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Wastewater containing chromium treatment by loading flocculation method

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ABSTRACT

Use the loading flocculation process to treat the chromium-containing wastewater, testing the removal efficiency of loading flocculation method on trivalent chromium, turbidity, and COD. The study results shows that when the fixed dosage of ferric chloride is 36mg / L, PAM dosage of 1.5mg / L, the dosage of loading agent is 3000mg / L, turbidity can be reduced to 1.2NTU, the removal rate of chromium can reach more than 95%, the removal rate of COD is above 63%; When the fixed loading agent dosage is 3 000mg / L, PAM dosage fix in 1.5mg / L, the dosage of ferric chloride is 60mg / L, turbidity can be reduced to 2.2NTU, the removal rate of chromium can reach more than 95%, the removal rate of COD is above 63%. According to the contrastive analysis of the two methods, adding the right amount of loading agent can significantly improve the turbidity, trivalent chromium, COD removal efficiency.

KEYWORDS

Loading flocculation;
Wastewater containing chromium;
Turbidity.

INTRODUCTION

Chromium-containing wastewater mainly comes from chromium ore processing, electroplated base metal, paint production, printing, photographic materials and other industries. Wastewater is mainly hexavalent chromium and trivalent chromium. Almost all of the aqueous solution of chromium compound has a vivid color[1]. In natural water of normal pH value, trivalent and hexavalent chromium can be transformed into each other. Trivalent chromium in natural water has a tendency to form a stable complex with negatively charged organism or inorganic matter. Only if the soluble ions or suspended particles exist, there will not be significant uncompleted trivalent chromium ions[2]. In the water, trivalent chromium can be low-velocity oxidized by dissolved oxygen. Almost all of the aqueous solution of hexavalent chromium exists in anionic form. Generally, the water removal method for removing the trivalent chromium is formed chromium hydroxide precipitation and separated from the water. Common disposal method for hexavalent chromium is reduced to trivalent chromium, coupled with alkaline substance to make sedimentation.

This test used actual wastewater containing chromium as water samples, through the laboratory cup pot experiment simulated on-site conditions, determine the relationship of ballasted flocculation parameter and the removal of hexavalent chromium[3]. Thus the coagula-

tion method for chromium wastewater treatment can be improved and it provides a new route for low turbidity treatment technology of wastewater containing chromium..

EXPERIMENTAL

Testing device

Chromium waste water sample is from sewage treatment plant in Samsung SDI Co., Ltd., Shenzhen, China. The samples were chartreuse, after placing a period, the bottom of the container forms a layer of white adhesive film precipitation. We sampled once 2h, and even take two days to measure the main indicator, the results are shown in TABLE 1:

TABLE 1 : The index values of the water sample

pH	6.1~6.5	COD	90~120
Turbidity	24~27	Trivalent chromium	0.3~0.5
Total Chromium	1.7~1.9	Hexavalent chromium	1.2~1.3

As illustrated from TABLE 1, the content of hexavalent chromium and total chromium are higher than the maximum allowable emission concentration (total chromium for 1.5mg/L, hexavalent chromium for 0.5mg/L) of Chinese wastewater discharge standard (GB 8 978-2002)[4].

The main measure of the experiment is total chromium concentration, the concentration of hexavalent chromium and trivalent chromium concentration, COD and turbidity. And the concentration of trivalent chromium is equal to the concentration of total chromium minus the hexavalent chromium.

In this experiment, the ballasted flocculation device is coagu-flocculation test mixer of ZR 4-6 type. Process shown in Figure 1:

RESULTS AND DISCUSSION

The effect of loading agent dosage for turbidity removal

Loading dosage illustrated in Figure 1

Figure 1 shows that, with amounts of sludge increasing, the turbidity of coagulation supernatant first decrease, after reaching a minimum point, then stay a steady trend. Turbidity reach minimum at the sludge dosage of 3000mg / L (in the form of slurry dosing). When the sludge dosage is 3 000 ~ 4 000mg / L, the turbidity value changes very little. Turbidity keeps declining before minimum occurring because the loading agent has a great surface energy, part of the suspended particles and colloids are absorbed by the loading sludge, and loading agent can be used as the crystal nucleus precipitated by ferric hydroxide crystallization to force the netting effect. Loading agent acts as the crystalline cores of ferric chloride hydrolysis product and has a large surface area and. So it carries a large number of colloidal and suspended solids, then results in the volume keeping larger and becoming loose, the crushing occurs partly through continued shearing force and the produced micro flocculation influence the turbidity decreasing. The results showed that the water samples after the ferrous salt reduction, fixed dosage of ferric chloride is 36mg / L, PAM dosage of 1.5mg / L, better turbidity removal effect can be got when the dosage of loading agent is more than 3 000mg / L.

