Utilization of Solar Energy and Magnetic Nano Particle for the Treatment of Dye Effluent around Dindigul District

Dr. G. Vimala[1], Dr. S. Sheik Mydeen[1a], Dr.K.Thara[1b], Dr. P. Uma Mageshwari[2], P. Arulmozhi[2a], Dr. R. Shanmuga Selvan[3*]

[1]*Assistant Professor, Department of Chemistry, Chellammal Women's College, guindy, Chennai-600032*
[1a]*Associate Professor, Sethu Institute of Technology, Puloor, Kariapatti, -626115*
[1b]*Associate professor, SSM Institute of Engineering and Technology, Dindigul-624005*
[2]*Department of Physics, G.T.N Arts College, Dindigul-624005.*
[2a]*Research and development center Bharathiyar University Coimbatore- 641 046*
[3*]*Assistant Professor, Department of Chemistry, G.T.N Arts College Dindigul-624005*

Keywords

Abstract

Nano particles were prepared by green synthesis method. The Nano particle was characterized by XRD, SEM confirm the structural, textural and magnetic property. Surface morphology method. Surface morphology changed cubic to needles shape and size below 100 nm confirmed by SEM analysis, XRD analysis shows that doping reveals the magnetic nature of the CuO_2Nano particle by changed its crystal structure and magnetic nature. The prepared Nano particle was used to treat industrial effluent companied with solar energy as one parameter.

INTRODUCTION

The state of the environment and its components increasingly affects economic development, health, and life expectancy. Protection of the environment and, especially, water bodies from pollution and depletion is one of the most important tasks in the modern world. Discharge of untreated and insufficiently treated wastewater into surface water bodies constantly worsen their condition. A further uncontrolled increase in the anthropogenic load on natural resources can lead to a global disruption of the natural balance that will entail the destruction of the natural balance of human life. This necessitates the design and construction of wastewater treatment plants that meet the pollution abatement targets set by the state environmental protection agencies. The scale of the forthcoming work in this direction requires a serious justification of the decisions made and determines the number of specific problems related to wastewater disposal and treatment Dindigul is one of the cities which have more than 25 dye industries. Effluent from those industries is major issue in this city. Many treatment methods suggest to these industries but none of them help to prevent the effect of the effluent. Many are costly in price and some doesn't help to treat the effluent effectively. So in this paper we discuss about combined treatment method for these effluent. In recent studies magnetic nanoparticles are used to treat industrial effluent in various countries. In this paper researcher suggested a companied treatment method for dye industries. This is companied with solar evaporation

RESULTS AND DISCUSSION

The water quality for drinking and irrigation depends upon the total dissolved constituents. The dissolved ions are prime importance in determining the water quality for drinking and irrigation purpose. The reason may be that various chemical ions can move much faster into the ground and can seep through the sandy soil in to the ground water and surface water which causes pollution. In general these Distillery effluent ions can cause high degree of water pollution in the water resources. Hence TDS are dominated in the effluents which enter into the water resources like ponds, lake and river. In order to control the Distillery effluent problems, the black surface solar evaporation Tank has been fabricated using kadappa-stone here, black surface of kadappa-stone Tank enhances the absorption of solar radiation for evaporation. It prevents the dissolved salts from contaminating the water resources and the soil, directly without any pre-treatment. The results obtained during solar evaporation process using black kadappa-tanks are presented and discussed below.

Effect of nano particle and solar evaporator in waste water treatment The physical and chemical observations for the sample Eastern side of RM colony are tabulated in the above tabular column. The observation in the tabular column reveals that. The amount of Electrical conductivity in this sample of water is 1705 mg/lit but the acceptable limit for drinking water is 500 mg/lit so the water is unfit for drinking. The permissible limits for total hardness are 200 mg/lit but the observed values of the sample of water is 384 mg/ lit. So the water is unfit for drinking purpose. The permissible limit for Iron is 0.1 mg/lit but the observed

values of the sample of water is 0.87 mg/ lit. So the water is unfit for drinking purpose. The permissible limit for both ammonia and phosphate are Nil but the observed values are 0.85 mg/lit and 0.62mg/lit, so this water is unfit for drinking.

