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DIRECT ORANGE VIA TIO_2 ASSISTED PHOTOCATALYSIS

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Abstract
In this paper, photocatalytic degradation of direct orange dye solution was achieved in the presence of $CoFe_2O_4$: TiO_2 as catalyst under solar light. The process was of pseudo-first order kinetics. The best conditions of decolourization for this dye was the following: initial dye concentration is 50 mg/L, photocatalytic system $CoFe_2O_4$: TiO_2 (50%:50%) = 0.025 g/100 mL and the initial pH of an aqueous solution of dye is 8.

Introduction
Synthetic dyes as trade effluent from textile, paper and cosmetic industries, released in the environment have major effects on the health and integrity of the ecosystem. Many of them are highly toxic, with mutagenic and carcinogenic long-term effects, present high stability to light, heating, and oxidation. This is the reason that new materials used as photocatalysts are necessary, knowing that usual technologies for dyes removal include adsorption on inorganic/organic matrices, photocatalysis, oxidation and enzymatic decomposition. The direct photolysis and application of different catalysts is preferred in order to optimize the photocatalytic degradation of DO-26.

Materials and methods
The synthetic solution of DO-26 were subject to photocatalytic experiments using a sun photochemical reactor. In order to determine optimum $CoFe_2O_4$: TiO_2 dose, a solution of DO-26 with the concentration of 50 mg/L was subject to degradation for 11 hours (at every 30 minutes of irradiation a sample has been collected and analysed. The linearization of DO-26 degradation reaction after a pseudo-first order kinetic allowed to calculate the rate constants for each photocatalyst dose (figure 1). At a regular intervals; 2.5 mL of reaction mixture was withdraw from the suspension solution by a syringe to a plastic test tube, then centrifuged at (4,000 rpm, 10 minutes) in a centrifuge. The filtrated solution was carefully removed by a syringe to new plastic test tube and centrifuged again at the same top conditions, to remove the fine particles of photocatalyst. The concentration of residual direct orange dye was determined spectrophotometry at 519 nm, using UV-visible spectrophotometer type SPECORD M400. The apparent first-order kinetic constants k was estimated through non-linear regression by fitting the exponential decay equation: $D(\%) = (A_0-A_f)/A_0$ x

100, where A_0 is the initial absorbance of the sample and A_f represents the final absorbance at the same wavelength after 11 h of reaction.

Results and conclusions

From the obtained results was selected an optimum photocatalyst dose [$CoFe_2O_4$: TiO_2] = 50%:50% which assures a DO-26 degradation efficiency of 65.59% degradation being achieved after 11 h of irradiation (figure 1).

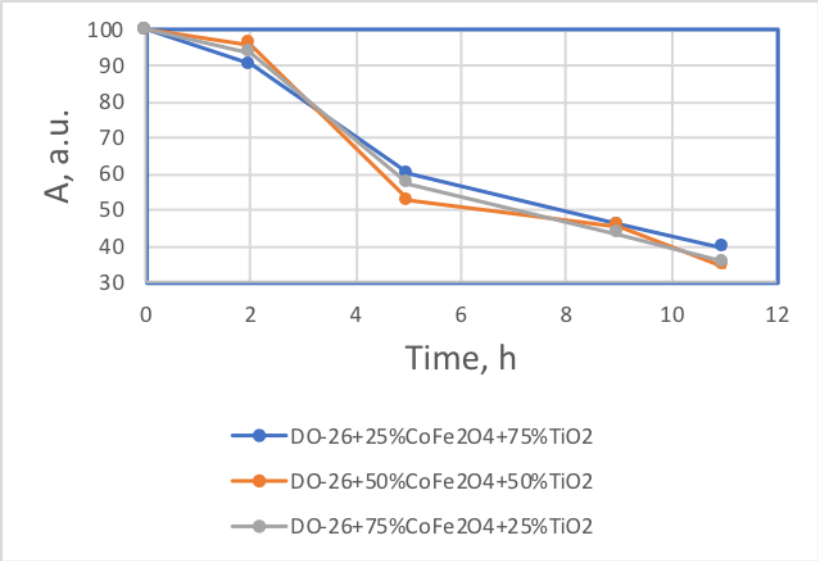

Figure 1. DO-26 photocatalytic degradation kinetics

Experimental results proved that DO-26 photocatalytic degradation is obeying Langmuir Hinshelwood model (rate constant value = 1,075 x 10^{-5} M min^{-1}).

The photocatalytic degradation efficiency of DO-26 was 65.59 % by using $CoFe_2O_4$-TiO_2 = 50%:50% as a photocatalyst under solar light irradiation after 11 h, indicating that this catalytic system itself had the best photocatalytic activity.

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