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Photo Catalytic Degradation of Methylene Blue by Using CuO Nanoparticles

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***Abstract*—Photo catalytic degradation of methylene blue has been studied by using different concentration from CuO nanoparticles. The study was carried out with sunlight and in the absence of UV source. As well as the study was the presence of UV source. The Characterization catalysts have performs by UV–Visible spectroscopy. The rate of degradation of dye was monitored spectra photo metrically by measuring absorbance of dye at regular time intervals, change the concentration of dye and change the concentration of catalyst. The results show the best degradation for methylene blue dye was at the irradiation time of 5 hours and in the presence of UV source.**

***Index Terms*— Photo catalytic; methylene blue; absorbance; catalyst; CuO nanoparticle.**

I. INTRODUCTION

In spite of the expanded of meticulousness about ecological directions, phenols Persevere as one of the significant contaminants to oceanic life [1, 2]. These Composites are exceptionally cancer-causing and lethal to all types of life and can be distinguished in Upper fixations on the modern wastewater from petrochemical, paper-production, oil-refineries, press purifying procedures [1]. Because of the significance of its and rebellion to traditional debasement forms, it is a typical model compound depend in cutting edge water concentrates, Especially those including the propelled oxidation forms (AOP). Advanced oxidation forms (AOP) a procedure of mineralization of natural mixes into straightforward items, for example, water and CO_2, This promising innovation has risen in the previous couple of decades [3]. Among the semiconductors for AOPs, TiO_2 and CuO are the regularly examined materials and Works take a gander at their capacity to deliver hydroxyl radicals to wreck numerous sorts of natural contaminations [4]. Also, they are nontoxic, shabby and copious.

CuO is an imperative p-sort move metal semiconductor with a 3d9 electronic design, contract band crevice of 1.2 eV and low electrical resistance values, and Exhibits various regular attributes intriguing [5]. In view of its against ferromagnetism, minimal effort, non-poisonous and highlights high steadiness, CuO is Considered a standout amongst the most prominent materials in a wide assortment of uses of electronic and optical fields, similar to gas sensors, Super conductor high temperature, optical switch, sun powered cells, and electron field emitter , and so on [6,7].

Regarding to potential commercial values, CuO nanostructures with high rates of surface-size exploited on a large scale sensitive material gas and make offers excellent sensing [8]. Has made tremendous efforts to get new types of nanostructures or good nanostructures homogeneous material is copper oxide [9].

Concerning to a continuance published articles [10–27], we focus on addresses CuO nano particle syntheses for use as a catalyst in the photo catalytic degradation. The fundamental points of interest of utilizing CuO nanoparticles as the impetus for this esterification are to abbreviate the response time. Utilizing CuO nano particles likewise has minor preferences, for example, basic manufactured operation, brilliant yields, and recyclability.

II. EXPERIMENTAL WORK

A. Material and Instruments:

The materials used in this work are Methanol (CH_3OR) of purity 99.5% which was supplied from Fluka company, nano particles from copper oxide CuO as nano powder and high purity solution from methylene blue (Reidel). CuO nanoparticles were prepared as the catalyst of 0.1 g diluted in 100 ml methanol). Copper oxide CuO and methylene were weighed by using sensitive balance. Methylene blue as a dye often used for catalytic tests (0.05 g diluted with 500 ml methanol).

B. Photo catalytic set up:

The photo catalytic set-up consists of UV- source as a lamp of cylindrical shape (22cm body length and 16cm arc length) which was used as a photo source. This lamp was positioned in a container of the sample (mixture of copper oxide and methylene blue) and then placed on magnetic stirrer (to mix and disperse solutions result of high speeds and long time to prepare it solutions).

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C. *Irradiation time effect:*

The Mixture of CuO nano particles and mathylene blue was placed on magnetic stirrer and the temperature was fixed at 25C. The UV-lamp was switched on inside the sample container. Different irradiation time (1, 2, 3, 4 and5 hr) were employed. The photo degradation measured after each hour .The samples were examined by UV-spectrometer to measure the absorbance of all sample .

