PHOTOCATALYTIC ACTIVITY OF CADMIUM OXIDE NANOPARTICLES

P.Gurulakshmi , P.Duraiselvi ,U. Maheshwari,M.Parkavi

Department of Chemistry, A.P.C.Mahalaxmi College for Women, Thoothukudi 628008.

Abstract:

In this study Photocatalytic activity of Cadmium oxide nanoparticles were investigated by degradation of Methyl Orange and Methelene Blue dyes. Cadmium Oxide nanoparticles were synthesized by using Cassia auriculta flower extract. The flower extract acts as both reducing and stabilizing agent for the synthesized nanoparticles.

Keywords: Green synthesis, Nanoparticles, Cassia auriculata, Photocatalyst.

Nanotechnology is naturally very broad including fields of science such as surface science, organic chemistry, molecular biology, semiconductor physics, energy storage,[1,2] microfabrication,[3] molecular engineering,.[4],Opto electronic [5] etc. Metal oxides such as CdO, TiO_2 play a important role in many areas of chemistry, physics and materials science [6,7]. The metal elements are able to form a large diversity of oxide compounds [8]. CdO nanopowders possess excellent photocatalytic and antimicrobial activities due to their surface characteristics, shape and size [9]. Many researchers used green synthesis methods for different metal nanoparticles due to their eco-friendly properties [10].

2. Materials and Methods

2.1. Materials

In the present work all the chemicals used are analytical grade were obtained from E-Merck chemicals . Whatman no.1 filter papers are used for filtration purpose. Double distilled water was used for dilution purpose. All Glasswares were washed well, rinsed with double distilled water and dried in hot air oven before starting the experiment.

2.2 Methods

2.2.1. Preparation of the Cassia auriculata Flower extract

The collected Cassia auriculata was incised into small pieces, washed well with double distilled water to dirt and other forein materials. About 10 grams of thus dried Cassia auriculatawere weighed and transferred into 250mL beaker containing 100mL of Ethanol and boiled well for 30 minutes. The extract obtained was filtered through Whatman No-40 filterpaper and the filtrate was collected in a 250mL beaker and stored in refrigerator for further use.All the experiment was carried out using this extract.

2.2.2. Green synthesis of Cadmium Oxide nanoparticles:

In this method Cadmium nitrate was used as a precursor and Cassia auriculata Flower extract as a reducing and stabilizing agent for the synthesis of Camium Oxide nanoparticle.For the green synthesis of Cadmium Oxide nanoparticles, 50mL of previously prepared Cassia auriculata flower extract was taken in a 100mL beaker. To this 5g of $CdNO_3$ solution was added and the solution in the beaker was stirred in a heating magnetic stirrer at70^oC until the brown paste was obtained. Then the paste was collected in a ceramic crucible and calcinated in Muffel Furnace at 350 ^oC. A brown coloured powder of CdO nanoparticles was obtained and this was carefully collected and preserved in the air-tight sample tubes for further studies

2.2.3.Photocatalytic measurement

The photocatalytic activity of cadmium oxide nanoparticles was examined by degradation of Methylene Blue and Methyl Orange dye under UV-Visible spectrophotometer. For a typical photocatalytic experiment, 0.2g of the prepared sample was added to Dye solution.. The aqueous suspension was put under constant stirring in dark for 1hr, for the adsorption of dye on the surface of metal oxide nanoparticle. Then the solution was exposed to the sunlight . About 10 ml of suspension solution was taken out after every 10 min for measuring absorbance. The photocatalytic degradation of dyes mixed with synthesized CdONPs was examined using UV-Visible absorption values.

3.Result and discussion:

PHOTOCATALYTIC ACTIVITY:

The Photocatalytic activity of CdONPs was monitored by using Methylene blue and Methyl Orange dye as a test compound. The progression of the catalytic degradation of MB ,MO dye in presence of sunlight can easily be examined by decrease in absorbance at 665 nm and433nm respectively.The absorbance of Methylene blue and Methyl Orange (100mM) in the absence of CdONPs showed only a small increase of reductive degradation with time under the exposure of sunlight . However, the photocatalytic (in presence of sunlight) degradation observed after addition of CdONPs catalyst in the same sample solutions. The more decrease in absorbance of degradation of MB dye ,MO dye as shown in Table1 and 2 . It was also observed that the reaction rate of MB dye,MO dye degradation with CdONPs in presence of sunlight enhanced the degradation efficiency when compared with the results of the control test. This indicates the CdONPs act as good photocatayst.[102]

Table 1. Absorbance of MB Dye at different time intervals

Time in minutes	Absorbance	Absorbance (in presence of CdONPs)
0	1.3416	0.7616
10	1.3414	0.7213
20	1.3413	0.6950
30	1.3407	0.6735
40	1.3400	0.6363
50	1.3397	0.5913
60	1.3394	0.5243