Effect of chromium removal for loading dosage

The dosage of loading agent effect for removal of total chromium in Figure 2 shows that, as the loading dosage is increased, the chromium content in the supernatant of the coagulation decreased, when the dosage is larger than 3 000mg / L, the chromium content does not decrease obviously any more. The chromium content continues to reduce because there are more colloid and particulate matter absorbed with trivalent chromium. They are absorbed by surface of sufficient slime sludge and then precipitate together. The chromium content does not decrease obviously for that shearing effect cause crushing of large floes and the micro floes appeared influences turbidity.

The results showed that after reduction of the ferrous salt, adjust the pH value of water samples from 7.5 to 8.0 with lime, the dosage of loading agent is 3 000mg / L, that can have a better chromium removal effect.

Effect of loading agent dosage on the removal of COD

Effect of loading agent dosage on the removal of COD in Figure 3 below. Figure 3 shows that, with the increase of PAM dosage, COD content in the

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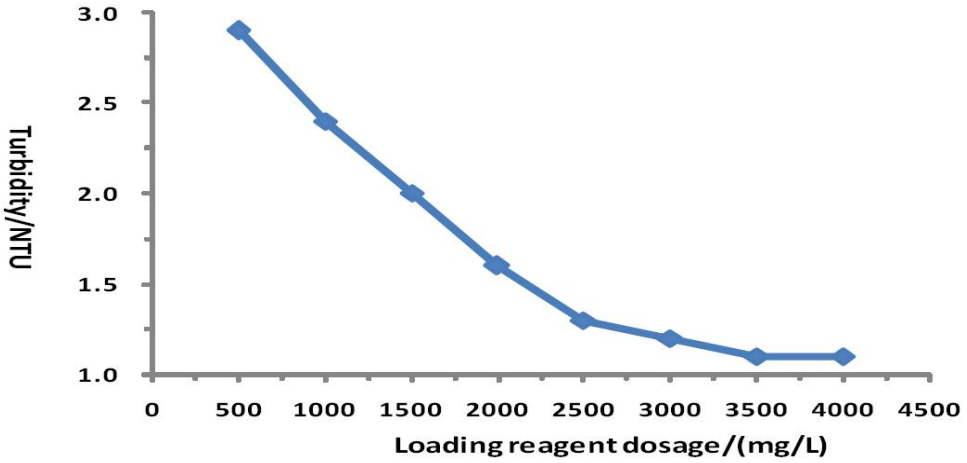

