVE RED-4 (RR4) DYE UNDER PHOTODEGRADATION VIA IMMOBILIZED SILVER (Ag) DOPED TiO_2 PHOTOCATALYST

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(Nurfarhanah Nadzira Bt Che Razak)

ABSTRACT

MINERALIZATION STUDY OF REACTIVE RED-4 (RR4) DYE UNDER PHOTODEGRADATION VIA IMMOBILIZED SILVER (Ag) DOPED TiO_2 PHOTOCATALYST

The organic dyes from the textile industry released to the water body might result in environmental effects which these dyes are high toxicity and non-biodegradability that must be treated using the photocatalysis process to degrade organic compounds into harmless chemicals. Therefore, several modifications have been approaches to reduce the E_g and electron-hole recombination like doping with Ag, since Ag indicates a beneficial influence on photocatalytic activity. In this work, titanium dioxide (TiO_2) was used in the photocatalysis process as a semiconductor due to its unique properties and has less effective under visible light irradiation. Doping with Ag, can reduced photogenerated electron-hole pair recombination, hence enhancing the photocatalytic activity of TiO_2. The 3 wt% of Ag on TiO_2 (Ag doped TiO_2) was prepared by photo deposition method prior immobilization to study the mineralization of 12 mgL^{-1} RR4 dye under photodegradation using 55 W fluorescent lamp up to 480 mins (8 hrs) irradiation time. TiO_2 was coated onto double-sided adhesive tape (DSAT) by using brush technique on glass plate 10 x 1.5 x 0.2 cm (L x H x B) as support material. The diffraction angles obtained in immobilized Ag-doped TiO_2 was aligned with TiO_2 based on JCPDS card no: 21-1276 with additional peaks appears at 32.7, 35.3, 38.2° representing the peaks for Ag_2O. The hydroxyl bonding was observed at 1600-1800 $cm^{-1}$and the peak detected at 700-900 cm^{-1} indicates Ag-O vibration which scrutinized by FTIR analysis. The acquired results from FESEM-EDX indicated the presence of 0.6% Ag on the Ag doped TiO_2 photocatalyst. Ag doped TiO_2 has shown an excellent mineralization process where a complete mineralization was achieved at 480 minutes as compared to unmodified TiO_2 which ca. 64.77% COD remained at same irradiation time. Also, the immobilized Ag doped TiO_2 is durable with sustain of its photocatalytic performance which able to perform the same photocatalytic activities up to 10 cycles.

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CHAPTER 1

INTRODUCTION

1.1 Background of study

The textile industry is one of the world's greatest water consumers and a major anthropogenic producer of organic and chemical pollutants found in wastewater. According to Nimkar (2018), an average of 8000 chemicals are used in the production of textiles. Organic dyes used in the food and textile sectors are the primary causes of environmental pollution because of their high toxicity and non-biodegradability with carcinogenic consequences to humans (Tichapondwa *et al*., 2020).

Acids, alkalis, dyes, hydrogen peroxide, starch, and dispersing agents categorized as organic chemicals (Holkar *et al*., 2016). The dye effluent released might result in environmental effects such as photosynthesis and aquatic life inhibition. Therefore, these hazardous dyes must be treated prior to being released to the water body. The treatment of dyes from industrial effluents has been accomplished using a variety of approaches where the photocatalysis process is one of the effective techniques to degrade organic compounds into harmless chemicals (Tichapondwa *et al*., 2020).

Titanium dioxide (TiO_2) is one of the semiconductors used in the photocatalysis process due to its own unique properties such as low cost, no