E-ISSN: 2664-6773
P-ISSN: 2664-6765
Impact Factor: RJIF 5.6
IJCBS 2022; 4(2): 30-32
www.chemicaljournal.org
Received: 02-09-2022
Accepted: 05-10-2022

Vandana Sukhadia
Department of Chemistry, S.D. Govt. College, Beawar, Rajasthan, India

Corresponding Author:
Vandana Sukhadia
Department of Chemistry, S.D. Govt. College, Beawar, Rajasthan, India

Study of percent degradation of copper complex with various solvents

Vandana Sukhadia

DOI: https://doi.org/10.33545/26646765.2022.v4.i2a.44

Abstract
Transition metal soaps have their vast area of different fields like industry, technology and in allied science. Recently their complexes have greatly attracted the attention of industries and are finding increasing their application in different fields. The photocatalytic degradation of copper (II) soap complex have been studied spectrophotometrically in non- aqueous and non polar solvent benzene. Copper (II) Mustard complex was synthesized with N and S containing ligands. The aim of this study to observe the percent degradation of copper soap complex which increases with increasing amount of methanol solvent and further decrease with some extent. Zinc oxide (ZnO) was used in the photocatalytic decolourisation and degradation study of copper (II) Mustard thio urea complex. Intensity of light is measured with the help of solar meter (CEL India Model SM 201). Absorption of light is recorded by U.V. visible spectrophotometer (SYSTRONIC MODEL 106) at different time intervals. The various thermodynamic and kinetic parameters of the process were evaluated. Photo degradation has been considered in many reaction of biological, synthetic and industrial importance where energy received from sun can be better utilized for converting the pollutants into less toxic or almost harmless materials. The best way for the overall treatment of dyestuff effluent, is photo degradation. Photo-catalysis has proven as a booming field of chemistry due to its numerous potential applications. An attempt has been made to focus on anti-microbiological activity of copper (II) mustard thiourea complex at different concentrations with *Staphylococcus aureus* which may causes skin infections.

Keywords: ZnO, photocatalytic degradation, copper mustard thiourea complex, semiconductor, rate of reaction

Introduction
Heterogeneous photo-catalysis on semiconductor surfaces has attracted a lot of attention due to application like water disinfection, degradation and complete mineralization of organic contaminants in waste water and purification and water splitting for hydrogen production [1-3]. Various conventional methods have been pressed into practice, in the decolourisation and degradation of dyes in the waste namely - biological treatment methods, coagulation, filtration, adsorption by activated carbon, reverse osmosis [4]. Low cost methods such as adsorption by activated charcoal, amongst these have been proven to be effective but incomplete in that they produce large amounts of solid wastages for further disposal thus adding to further pollution and environmental hazards. The other methods which have been proved efficient are not cost-effective [5]. Photocatalytic techniques may prove to be faster and more economical than the traditional techniques of treating pollutant. Today, people are facing a major problem of water pollution for all living beings. The world's water supply is under considerable stress due to increasing industrialization, increasing demand, and a decreasing supply due to all kind of pollutions. The industrial effluents are toxic sources of water contamination which threatens our health as well as environment and has become an issue of major social and economic concern [6].
There is an increasing demand of clean water all over the globe. Different types of method have been applied for degradation of coloured water but also require an urgent eco-friendly solution for treatment of waste water. The discharge of the major constituent of pollutants in waste water into water sources from textile and other industries affects water quality including turbidity, temperature, alkalinity, pH, acidity COD, BOD, and colour. The discharge of those coloured waste waters in the ecosystems causes serious environmental problems also like eutrophication aesthetic pollution and can originate dangerous by-products through hydrolysis,

oxidation, or other chemical reactions in the wastewater phase [7, 8].

The photocatalytic properties in the presence of visible light were utilized in the degradation of pesticides, textile dyes and pharmaceutical drugs that cause air and water pollution [9-11].

Experimental

Initially copper mustard soap is prepared by direct metathesis of corresponding potassium hydroxide with oils to get soap with slight excess of required amount of copper sulphate at 50-55 °C [12].

$$RCOOH \xrightarrow[EtOH]{KOH} RCOOK \longrightarrow R(COO)_2K \xrightarrow{Cu^{+2}}$$

The prepared soap derived from edible oil was refluxed with ligand thiourea to get its complex. Photocatalytic degradation of CMT complex was observed at lambda maximum 680nm. Irradiation was carried out in covered glass bottles for the protection of evaporation of solvent with a 200 W tungsten lamp. A water filter was used to avoid thermal degradation. Absorption of light is recorded by U.V. visible spectrophotometer (Systronic model 106) at different intervals of time.

