

Contents List available at VOLKSON PRESS

New Materials and Intelligent Manufacturing (NMIM)

DOI: http://doi.org/10.26480/icnmim.01.2018.236.238 Journal Homepage: https://topicsonchemeng.org.my/

ISBN: 978-1-948012-12-6



CORN COB POLYMER FLOCCULANT PREPARATION METHOD AND ITS APPLICATION IN ORGANIC WASTE WATER TREATMENT

Ze Li, Wanhai, Li*

School of Resources and Environmental Engineering, Jilin Institute of Chemical Technology, Jilin 132022, China. *Corresponding Author Email: 2532272507@qq.com

This is an open access article distributed under the Creative Commons Attribution License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited

ARTICLE DETAILS

ABSTRACT

Article History:

Received 26 June 2018 Accepted 2 july 2018 Available online 1 August 2018 In this paper, the corn cob was modified to prepare cellulose xanthogen with flocculation. A comparative experiment was conducted on the flocculating adsorption effect of the finished product. Experiments show the best experimental conditions during the modification of the corn cob. It is known from the literature that the adsorption and flocculation of heavy metal ions is better. This article focuses on the effect of the finished product on the removal of Cu^{2+} in coppercontaining wastewater. It was found that under certain conditions, cellulose xanthogen prepared from corn cobs can remove Cu^{2+} from wastewater. The rate can reach more than 90%.

KEYWORDS

Cellulose xanthogen, Corn cob, Flocculant

1. INTRODUCTION

In this paper, corncobs with high yields have been chemically modified to obtain natural polymer flocculants. The modified natural polymer flocculants have a wide range of molecular weight distribution, many active groups and a variety of structures, and their raw materials. The source is abundant, the price is low, especially outstanding is it is safe and nontoxic, can be completely biodegradable, has good environmental acceptability [1-3]. As a kind of agricultural waste, corn cobs have been used as farm fuels for the most part. In recent years, with the continuous advancement of science and technology in China, the field of deep processing of corn cobs has been expanding, and a series of high valueadded products such as furfural, xylose, xylitol, and xylo-oligosaccharides have successively achieved industrialized production. The corn cob resources have been obtained. Make full use of [4]. In this paper, a twostep modification of corn cob, including swelling and grafting reaction, was used to prepare a crude flocculant with cellulose xanthogen as the main component.

2. MATERIALS AND METHODS

2.1 Experimental raw materials

2.1.1 Natural corn cob

The dried corn cobs are first crushed into coarse granules by conventional mechanical methods, dried in an oven, and then crushed into powder by a pulverizer and collected through a 80-mesh sieve for use.

2.2 Experimental instruments and reagents

Centrifuge, Magnetic electric mixer, Spectrophotometer, Analytical Balances, Filtering device, Distillation device, Universal Crusher, Electric blast drying box. Carbon disulfide, Magnesium sulfate, Anhydrous ethanol, Copper sulfate pentahydrate, Sodium hydroxide, Chloroform, Ammonium hydroxide, Diethyldiamine sodium dithiocarbamate.

2.3 Experimental method

2.3.1 Preparation of corn cob xanthic acid

The crushed and dried corncob powder is immersed and swelled in

 $10\%{\sim}20\%$ NaOH solution for $15{\sim}30\text{h}$, filtered and dried to obtain alkali cellulose; CS_2 reaction is added to the solution; and the soluble magnesium salt is used for the transition reaction to the solution. Diluted magnesium salt and alcohol were added, suction filtered, pressed dry, and dried to obtain the corn cob xanthate.

2.3.2 Method for treating copper-containing wastewater by corn cob xanthate

Take a certain concentration of Cu^{2+} -containing wastewater, adjust the pH value of the wastewater, add the corn cob xanthate to the wastewater, stir, filter, and effluent, and determine the Cu^{2+} ion content in the water by spectrophotometry.

