

Modified Treatment of Sludge Using the Amphoteric Lignin-Based Flocculant

LU Qian-jun², ZHAN Hua-yi¹, LIU Ming-hua³

(1. State Key Laboratory of Pulp & Paper Engineering, South China University of Technology, Guangzhou 510640, China; 2. College of Environmental Science & Engineering, Guangdong University of Technology, Guangzhou 510090, China; 3. College of Environment & Resources, Fuzhou University, Fuzhou 350002, China)

Abstract: The amphoteric lignin-based flocculant was adopted to treat the sludge. And the average sedimentation speed of the treated sludge increased from original 1.86 to 2.33 mL/min, which was 1.25 times as the original sedimentation speed. The filtering resistivity of treated sludge decreased to 40% of the original one. And the moisture content of the mud-cake could decrease from 93% to 80%. Therefore, the modified lignin-based flocculant will open a new way for the lignin utilization in the sludge dewatering process.

Key words: Lignin; modified treatment; sludge; performance; flocculant

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1 Introduction

In recent years, the amphoteric flocculants have been reported to own excellent dewatering and filtration performance for various sludges with different decaying degree. And the mud-cake had low moisture content. In this paper, the calcium lignosulphonate from the pulping process can be used as raw material to prepare the amphoteric lignin-based flocculant by chemical modification processes, i.e., graft copolymerization and Mannich reaction. Then the amphoteric product was adopted to treat the sludge. And the experiments including the comparison tests were conducted to study the dewatering performance of the modified flocculant.

2 Experiment

2.1 Materials

The calcium lignosulphonate was kindly provided by the Guangzhou Paper Group Co., Ltd., Guangzhou, China. The amphoteric lignin-based flocculant was prepared by chemical modification processes, i.e., graft copolymerization and Mannich reaction. The cationic polyacrylamide, denoted as CPAM, with 6 million of the molecular weight was commercial. The water treatment sludge samples were collected from the

secondary sedimentation pole in the Wastewater Treatment Plant of Liede in Guangzhou. The moisture content was 99.18% determined by drying and weighing. The value of PH was 6.5-7.5.

2.2 Determination of the sedimentation speed of sludge

100 mL sludge was put into the cylinder with a plug after shaking evenly. Then the calculated amount of flocculant was placed into the cylinder before mixing evenly. And the volume of the sedimentation sludge cylinder as recorded at a predetermined time intervals.

2.3 Determination of the dewatering performance of sludge

The dewatering performance of the sludge was determined according the method described in reference. The residual turbidity in the supernatant was determined with a HACH 2100 N turbidity detector.

3 Results and discussion

3.1 Effect on the sedimentation speed of sludge

Fig 1 shows the sedimentation curves with 10 mg/L of the dosages of blank sludge, LSDC and CPAM. It can be seen from the Fig 1 that the sedimentation speed is faster in the initial 35 minutes. The minimal height of the substrate sludge of blank sludge is 34.8

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作者简介: 刘千钧 (1971年生), 女, 博士, 副教授, E-mail: liqhck@gdut.edu.cn

mL, and the average sedimentation speed is 1.86 mL/min. The minimal height of the substrate sludge of CPAM substrate sludge is 32 mL, and the average sedimentation speed is 1.94 mL/min. The minimal height of the substrate sludge of LSDC sludge is 30 mL, and the average sedimentation speed is 2.33 mL/min, which is 1.25 times as the blank sludge. The results indicate that LSDC can increase the sedimentation speed more efficiently than LSDC at the start of sedimentation. But 35 minutes later, the substrate sludge inclines to be the same. It shows that the volumes of two kinds of sludge from CPAM or LSDC are close.

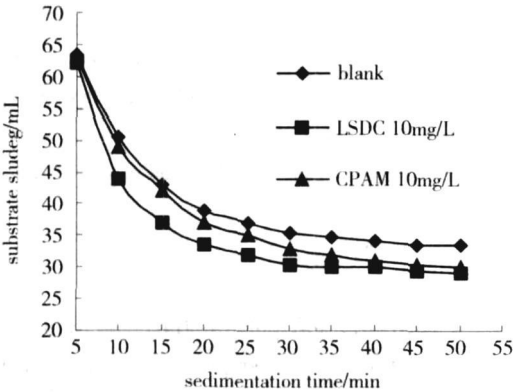


Fig 1 Sludge sedimentation before and after dosing

3.2 Effect on the dewatering property of sludge

Fig 2 shows the relationship between the dosage of LSDC and CPAM and the filtrate volume by natural filtering for 5 minutes.

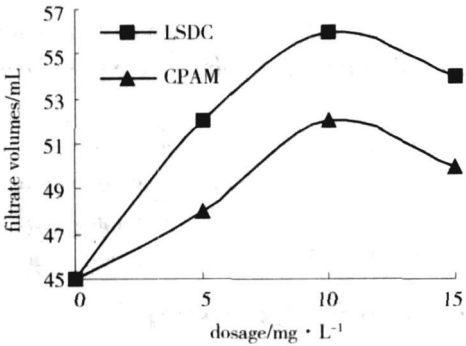


Fig 2 The relationship between the dosage of LSDC and filtrate volume by natural filtration

Obviously, the optimum dosage of LSDC put into the biological active sludge is 10 mg/L. Filtrate volume will decrease while exceeding the dosage. The results indicate that the dewatering performance of LSDC prevails over CPAM under otherwise identical conditions.