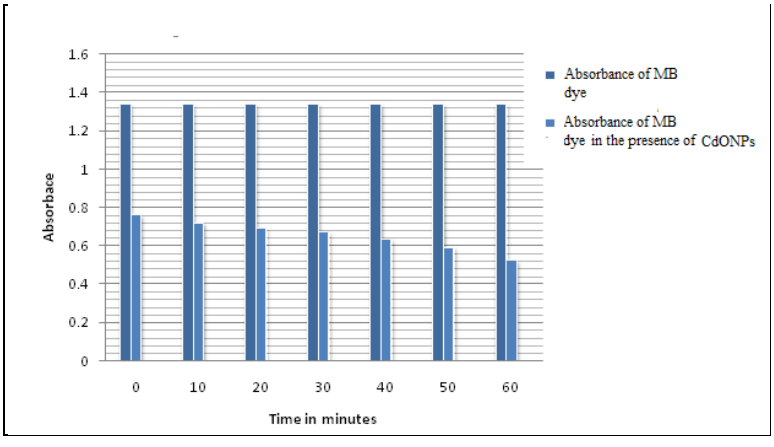

Fig.3.3. Bar diagram for absorbance of MB dye in the absence and presence of CdONPs

Fig.3.3. indicated the Bar diagram for absorbance of MB dye in the absence and presence of CdONPs.This diagram shows the absorbance decrease in the presence of CdONPs,

Table 2. Absorbance of MO Dye at different time intervals

Time in minutes	Absorbance	Absorbance (in presence of CdONPs)
0	1.4988	1.1071
10	1.4974	0.7533
20	1.4963	0.4860
30	1.4917	0.4232
40	1.4912	0.4172
50	1.4903	0.3948
60	1.4897	0.3550

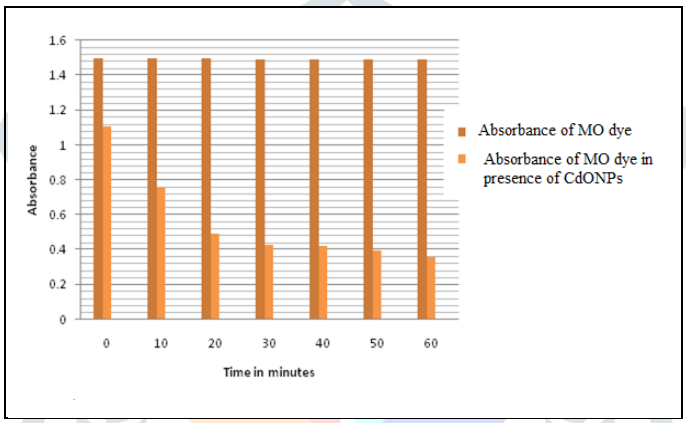

Fig.3.4. Bar diagram for absorbance of MO dye in the absence and presence of CdONPs

Fig.3.4. indicated the Bar diagram for absorbance of MO dye in the absence and presence of CdONPs.This diagram shows the absorbance decrease in the presence of CdONPs .

Conclusion:

The cadmium oxide nanoparticles was successfully synthesized by using *the extract of cassia auriculata* which provides cost effective, easy and proficient method for synthesis of CdONPs.. The photcatalytic dye degradation studies were performed on Methylene blue and Methyl orange dye using synthesized cadmium oxide nanoparticles.In future CdO nanoparticle synthesized from cassia auriculata can be utilized for removal of organic pollutant

References:

1.Yeoheung Yun,Nanomedicine Design of Particles, Sensors, Motors, Implants, Robots, and Devices

2. *Hubler, A. "Digital quantum batteries: Energy and information storage in nanovacuum tube arrays". .* doi*:*10.1002/cplx.20306.*(2010).*

3.*Shinn, E. "Nuclear energy conversion with stacks of graphenenanocapacitors". Complexity..* doi*:10.1002/cplx.21427.(2012).*

4.*Lyon, David; "Gap size dependence of the dielectric strength in nano vacuum gaps". IEEE.*doi*:10.1109/TDEI.2013.6571470.(2013).*

5.*Saini, Rajiv; Saini, Santosh; Sharma, Sugandha"Nanotechnology: The Future Medicine". Journal of Cutaneous and Aesthetic Surgery.3 (1)*,doi*:10.4103/0974-2077.63301(2010), 32–33.*

6.SathyavathiR., Balamurali Krishna M., VenugopalRao S.,.Saritha R, and NarayanaRao D., Advanced Science Letters**,** 3, 2010, 1–6.

7. Noguera, C. Physics and Chemistry at Oxide Surfaces; Cambridge University Press:

Cambridge, UK, 1996.

8. V.E. Henrich, P.A. Cox, The Surface Chemistry of Metal Oxides, Cambridge

University Press, Cambridge, UK, 1994.

9. Wyckoff, R.W.G. Crystal Structures, 2nd ed; Wiley: New York, 1964.

10.adsorption- enhanced photocatalysis of Cd/TiO2 nanocomposite, Powder

Technol. 239 (1), (2013)

11. Mohammad Mansoob Khan Syed , Farooq Adil, Abdullah Al-Mayouf, Metal oxides as photocatalysts, Journal of Saudi Chemical Society**,**19(5), September 2015, 462-464