Experiment-I
Result for the evaporation of 20 liters of Distillery Industry effluents.

Table-1 Solar evaporation of the Distillery Industry effluent on the 1st day of the experiment

NO	Time (hr)		Temp^0 (c)		Depth (cm)		TDS (ppm)	
	Tank-II	Tank-Ill	Tank-II	Tank-Ill	Tank-II	Tank-III	Tank-II	Tank-Ill
1	10:00 A.M		37		5.9		16700	
2	11		38		5.7		16850	
3	12:00 P.M		40		5.5		16940	
4	1		41		5.3		17300	
5	2		40		5.2		17500	
6	3		37		5.1		17800	
7	4		35		5.0		17950	

Table-2 Solar evaporation of the Distillery Industry effluent on the 2nd day of the experiment

NO	Time (hr)		Temp^0 (c)		Depth (cm)		TDS (ppm)	
	Tank-II	Tank-Ill	Tank-II	Tank-Ill	Tank-II	Tank-III	Tank-II	Tank-Ill
1	10:00 A.M		37		4.7		18500	
2	11		38		4.6		18700	
3	12:00 P.M		42		4.5		19100	
4	1		45		4.3		19500	
5	2		39		4.2		19700	
6	3		38		4.1		19800	
7	4		34		4.0		20200	

Table-3 Solar evaporation of the Distillery Industry effluent on the 3rd day of the experiment

NO	Time (hr)		Temp^0 (c)		Depth (cm)		TDS (ppm)	
	Tank-II	Tank-Ill	Tank-II	Tank-Ill	Tank-II	Tank-III	Tank-II	Tank-Ill
1	10:00 A.M		37		3.8		20400	
2	11		40		3.7		20500	
3	12:00 P.M		41		3.5		20600	
4	1		43		3.4		20700	
5	2		39		3.3		20800	
6	3		38		3.25		20900	
7	4		35		3.1		21000	

Table-4 Solar evaporation of the Distillery Industry effluent on the 4th day of the experiment

NO	Time (hr)		Temp^0 (c)		Depth (cm)		TDS (ppm)	
	Tank-II	Tank-Ill	Tank-II	Tank-Ill	Tank-II	Tank-III	Tank-II	Tank-Ill
1	10:00 A.M		30		2.9		21200	
2	11		35		2.9		21400	
3	12:00 P.M		36		2.8		21600	
4	1		38		2.7		21800	
5	2		34		2.65		21900	
6	3		32		2.6		22100	
7	4		31		2.5		22200	

Table-5 Solar evaporation of the Distillery Industry effluent on the 5th day of the experiment

NO	Time (hr)		Temp^0 (c)		Depth (cm)		TDS (ppm)	
	Tank-II	Tank-Ill	Tank-II	Tank-Ill	Tank-II	Tank-III	Tank-II	Tank-Ill
1	10:00 A.M		40		2.3		22600	
2	11		41		2.2		22700	
3	12:00 P.M		42		2.1		22800	
4	1		45		1.9		23150	
5	2		38		1.8		23300	
6	3		37		1.7		23400	
7	4		36		1.65		23500	

Table-6 Solar evaporation of the Distillery Industry effluent on the 6th day of the experiment

NO	Time (hr)		Temp^0 (c)		Depth (cm)		TDS (ppm)	
	Tank-II	Tank-Ill	Tank-II	Tank-Ill	Tank-II	Tank-III	Tank-II	Tank-Ill
1	10:00 A.M		38		1.45		23700	
2	11		40		1.2		23800	
3	12:00 P.M		44		1.1		23900	
4	1		46		0.9		24200	
5	2		37		0.8		24400	
6	3		34		0.7		24500	
7	4		32		0.65		24600	

Table-7 Solar evaporation of the Distillery Industry effluent on the 7th day of the experiment

NO	Time (hr)		Temp^0 (c)		Depth (cm)		TDS (ppm)	
	Tank-II	Tank-Ill	Tank-II	Tank-Ill	Tank-II	Tank-III	Tank-II	Tank-Ill
1	10:00 A.M		31.5		0.5		24800	
2	11		32		0.4		24900	
3	12:00 P.M		36		0.2		25100	
4	1		33.6		0.1		25200	
5	2				**Completely Evaporated**		**Salt formed**	