3. EXPERIMENTAL RESULTS AND DISCUSSION

3.1 Drawing of standard curve

3.1.1 Standard curve drawing test

The sample was dissolved with dilute sulfuric acid and the pH was adjusted to 9. A stable yellow complex was formed between the copper reagent and copper ions. The mixture was extracted with chloroform and the absorbance was measured at a wavelength of 430 nm at the spectrophotometer. Specific steps are as follows: Place the sample in a 300ml beaker and add 20ml of sulphuric acid solution. Heat the sample at a low temperature to dissolve completely, cool, transfer to a 50ml volumetric flask, dilute to the mark with water, and mix. Pipette 25 ml of the solution in a 125-ml separatory funnel. Add 25 ml citric acid solution. Neutralize with ammonium hydroxide to a solution pH of about 9. 10 ml of copper reagent solution was added, 20 ml of chloroform was added, shaken for 2 min, allowed to stand for stratification, and the aqueous phase was discarded. The organic phase was transferred to a 1 cm cuvette and trichloromethane was used as a reference to measure the absorbance at a wavelength of 430 nm at the spectrophotometer. Subtract the absorbance of the blank test performed with the sample.

3.2 Selection of preparation conditions for corn cob xanthate

3.2.1 Effect of Alkaline Concentration on the Properties of Corncob Xanthate

Take 3g corncob powder, use 10%, 15%, 20% and 25% NaOH solution, alkalinize at 20°C, add 1.5ml CS₂, and yellow at 30°C for 2h. The Cu²⁺ ion wastewater with an initial concentration of 10.0 mg/l was treated with the synthetic corn cob xanthate, stirred for 30 min, and the measured copper ion concentration was determined as shown in Table 1.

Table 1: The Influence of Different Alkali Concentration on Flocculation Properties

Alkali concentration	10%	15%	20%	25%
Absorbance	0.91	0.86	0.73	0.83
Cu2+ concentration	0.72	0.68	0.58	0.66
Removal rate	92.8%	93.2%	94.2%	93.4%

Since the alkali concentration affects the cellulose purity after the swelling of the corn cob, and then affects the nature of the corn cob xanthic acid, resulting in different flocculation performance, from the above data, we can see that the best flocculation is achieved when the alkali concentration is 20%. effect.

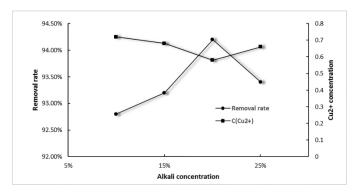


Figure 1: The Influence of Different Alkali Concentration on Flocculation Properties

3.2.2 Effect of Alkaline Temperature on the Performance of Wood Xanthate

Take 3g corncob powder, the alkali concentration of 20%, CS_2 dosage of 1.0ml, yellowing reaction temperature 30°C, When the yellowing reaction time is 2h, the alkalizing temperature is 20°C, 40°C, 60°C, and 80°C, respectively. Synthetic corn cob Xanthate is treated with Cu^{2+} solution with an initial concentration of 10 mg/l, The copper ion concentration after the reaction was measured is shown in Table 2.

Table 2: The Influence of Different Swelling Temperature on Flocculation Properties

T				
Swelling temperature°C	20	40	60	80
Absorbance	0.86	0.88	1.19	1.38
Cu2+ concentration	0.68	0.70	0.95	1.13
Removal rate	93.2%	93.0%	90.5%	88.7%

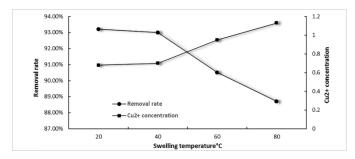


Figure 2: The Influence of Different Swelling Temperature on Flocculation Properties

In the process of swelling, the alkalinization temperature is also a very important condition. From the above data, it can be seen that the xanthic acid obtained from the alkalization at 20° C. has the best adsorption flocculating performance.

3.2.3 Effect of carbon disulfide dosage on the performance of corn cob xanthate

Take 3g corncob powder and soak at 20°C for 24h under 20% alkali concentration to obtain alkali cellulose. The amount of CS_2 used for

yellowing was taken as follows: 0.1667, 0.3333, 0.5000, 0.6667 ml/g, and yellowing at 30° C for 2.0 h. The prepared corn cob xanthate is treated with a copper ion solution having an initial concentration of 10.0 mg/l. The copper ion concentration after the reaction was measured is shown in Table 3. From the above data, it can be seen that cornstard xanthogen has the best flocculation effect when CS_2 dosage is 0.5ml/g.