3.3 Effect on the filtering resistivity of sludge

The resistivity of sludge is widely used as a syn-

thetic indicator to judge the filtering property of sludge. The larger the resistivity is, the worse the dewatering.

Assuming the resistance of sludge is r and the filtrate volume is V_1 before putting LSDC, the resistance of sludge is r_2 and the filtrate volume is V_2 after putting LSDC. Then we can draw from formula $\frac{r}{r_2} = \frac{V_1^2}{V_2^2}$.

When $t=1$ min, $\frac{r}{r_2} = \frac{V_1^2}{V_2^2} = (\frac{45}{70})^2 = 0.41$

When $t=2$ min, $\frac{r}{r_2} = \frac{V_1^2}{V_2^2} = (\frac{56}{87.5})^2 = 0.410$

In the formula, it can be found that the reduction percentage of the filtrate resistance of sludge could reach 40%, indicating the filtering property was improved greatly.

3.4 The moisture content of mud cake

The moisture contents of filter cakes are listed in Table 1. It can be calculated that the volume of sludge has been reduced to 1/27 of the original one after modification of LSDC, then the floor area and expense of transport can thus be greatly saved.

Tab 1 The moisture content of filter cake before and after dewatering

	Blank	CPAM	LSDC
Moisture (%)	93	81	80

4 Conclusion

Modified lignosulphonate can be used in the modified treatment of sludge. The effect is similar to CPAM. The sedimentation speed increased 1.25 times and the reduction percentage of the filter resistivity could reach 40%. It provides a new way to utilize the lignosulphonate products that yield a high added value.

References

[1] WATANABE Y, KUBO K, SATO S. Application of Amphoteric Polyelectrolytes for Sludge Dewatering [J]. Langmuir, 1999, 15 (12): 4157—4164.
[2] MIKKELSEN IH, KEDING K. Effects of solids concentration on activated sludge deflocculation, conditioning and dewatering [J]. Water Science and Technology, 2001, 44 (2/3): 417—425.
[3] 袁园, 杨海真. 污泥化学调理和机械脱水方面的研究进展 [J]. 上海环境科学, 2003, 22 (7): 499—506.
[4] MOHAMMED A, WEIR S, MOODY G. Flocculants development trends [J]. Filtration and Separation, 2000, 37 (8): 24—27.

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The thermal properties of polymer 3 a and 3 b are summarized also in Table 1. Both 3 a and 3 b have high glass transition temperature of 221 °C and 239 °C, respectively, which might originate from the bulky unsymmetrical Phthalazinone architecture which would greatly restrict the rotation of polymer backbone. The polymer 3 b exhibits a distinct higher T_g than 3 a because of the extremely rigid molecular main chain with biphenyl architectures. It is not surprisingly that the polymer 3 a and 3 b exhibit excellent thermal stability; the initial decomposition temperatures are both higher than 400 °C and the 10 % weight loss temperature is higher than 507 °C. Obviously, the replacement of substituted aryl groups along the polymer backbone exhibit better thermal stability than their counterparts of

polymers with pendant methyl groups. The high residue yield of 67 % could further demonstrate the excellent thermooxidative properties.

References

[1] HAY A S 1993, U. S. Pat, 5, 237, 062
[2] CHEN Y L, MENG Y Z, HAY A S Poly (Phthalazinone ether ketone) ionomers synthesized via n.C coupling reaction for fuel cell applications [J]. Macromolecules, 2005, 38: 10007—10013
[3] CHENG L, YING L, FENG J Novel heterocyclic poly (arylene ether ketone) s: synthesis and polymerization of 4— (4' -Hydroxyaryl) (2H) Phthalazinone with methyl groups [J]. J Polym Sci Part A, 2007, 45 (8): 1525—1535

新型含二氮杂萘酮结构聚芳醚酮酮的合成与表征

李建灵, 许 震, 程 琳

(华侨大学材料科学与工程学院, 福建泉州 362021)

摘 要: 通过苯基取代的二氮杂萘酮的衍生物 1 a和 1 b与活性的含氟单体反应合成了两种新的苯基取代的含二氮杂萘酮结构的聚芳醚酮酮。聚合物 3 a和 3 b的结构由 FT-IR与 NMR进行表征, 此类聚合物表现出很高的玻璃化转变温度和优良的热稳定性。

关键词: 聚芳醚酮酮; 二氮杂萘酮

中图分类号: O63

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两性木素絮凝剂用于污泥的调质处理

刘千钧^{1, 2}, 詹怀宇¹, 刘明华^{1, 3}

(1. 华南理工大学制浆造纸工程国家重点实验室, 广东 广州 510641;

2. 广东工业大学环境科学与工程学院, 广东 广州 510006

3. 福州大学环境与资源工程学院, 福建 福州 350002)

摘 要: 以木素为原料制备了两性絮凝剂 LSDC, 并将其用于污泥的调质处理。实验结果表明 LSDC可使污泥沉降速度提高至原始污泥的 1.25倍, 污泥的过滤比阻则降低至原始污泥的 40%左右, 泥饼含水率由 93%降低至 80%。两性木素絮凝剂在污泥调质处理中的应用为木素的高附加值利用提供了新的途径。

关键词: 木素; 调质处理; 污泥; 性能; 絮凝剂

中图分类号: X17