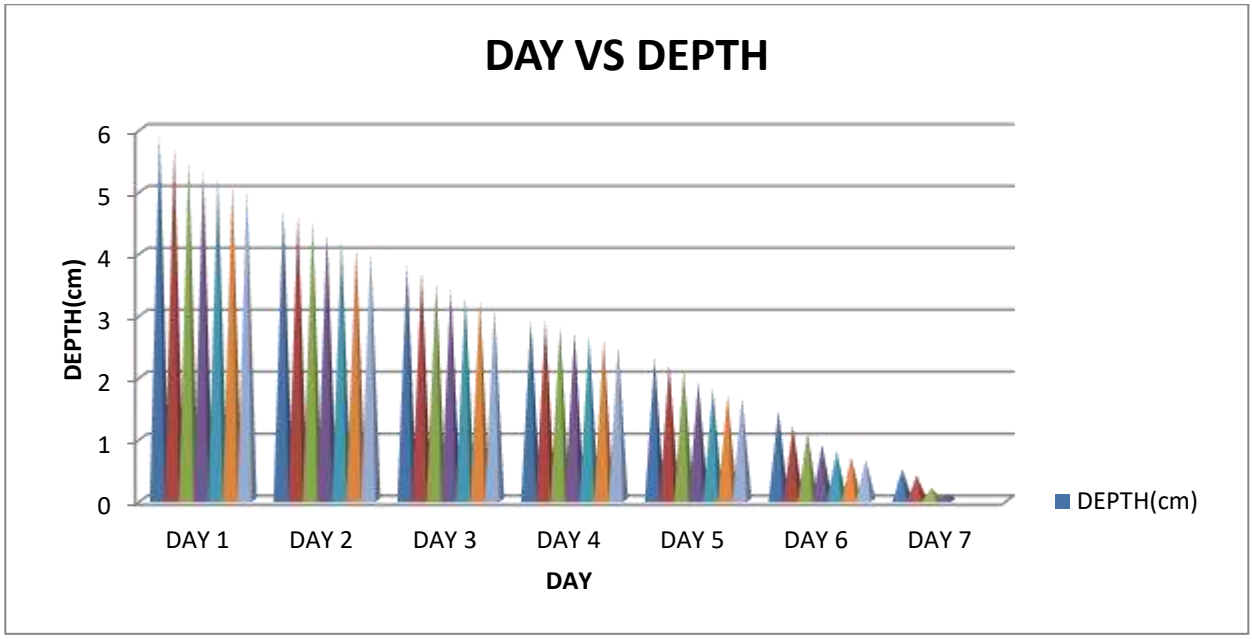

Fig-1 Depth of the Tank at various days (for 20L)