Table 3: The Influence of Different CS2 Dosage on Flocculation Properties

CS ₂ amount (ml / g)	0.1667	0.3333	0.5000	0.6667
Absorbance	0.72	0.51	0.41	0.56
Cu2+ concentration	0.56	0.39	0.31	0.43
Removal rate	94.4%	96.1%	96.9%	95.7%

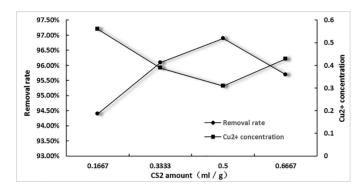


Figure 3: The Influence of Different CS2 Dosage on Flocculation Properties

3.3 Application of Corncob Xanthate Modified Flocculant in Wastewater

3.3.1 Effect of corn cob xanthate dosage on the treatment of heavy metal wastewater

The Cu^{2+} ion simulation wastewater concentration is 10mg/l, the pH is 7 and the simulation wastewater is 100ml each time. Add corncob xanthates 0.1, 0.3, 0.5, 0.7, and 0.9 mg/g, respectively, and stir at room temperature for 30 min. The filtrate was taken for ion concentration detection. The results obtained are shown in Table 4.

Table 4: The Influence of Different Product Dosageon Flocculation Properties

Finished product (mg / g	() 0.1	0.3	0.5		0.9
Absorbance	1.69		0.87	0.56	0.60
Cu ²⁺ concentration	1.56	1.39			0.47
Removal rate	84 4%	86.1%	92.9%	95.7%	95.3%

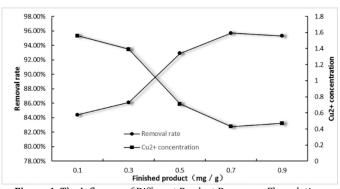


Figure 4: The Influence of Different Product Dosage on Flocculation Properties

From the above icons, it can be seen that when the dosage of finished flocculant is about $0.7\ mg/g$, there is better flocculation performance.

3.3.2 Effect of pH Value of Heavy Metal Waste Water on Treatment Effect

Take a certain concentration of copper ion wastewater 100ml, the pH adjusted with 25% sodium hydroxide and 10% sulfuric acid were: 3, 5, 7, 9, 10, respectively. Add corn cob xanthate at 1 mg/g, and stir at room temperature for 30 min. Take the filtrate for ion detection. The results are shown in Table 5:

Table 5: The Influence of Different pH Value on Flocculation Properties

pН	3	5	7		10
Absorbance	1.58	0.			
Cu ²⁺ concentration	1.46	0.77			0.16
Removal rate	85.4%	92.3%	94.9%	96.7%	98.4%

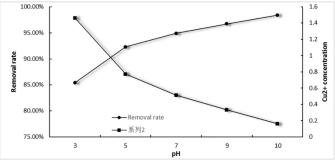


Figure 5: The Influence of Different pH Value on Flocculation Properties

From the above chart, we can see that the removal rate can reach nearly 95% when the wastewater pH is about 7. As the pH value increases, the copper ion removal rate further increases. This is due to the precipitation of $\text{Cu}(0\text{H})_2$, but most of the copper ion removal rate is due to the adsorption flocculation of the corn cob xanthate.

4. CONCLUSIONS

Corncob preparation of cellulose xanthate as a flocculant has a good effect on the adsorption of heavy metal ions in flocculating wastewater. This paper focuses on the flocculation effect of Cu²⁺ ion-containing wastewater. Through the selection of different experimental conditions in the corn cob

modification test, the optimal test conditions for the modification process were obtained: When the concentration of NaOH was 20%, the swelling temperature was 20°C, and CS_2 dosage was 0.5ml/g during the swelling process, the cornstarch xanthate had the best removal effect on Cu^{2+} wastewater. This paper also discussed the selection of experimental conditions for the treatment of copper-containing wastewater from corn cob xanthate, and found that the flocculation and adsorption effect was better when the flocculant dosage was 0.7 mg/g and the pH of the wastewater was 7-9 good.

REFERENCES

- [1] Yin, H., Peng, H., Xiao, J. 1998. Development and application of modified cationic natural polymer flocculant. Industrial Water Treatment.
- [2] Chen, Y. 1999. Researching and application of nature organic flocculant. Techniques & Equipment for Enviro.poll.cont.
- [3] Kumar, M. N.V. R. 2000. A review of chitin and chitosan applications. Reactive and Functional Polymers, 46 (1), 1-27.
- [4] Chen, H. 2005. Comprehensive use of jade. Grain circulation technology.

ABOUT THE AUTHORS

- Ze Li, postgraduate, research field: Environmental pollution source governance and analysis.
- *Corresponding author: Wanhai,Li*, graduate supervisor, research field: Environmental pollution source governance and analysis E-mail: 2532272507@qq.com