A solution of ligand thiourea in 15 ml of ethanol was taken and solution of purified Copper (II) soap Copper (II) mustard soap in benzene were added in 1:1 ratio and refluxed for 1 hrs. The formed precipitate was filtered off, washed with purified hot benzene, and dried. The sticky product was passing through a filter, washed several times with ethanol and dried. Formed product is clearly green in color and soluble in benzene and organic solvents but insoluble in water.

Result and Discussion

Percentage degradation of CMT complex was estimated by the following equation.

$$\% \text{ degradation} = A_o - A_t / A_o * 100.$$

Here

$A_{o=}$ initial concentration of complex

$A_{t=}$ final concentration of complex

Percent Degradation

Photocatalytic degradation of Copper (II) soap complexes were carried out by using ZnO as semiconductor under light of 34 $mWcm^{-2}$. The rate of complex degradation was identified by color change. Initially the color of complex was dark green- blue, which was gradually fades to light green after 2 h. Further light green was disappears slowly and solution becomes almost color less after completion 18 h light exposure.

Different rate affecting parameters for percentage degradation were varied to obtain the maximum rate of degradation for photocatalytic degradation of Copper (II) soap complex.

Percent degradation and effect of solvent polarity

As the polarity of solvent increase percent degradation also increase for some extent but after that it remains constant. Results are shown in Table 1.

A perusal of data suggests that the rate of degradation increases with the increase in percentage of polar component in solvent mixture. This may be due to the increase in early participation of the macromolecular solute to get excited by absorbing the electron and degradation starts earlier up to a certain limit. In all the Copper (II) soap complexes, Copper (II) soya complexes degrades first as compared with Copper (II) mustard complexes as reported in Figure 1.

Table 1: Solvent effect on copper (II) mustard thiourea complex

Methanol- Benzene %	A_0-A_t/A_0*100
20	63.5
30	70.27027027
40	72.54901961
50	77.39726027
60	83.33333333
70	81.42076503
80	68.846

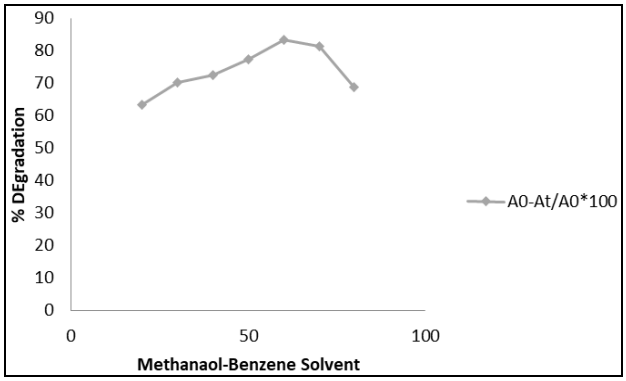

Fig 1: Solvent Effect with percent degradation on Copper (II) mustard thiourea complex.

Antimicrobial activity of CMT

Antimicrobial activity of CMT complex was done against Staphylococcus aureus. In study Streptomycin was used as positive control (300 mcg/ml concentration). Dilutions were made in hot benzene and two different concentration solutions C_1 (50 mg/ml) and C_2 (25 mg/ml) were prepared. Composition of stock solutions for CMT complex has been shown in Table 2.

Mueller-Hinton agar medium was used for antimicrobial activity of given compounds on two different concentrations by disk/ well diffusion susceptibility testing. Fresh Cultures of *Staphylococcus aureus* strain ATCC-25923 were inoculated in Peptone water & kept for incubation for 30 minutes at 37 °C. The bacterial suspensions were compared to 0.5 McFarland Turbidity Standard. Microbial culture was swabbed onto the Mueller Hinton Agar surface through sterile Cotton swab sticks. After proper marking of plates, 50 µl extracts from different dilutions prepared was loaded into the respective wells. The swabbed *Staphylococcus aureus* plates were kept for incubation at 37°C for 24-48 hours and results were observed and shown in table: 14 and results are shown in Figure 2.