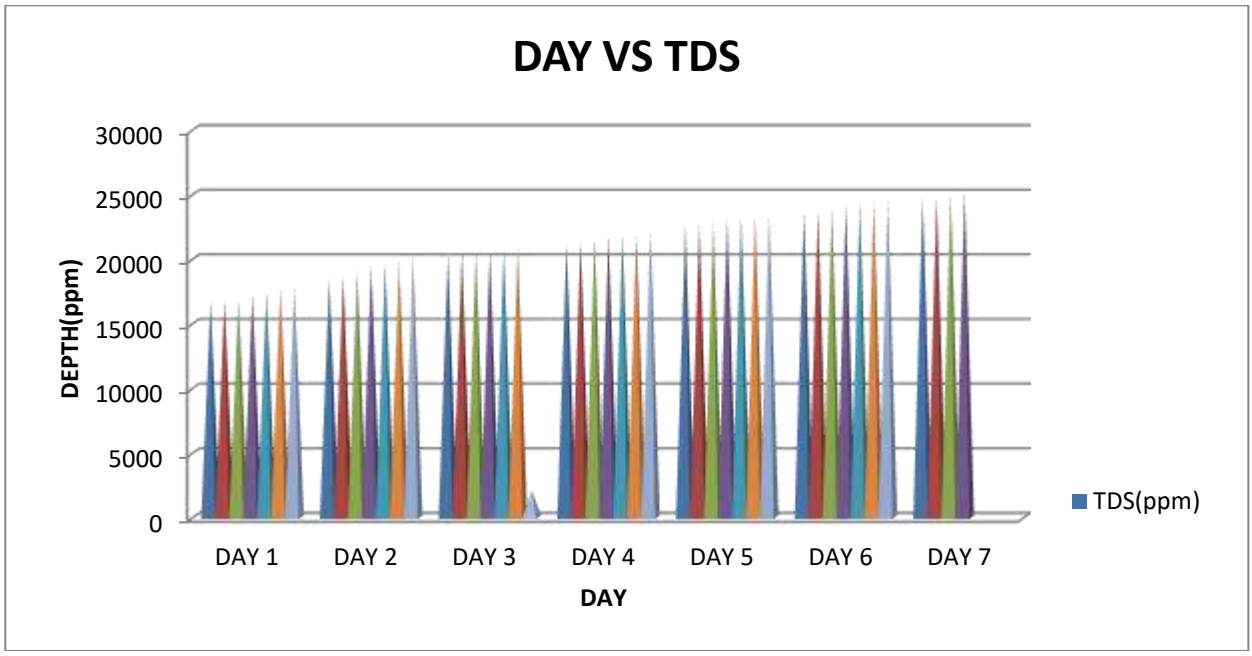

Fig-2 Depth of the Tank at various days (for 20L)

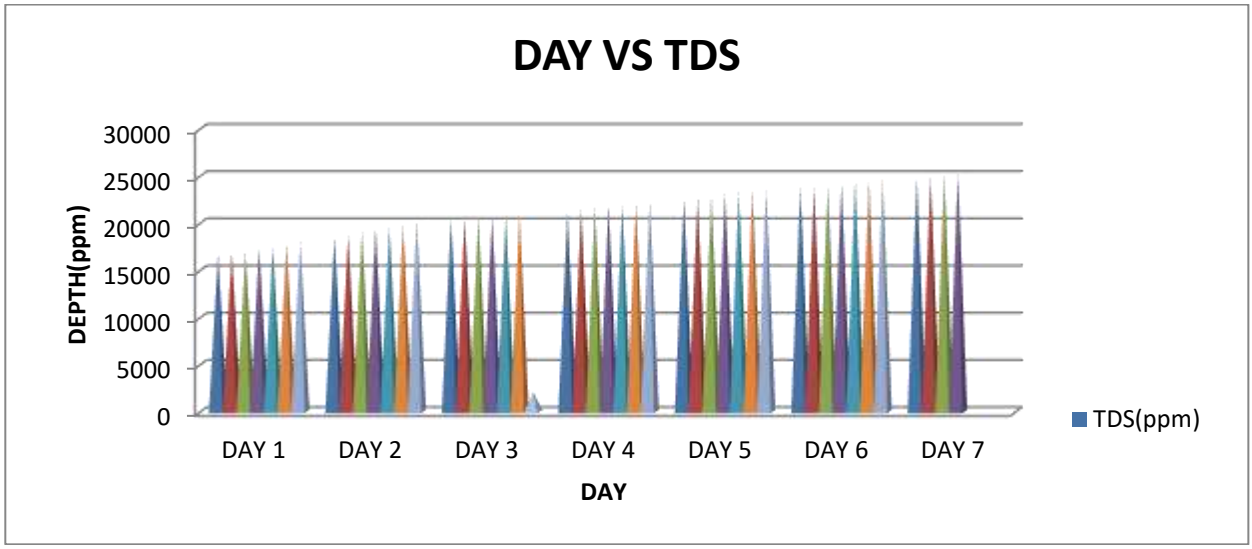

Fig-3 TDS of the Tank at various days (for 20 L)

Table-8 During solar evaporation process, the salt recovered from treated effluent in Tank-I and Tank-II and its weights are tabulated below

NO	Volume of effluent (Litres)	Weight of the total dissolved solids collected from Tank-II (gms)	Weight of the total dissolved solids collected from Tank-II (gms)
1	10	70	98
2	20	150	190