D. *Dye concentration effect:*

Different concentrations of the methylene blue were used in the range of (0.1, 0.2, 0.5, 1, 1.5, 2g) and 0.1g from CuO. The samples were withdrawn from the mixture without photo catalysts and after 15 minute for each concentration of methylene blue. The samples were examined by UV-visible spectrophotometer to measure the optical absorbance.

E. *CuO nanoparticles concentration effect:*

Different concentrations of the CuO nanoparticles were used in the range of (0.1, 0.2, 0.5, 1, 1.5, 2g) and 0.1g from methylene. The samples withdrawn from the mixture without photo catalysts and after 15 minute for each concentration of the CuO nanoparticles .The samples were examined by UV-visible spectrophotometer to measure the optical absorbance.

III. Results and Discussion

A. With sunlight: Figure 1 represent the relation between the optical absorbance and the photocatalytic time with irradiate to sunlight. The increasing of photo degradation time up to 4hr. leads to that the values of absorbance increased, because of the degradation process happened to sample. This conduct concurs with the mixed corruption of contaminants is another promising territory in photograph synergist water handling. Particular debasement could be valuable for blends of exceptionally dangerous Contamination in low fixations and less unsafe mixes in higher focuses [28]. Figure 2 represent the absorption spectrum of CuO with sun light, and can be shown that the minimum absorption take place at the range of wavelength (490-508nm) for different irradiative time.

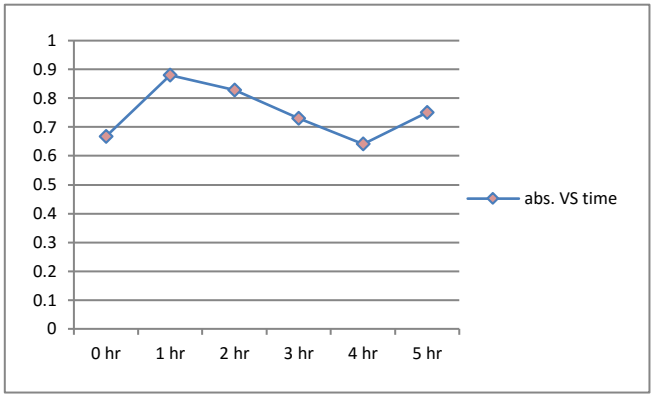

Fig. (1): The absorbance when change the time of irradiation with sun light.

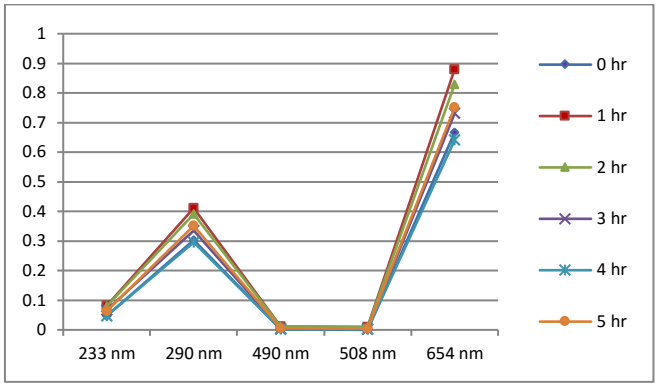

Fig. (2): the absorbance of dye for different region when change the time of irradiation with sun light.

The effect of variation of concentration of methylene blue (Fig. 3) on its degradation rate has been observed in the range from 0.1g to 0.5g. It has been observed that the rate of degradation increases with increasing concentration of dye up to 3.00 for CuO catalyst. Advance increment in focus past this utmost result in a reduction in corruption rate. This might be clarified on the premise that, on expanding the grouping of color, the response rate increments as more atoms of colors were accessible yet a further increment in focus past 3.00 for CuO impetus cause hindrance of response because of an expansion in the quantity of crashes between color particles though, impacts amongst color and OH radicals diminish. As a result, rate of response is diminished [29]. Figure 4 noticed the absorption of dye was increased when irradiated the solution 15 min.