Figure 1 : Values of turbidity with the change of loading agent dose

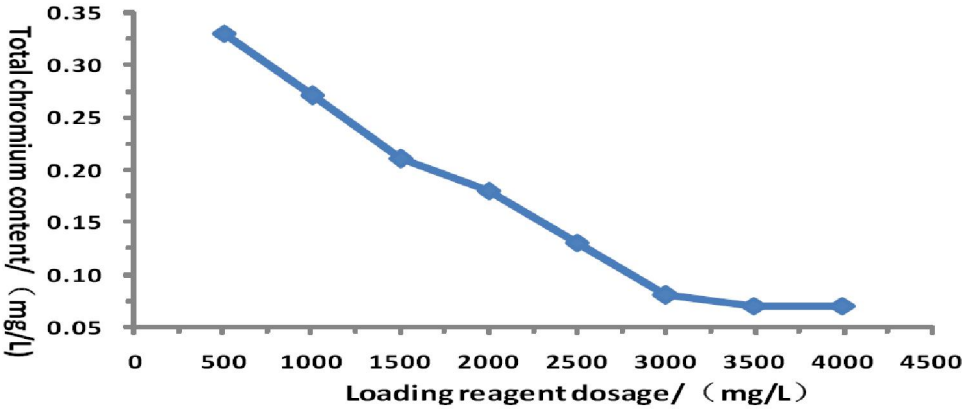

Figure 2 : Total chromium contents with the change of loading agent

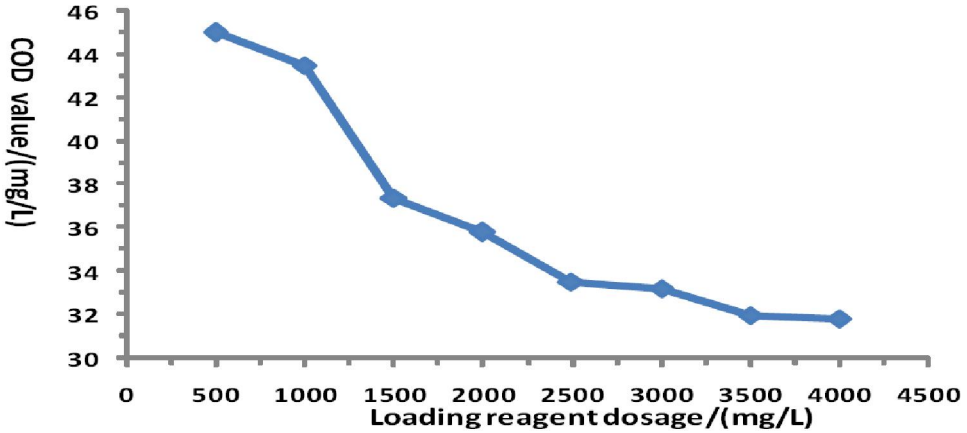

Figure 3 : COD removal with the change of loading agent dose

supernatant of coagulation keeps declining. When loading agent dosage is larger than 2 500mg / L, the magnitude of the COD value changing becomes small. These results illustrate that under the conditions of this study, COD removal rate increases with loading dose increasing, when the loading agent dosage is larger than 3 000mg / L, the effect of COD removal is better. The reason for the phenomenon in diagram is the organics are absorbed by loading agent and precipitate with loading agent together. With the increase of loading dosage, growing floes are broken by shearing and part of organics back to the solution, account for COD in the supernatant did not change significantly for the loading agent dosage more than 2 500mg.

CONCLUSIONS

1. In the experiments of loading agent dosage effects on coagulation, the water samples after reduction by ferrous salt mixed lime to adjust the pH value. The fixed dosage of ferric chloride is 36mg / L, the PAM dosage is 1.5mg / L. When the dosage of loading agent is 3 000mg / L, it can get better coagulation effect and sedimentation, turbidity, total chromium, COD removal have also been better.
2. In the experiment of the ferric chloride dosage effects on coagulation, the water samples after reduction by ferrous and using lime to adjust the pH value, fixed loading agent dosage is 3 000mg / L, PAM dosage fix in 1.5mg / L, when the dosage of ferric chloride is 60mg / L, it has a good effect of coagulation and then sedimentation, turbidity, total chromium, COD removal have been better.
3. In the experiments of PAM dosage effects on coagulation, the water samples after reduction by ferrous salt and with lime to adjust the pH value, the loading agent dosage fixed at 3 000mg / L, ferric chloride dosage is fixed at 36mg / L, when the dosage of PAM is 3.0mg / L, it has a good effect of coagulation and sedimentation, turbidity, total chromium, COD removal have been better.

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REFERENCES

[1] Ji Zhu; (translation) Chromium complexes of biological activities, Chromium Salt Industry, **1**, 3-12 **(2009)**.

[2] Wu Qi, Zhang Ying, Zhang Qiong; Processing of chrome (VI)-contaminated wastewater with Chengde's organically modified zeolite, Journal of Lanzhou University of Technology, **34(3)**, 69-72 **(2008)**.

[3] Pu Guangyu; in Yanxia, Liang Tianmin; Experiment method of Treating Chromium- containing Wastewater by SiO2 -TiO2 with light catalyzing, Heilongjiang Environmental Journal, **33(2)**, 22-23 **(2009)**.

[4] Chen Yuan, Zhang Lingru, Xia Changbin; Adsorption and reduction of Cr (VI)- containing wastewater over bamboo charcoal/TiO2 photocatalyst, Journal of Hunan University of Science & Technology (Natural Science Edition), **24(4)**, 118-121 **(2009)**.