CONCLUSION

The energy received from the sun comes in the form of light, a short wave radiation but not all of which is visible to human eye. When this radiation strikes a black surface it is absorbed better rather than reflects and thus become more heat and conducts heat energy to evaporation of Distillery industry effluent or re-radiates heat energy to Distillery industry effluent of low temperature. Hence there is increase of the temperature of Distillery industry effluent from 50°c to 80°c and this improves the greater evaporation of Distillery industry effluent having high TDS. Hence solar energy source have become dependable energy source without any new requirement of highly technical and specialized nature of its wide and comfort utilization. In addition there are no polluting effects create from the use of solar evaporation tank Thermal energy is directly utilized for evaporating the high volume of Distillery industry effluent which causes pollution in ground water, surface water and all water resources like river and pond. The investigator found that the solar evaporation tank made up of black body kadapa-tank function more effectively during summer with high evaporation rate. The number of days took for the evaporation is 7 days for 20 liters in natural black coated kadapa-tanks.

REFERENCE

1. Kalavathi D.F., Uma L. and Subramanian G. (2001). Degradation and metabolization of the pigment-melanoidin in distillery effluent by the marine CyanobacteriumOscillatoriaboryana BDU 92181.Enzyme Microb. Technol., 29, 246-251.
2. Uppal, J. (2004). Water utilization and effluent treatment in the Indian alcohol industry: an overview. In: Tewari, P.K. (Ed.), Liquid Asset, Proceedings of the Indo-EU Workshop on Promoting Efficient Water Use in Agro-Based Industries. TERI Press, New Delhi, pp. 13–19.
3. Tiwari P.K., Batra V.S. and Balakrishnan M. (2007). Watermanagement initiatives in sugarcane molasses based Distillery in India. Res ConservRecycl., 52, 351–367.
4. Ghosh M., Ganguli A. and Tripathi A.K. (2002). Treatment of anaerobically digested distillery spentwash in a two-stage bioreactor using Pseudomonas putida and Aeromonas sp. Process Biochem., 7, 857–862.

5. Kumar V., Wati L. Nigam P., Banat I.M., MacMullan G., Singh D. and Marchant R. (1997b). Microbial decolourization and bioremediation of anaerobically digested molasses spent wash effluent by aerobic bacterial culture. Microbios., 89, 81– 90.
6. Kanimozhi R. and Vasudevan N. (2010). An overview of wastewater treatment in distillery industry.International Journal of Environmental Engineering. 2, 159-184.
7. Garg U.K. and Garg H.K. (2016). Optimization of process parameters for metal ion remediation using agricultural materials.International Journal of Theoretical & Applied Sciences. 8(1): 17-24.
8. Wedzicha B.L. and Kaputo M.T. (1992). Melanoidins from glucose and glycine: composition, characteristics and reactivity towards sulphite-ion. Food chem., 43, 359–367.
9. Nandy, T., S, S., and Kaul, S. (2002). "Wastewater management in cane molasses distillery involving bioresource recovery." Journal of Environmental Management, 65, pp. 25–38.
10. Saha, Balakrishnan, M. and Batra., V. (2005). "Improving industrial water use: Case study for an Indian distillery."Resource Conservation Recycling, 43, pp. 163–174.
11. Mohana S., Desai C. and Madamwar D. (2007). Biodegrading and decolourization of anaerobically treated distillery spent wash by a novel bacterial consortium. Biores, Technol., 98: 333-339.
12. Agarwal R., Lata S., Gupta M. and Singh P. (2010). Removal of melanoidin present in distillery effluent as a major colorant: A Review Journal of Environmental Biology. 31: 521-528.
13. 19. Mageshwari, P. U., Jayarubi, J., Sundari, A. U., Sundaranayagi, S., Anandhi, R., & Selvan, R. S. Synthesis, And Characterization of Metal Oxide (Cuo) Nanoparticles By Simple Precipitation Method. Educational Administration: Theory and Practice, 30(4), 7008-7012, (2024), https://doi.org/10.53555/kuey.v30i4.2506
14. 20. SULOCHANA, S., SOUNDARAVALLI, K., & SELVAN, R. S. Effect of Aluminium, Magnesium Doping on Magnetic Nature of Zinc Oxide Nanoparticles Studied by X-ray Diffraction Method. Oriental Journal of Chemistry, 38(3), (2022), http://dx.doi.org/10.13005/ojc/380310