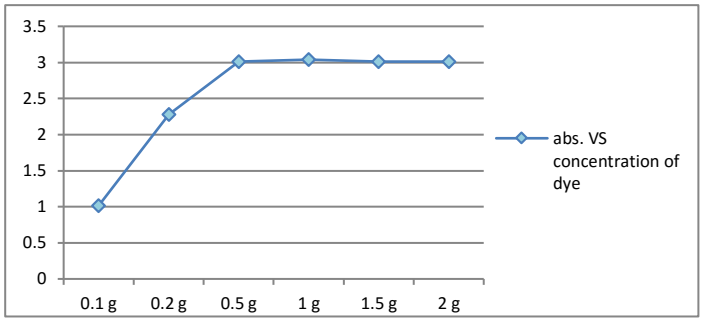

Fig. (3): the absorbance of dye when change the concentration of dye without irradiation.

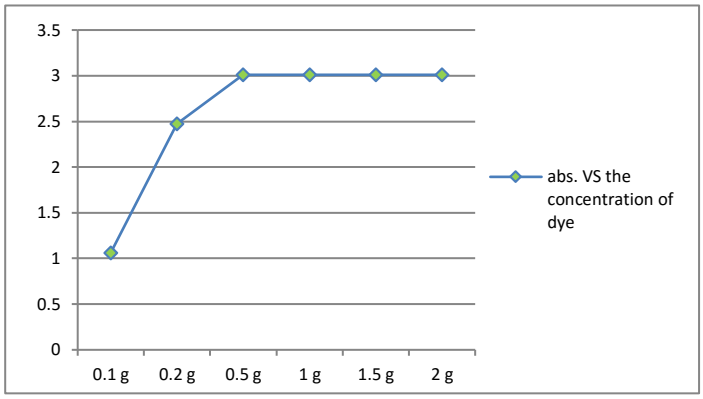

Fig. (4): the absorbance of dye when change the concentration of dye after 15 minute from irradiation.

A progression of investigations was done to discover the impact of CuO fixation. Centralization of CuO was changed (0.1, 0.2, 0.5, 1, 1.5, 2) g, Mathlyene blue was altered 0.1 g . The rates of response have been found now and again to enhance as impetus focus increments and after that falling gradually or turning out to be almost autonomous of fixation. As it is shown in Figure 5, the corruption is expanded after time 15 min. The expansion turbidity of the arrangement lessens the light transmission through the arrangement, while it is accepted underneath this level of fixation. This perception is a result of the impetus surface and the assimilation of light by breaking point CuO particles. Another case might be because of a close aggregate light eradication which is happened by impetus particles at an ideal focus [30].

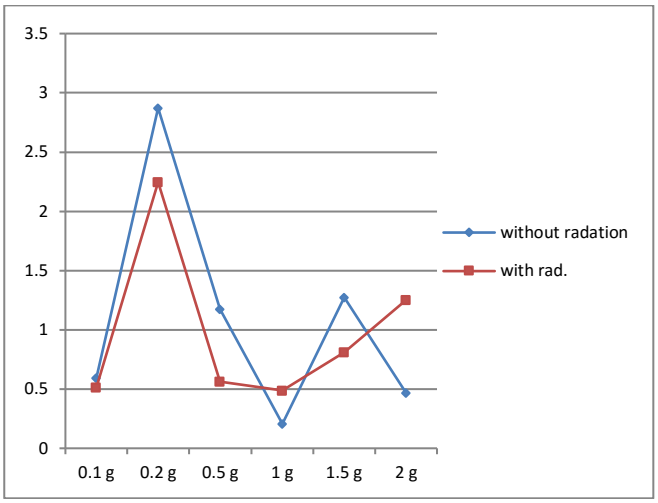

Fig. (5): the absorbance when change the CuO concentration and fixed the dye concentration at 654 nm.

IV. Conclusion

Photocatalysts were efficient for the degradation of MB solution under ultraviolet light irradiation. CuO showed the most excellent activity for the photo degradation of MB no matter under visible or ultraviolet light irradiation.

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