ATLANTIS PRESS
Advances in Engineering Research, volume 163
7th International Conference on Energy, Environment and Sustainable Development (ICEESD 2018)

The Study of the Effect of Titanium Dioxide - Surfactant Compound on Cefoperazone Treatment

LIU ZHI-bin[1]
School of Food Engineering,Haerbin University of Commerce,Haerbin 150076,China

Keywords: TiO_2; surfactant; hexadecyltrimethylammonium bromide; cefoperazone

Abstract:efoperazone wastewater's composition is complex,of high COD， biodegradability is relatively poor，while TiO2 photocatalytic oxidation method is of high efficiency，safe，non-toxic and simple to operate， which can be used as a treatment method. The effect of hexadecyltrimethylammonium bromide (CTAB) on the photocatalytic oxidation of TiO2 was also discussed. The TiO2 photocatalyst was investigated by sol-gel method. The TiO2 photocatalyst was coated with CTAB，and the dosing amount was 5%. Treating cefoperazone as the target degradation products and the degradation rate of cefoperazone was determined by the change of COD value. The effects of photocatalyst dosage， light time，pH and other factors on the photocatalytic activity were investigated in this experiment. The results showed that the photocatalytic degradation efficiency was the highest when the dosage of TiO2-CTAB was 0.12g，the irradiation time was 5h and pH was 7. The degradation rate of cefoperazone antibiotic wastewater was 95.1% with the best experimental solution.

Introduction

The study about Antibiotic wastewater has been reported in the last twenty years.Photocatalytic degration of cefoperazone with Titanium Dioxide - Surfactant has not been previously investigated. We have researched the effect of Titanium Dioxide - Surfactant on photocatalytic degration of cefoperazone in water.

Apparatus

Electronic balance(FA604B) produced by Bejing satrious corporation.PH meter(PHS-3C) produced by shanghai spectral corporation.Electric vacuum drying oven produced by shanghai yiheng corporation.Muffle furnace produced by tianjin zhonghuan experiment corporation.Vacuum pump produced by Henan province yuhua corporation.

Reagent and materials

Sodium hydroxide(AR);hydrochloric acid(AR);CTAB(AR);phenanthrolime(AR);ferrous sulfate(AR);glacial acetic acid(AR);tetra-n-butyl titanate(AR);mercuric sulfate(AR);potassium dichromate(AR);ammonium ferrous sulfate(AR);absolute ethyl alcohol(AR);nitric acid(AR);(The reagent were produced by Tianjin kemiou chemical corporation).Cefoperazone sodium sulbactam(Harbin Pharmaceutical Group Pharmaceutical Factory)

Experimental section

The COD of cefoperazone solution has been determined.The method is putting water and cefoperazone solution into digestion tank,adding appropriate mercuric sulfate,adding 5ml potassium dichromate and 5ml sulphuric acid-silver sulfate,putting into microwave digester,adding ferrous metal indicator,titrating ammonium ferrous sulfate.Computing the value of COD.

Weighing appropriate amount TiO_2-CTAB and TiO_2 to cefoperazone solution of 0.1g/L.Putting ultraviolet lamp to illumination.Computing the value of COD.Computing the degradation rate.

Results and Discussion

Orthogonal experimental factors are in the following table 1

table1 experimental factors

level	A dosage/g	B light application time/h	C pH
1	0.08	3.5	7
2	0.1	4	6
3	0.12	4.5	5
4	0.14	5	4

Selection of orthogonal tables

Table 2 three factors and four levels

experiment	A	B	hollow	C	hollow	plan	degradation rate./%
1	1	1	1	1	1	$A_1B_1C_1$	72.8
2	1	2	2	2	2	$A_1B_2C_2$	72.1
3	1	3	3	3	3	$A_1B_3C_3$	71.3
4	1	4	4	4	4	$A_1B_4C_4$	69.8
5	2	1	2	3	4	$A_2B_1C_3$	81.1
6	2	2	1	4	3	$A_2B_2C_4$	80.4
7	2	3	4	1	2	$A_2B_3C_1$	82.3
8	2	4	3	2	1	$A_2B_4C_2$	82.9
9	3	1	3	4	2	$A_3B_1C_4$	89.9
10	3	2	4	3	1	$A_3B_2C_3$	92.4
11	3	3	1	2	4	$A_3B_3C_2$	94.3
12	3	4	2	1	3	$A_3B_4C_1$	95.1
13	4	1	4	2	3	$A_4B_1C_2$	81.6
14	4	2	3	1	4	$A_4B_2C_1$	83.4
15	4	3	2	4	1	$A_4B_3C_4$	82.6
16	4	4	1	3	2	$A_4B_4C_3$	81.2

The range analysis of the result is in table3

Table 3 range analysis

	A	B	C	D	E
I_j	286	325.4	328.7	333.6	330.7
II_j	326.7	328.3	330.9	330.9	325.5
III_j	371.7	330.5	327.5	326	328.4
IV_j	328.8	329	326.1	322.7	328.6
R_j	85.7	5.1	4.8	10.9	5.2

The result of Orthogonal experiment

We can investigated that the order of the three factors is A>D>B>hollow.The best experimental scheme is $A_3B_4C_1$：The dosage of TiO_2—CTAB is 0.12g，light application time is 5h，The value of pH is 7.

Conclusion

Photocatalytic degradation of cefoperazone has been carried up ,we have conclusion that:（1）Single factor experiment of TiO_2-CTAB for cefoperazone indicated that the best dosage of TiO_2-CTAB is 0.1g.

（2））Single factor experiment of pH for cefoperazone indicated that the best value is7.

（3） Single factor experiment of time for cefoperazone indicated that the best time is 4h.

（4）Single factor experiment of TiO_2-CTAB for cefoperazone indicated that the dosage of photocatalyst is better than time and pH.

（5）Orthogonal experimental results indicated the best programme is :the dosage of TiO_2-CTAB is 0．12g,the light time is 5h，the best value of pH is 7.The best degradation rate of cefoperazone antibiotic wastewater was 95.1%

Acknowledgements

This work was financially supported by the Natural Science Foundation of Heilongjiang Province NO.B2015025.

References

[1]Li Shizhong、Li Xiaoyun、Wang Diaozuo，et ai，Membrane(RO-UF) filtration for antibiotic wastewater treatment and recovery of antibiotic，sep Purif technol，2014，34（9）：109~114

[2]Konstantinou I K，Albanis T A. Photocatalytic transformation of pesticides in aqueous titanium dioxide suspensions using ar— tificial and solar light：intermediates and degradation pathways [J]. Applied Catalysis B-Environmental，2003，42：319-335

[3]Marta I L，Heterogeneous photocalysis and transition metal ions in photocatalytic systems[J] Applied catalysis，1999，23：89~114

[4]Cheung S T C，Fung A K M，Lam M H W，Visible photpsensitization of TiO_2-photodegradation of CCl_4 in aqueous mwdium[J]，Chemosphere，1998，36：2461~2473