- PC- Positive Control, NC – Negative Control,
- C_1 and C_2-two different concentrations of compounds,
- NZI – No Zone of Inhibition

Table 2: Zone of inhibition of two different concentrations of CMT against *Staphylococcus aureus*

Compound	PC	C_1(50mg/ml)		C_2(25mg/ml)		NC
		24hrs	48hrs	24hrs	48hrs	
CMT	31 mm	10 mm	10 mm	9 mm	10 mm	NZI

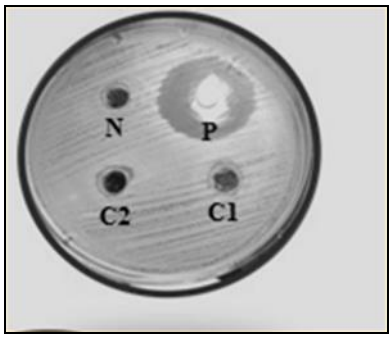

Fig 2: Results of antimicrobial susceptibility test of CMT against *Staphylococcus aureus*

Conclusion

- The goal of this work to determine the rate of photocatalytic degradation of Copper (II) Thiourea complex. All the above studies led to the conclusion that the rate of photocatalytic degradation increases with increase in the concentration of complex molecules up to a certain limit furthermore there is a decrease in rate of degradation. As the polarity of solvent increases, rate of photodegradation increases but rate becomes drop off after a definite polarity. CMT show antimicrobial activity against *Staphylococcus* aureus bacteria. These investigations may conclude that the CMT complex derived from natural oil had an inhibitory effect on the growth of S. aureus. Therefore, proper design of ligands and its complexation with suitable metal ions of surfactant may contribute to improve the biological efficacy of a molecule.

Acknowledgements

The authors pay their sincere gratitude to Dr. Lal Clinical laboratory Pvt. Ltd., Malviya Nagar, Jaipur for providing analytical data Principal, S.D.Govt College Beawar and Principal, S.P.C Govt College Ajmer for laboratory facilities.

Author's Contribution

Not available

Conflict of Interest

Not available

Financial Support

Not available

References

1. Hoffmann MR, Martin ST, Choi WY, Bahnemann DW. Environmental Applications of Semiconductor Photocatalysis, Chem. Rev. 1995;95:69-96. DOI: 10.1021/cr00033a004.
2. Mills A, Le Hunte S. An overview of semiconductor photocatalysis, J Photochem. Photobiol. A: Chem. 1997;108:1-98. DOI:10.1016/S1010-6030(97)00118-4
3. Tryk DA, Fujishima A, Honda K. Recent topics in photo electrochemistry: achievements and future prospects Author, Electrochim. Acta. 2000;45:2363-2376.
4. Kumar M, Tiwari R, Sharma K, Sharma OP, Sharma MK. Photochemical Treatment of Amido Black - 10B Waste Water by Photo-Fenton Reagent, Orient. J Chem. 2011;27(23):1179-1184.
5. Upadhyay R, Sharma OP, Jaker S, Sharma RK, Sharma MK. Photocatalytic degradation of Azure B using Copper hexacyanoferrate as semiconductor, Int. J Chem. Sci. 2013;11(1):331-340.
6. Chen D, Ray AK. Photocatalytic kinetics of phenol and its derivatives over UV irradiated TiO2, Appl. Catal. B Environ. 1999;23:143-157.
7. Prevot AB, Baiocchi C, Brussino MC. Photocatalytic degradation of Acid Blue 80 in aqueous solutions containing TiO_2 suspensions, Environmental Science and Technology. 2001;35(5):971-976.
8. Neppolian B, Choi HC, Sakthivel S, Arabindoo B, Murugesan V. Solar light induced and TiO_2assisted degradation of textile dye reactive blue 4, Chemosphere. 2002;46(8):1173-1181.
9. Wang Y, Xue S, Xie P, Gao Z, Zou R. Preparation, characterization and photocatalytic activity of juglans-like indium oxide (In_2O_3) nanospheres, Mat. Lett. 2017;192:76-79.
10. Elango G, Roopan SM. Efficacy of SnO_2 nanoparticles toward photocatalytic degradation of methylene blue dye, J Photochem. Photobiol. B:Biol. 2016;155:34-38. https://doi.org/10.1016/j.jphotobiol.2015.12.010.
11. Zhou P, Xie Y, Fang J, Ling Y, Yu C, Liu X, *et al.* CdS quantum dots confined in mesoporous TiO2 with exceptional photocatalytic performance for degradation of organic pollutants, Chemosphere. 2017;178:1-10.
12. Sharma R, Tak P, Saxena M, Bhutra R, Ojha KG. Synthesis and Characterization of Antifungal Agents Containing Copper(II) Soaps and Derived from Mustard and Soyabean Oil Tenside Surf. Det. 2008;45:2.

How to Cite This Article
Vandana Sukhadia. Study of percent degradation of copper complex with various solvents. International Journal of Chemical and Biological Sciences 2022; 4(2): 30-32. DOI: https://doi.org/